The Role of Zinc-Rich Food Consumption on Zinc Level and the Incident of Preeclampsia

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Abstract
Objective: Investigate the correlation between dietary intake of zinc, preeclampsia and blood zinc levels.
Methods: This study, which compared pregnant women in the third trimester at the Wahidin Sudirohusodo Hospital and the educational network hospital with and without preeclampsia, used a Cross Sectional methodology. Zinc level testing was carried out at Prodia using ICP-MS method. Mann Whitney, Kruskal Wallis, and chi square tests were used to examine the data.
Results: Preeclampsia group (n=38) and control group (n=40) were two groups made up of a total of 78 pregnant women. Zn level of severe preeclampsia (47.73 ± 11.23 ng/mL) was lower than preeclampsia (50.50 ± 13.59 ng/mL) and non-preeclampsia (50.58 ± 10.12ng/mL), but not significantly. Lower zinc rich-food consumption was a significant effect on zinc deficiency ($p< 0.05$), and was no significant effect on preeclampsia ($p > 0.05$).
Conclusion: Low intake of zinc-rich foods and occasionally exposure to cigarette smoke are the causes of zinc insufficiency in third trimester pregnancy, but has little impact on the occurrence of preeclampsia.

Keywords: preeclampsia, pregnant, zinc

Peranan Konsumsi Makanan Kaya Zink terhadap Kadar Zink dan Insiden Preeklamsia

Abstrak
Tujuan: Mengetahui korelasi antara asupan zink, preeklamsia dan tingkat zink serum.
Metode: Penelitian ini membandingkan ibu hamil trimester III di RS Wahidin Sudirohusodo dan RS jejaring pendidikan dengan dan tanpa preeklampsia menggunakan metodologi *Cross Sectional*. Pengujian kadar zink dilakukan di Prodia dengan menggunakan metode ICP-MS. Uji *Mann Whitney*, *Kruskal Wallis* dan *Chi Square* digunakan untuk menganalisis data.
Hasil: Kelompok preeklamsia (n=38) dan kelompok kontrol (n=40) adalah dua kelompok yang terdiri dari total 78 ibu hamil. Kadar Zn preeklamsia berat (47.73 ± 11.23 ng/mL) lebih rendah dibandingkan preeklamsia (50.50 ± 13.59 ng/mL) dan non preeklamsia (50.58 ± 10.12ng/mL), tetapi tidak bermakna. Rendahnya konsumsi makanan kaya zink berpengaruh signifikan terhadap defisiensi zink ($p<0.05$), namun tidak signifikan terhadap kejadian preeklamsia ($p>0.05$).
Kesimpulan: Diet rendah zink dan paparan asap rokok adalah penyebab defisiensi zink pada kehamilan trimester III, tetapi memiliki dampak kecil terhadap insiden preeklamsia.

Kata kunci: preeklamsia, kehamilan, zink

Introduction

Preeclampsia is a syndrome that is particular to pregnancy and can have an impact on almost all organ systems. Preeclampsia can occur anywhere between 3 and 10 percent of the time in nulliparous women. Preeclampsia occurs in multiparas between 1.4 and 4% of the time. Eclampsia and preeclampsia are blamed for about 63.000 maternal deaths annually across the globe. In addition to increasing maternal mortality and morbidity, preeclampsia kills 500.000 newborns each year.[1] On average, preeclampsia affects roughly 120.000 Indonesians each year, or about 5% of all pregnancies.[2]

Studies have shown that micronutrients are crucial for pregnancy and fetal development. A dietary imbalance may affect the metabolisms of the mother and the fetus. Being components of transcription factors and enzymes, micronutrients are crucial for growth and development. Appropriate implantation and angiogenesis are essential for maintaining a healthy pregnancy. The main role of matrix metalloproteinases in implantation is played by enzymes. By dissolving the extracellular matrix, this zinc endopeptidase enzyme functions.[3]

Zinc deficiency contributes to a number of birth defects, uterine growth retardation (IUGR), spontaneous abortion, preeclampsia, premature membrane rupture, low birth weight (LBW), labor problems, protracted labor, and postpartum bleeding. The immune system's performance may also be impacted. This effect may progressively lead to an increase in the mortality of pregnant women, developing kids, and newborns. Zinc is consequently extremely useful during conception and pregnancy and serves a critical purpose both then and in the embryonic period.[4]

Contradictory arguments have been made on the effectiveness of prenatal zinc supplementation in avoiding preeclampsia. There are still arguments made in favor of and against the effect on pregnancy. Pregnant women did not benefit from taking zinc supplements, according to earlier systematic reviews comparing their use with and without food sources of zinc. Although these changes were not statistically significant, it was found in the study that the incidence of LBW and preterm birth in mothers with lower earnings had decreased.[5] Even though most people in Makassar eat seafood, which is a good source of zinc, preeclampsia is still prevalent there, according to reports. Additionally, there are no data on the proper zinc consumption for pregnant women in Makassar and globally. For this reason, scientists decided to investigate whether there is a correlation between zinc levels in pregnancies with and without preeclampsia. The findings of this study may therefore serve as the foundation for future investigations into the relationship between zinc and preeclampsia.

A disease unique to pregnancy called preeclampsia can have an impact on almost all organ systems. Preeclampsia can occur anywhere between 3 and 10 percent of the time in nulliparous women. Preeclampsia occurs in multiparas between 1.4 and 4% of the time.[6] Around 63.000 maternal fatalities worldwide are attributed to eclampsia and preeclampsia each year. In addition to increasing maternal mortality and morbidity, preeclampsia kills 500.000 newborns each year.[1] On average, preeclampsia affects roughly 120.000 Indonesians each year, or about 5% of all pregnancies.[2]

Micronutrients are clearly important for pregnancy and fetal development, according to studies. The mother's and the fetus' metabolisms may be impacted by a nutritional imbalance. Micronutrients are essential for growth and development because they are parts of transcription factors and enzymes. Maintaining a healthy pregnancy depends on proper implantation and angiogenesis. Enzymes referred to as matrix metalloproteinases play the primary function in implantation. The extracellular matrix is broken down by this zinc endopeptidase enzyme.[3]

Zinc deficiency contributes to a number of conditions, including congenital abnormalities, spontaneous miscarriage, intrauterine growth retardation (IUGR), preeclampsia, early rupture of the membranes, low birth weight (LBW), labor problems, protracted labor, and postpartum bleeding. It can also affect immune system function. The mortality of pregnant women, developing babies, and newborns may gradually rise as a result of this effect. Zinc is therefore highly effective during conception and pregnancy and plays a crucial function during pregnancy and the embryonic stage.[4]

Zinc supplementation during pregnancy has not been proven to be useful in preventing preeclampsia, and debates on the topic are contradictory. The impact on pregnancy is still up for debate, and there are still arguments for and against it. Prior systematic reviews comparing zinc supplementation with and without revealed that pregnant women did not experience any benefits from using zinc supplements. Although not statistically significant, the study did detect a decrease in the prevalence of LBW and a 14 percent decrease in the incidence of preterm birth in mothers with lower incomes.[5] Despite the fact that most people in Makassar eat seafood, which is a good source of zinc, preeclampsia is still prevalent there, according to reports. Additionally, there are no data on the proper zinc consumption for pregnant women in Makassar and globally. For this reason, scientists decided to investigate whether there is a correlation between zinc levels in pregnancies with and without preeclampsia. Further studies examining the connection between zinc and preeclampsia may potentially build on the study's findings.

Method

Cross-sectional methodology was employed in this investigation. The research involved expecting mothers with and without preeclampsia who were receiving care at the Midwifery Installation at Wahidin Sudirohusodo Hospital, Sitti Khadijah I and Siti Fatimah Mother and Child Hospital Makassar. Consecutive sampling is the sampling technique. Pregnant women in their third trimester who consented to participate in the study and their families were also required to meet the inclusion criteria. Exclusion criteria included having a chronic conditions such type 2 diabetes, TB, renal, or liver disease, pregnant women or their families declining to be study participants, and the patient did not fully fill out the form or did not have information on zinc levels. The Zn serum levels were examined and Zn food frequency questionnaire (FFQ-Zn) was calculated. At a significance level of 5%, the Chi Square test, Mann Whitney, and Kruskal Wallis were used to evaluate the data.

Result

The results of the study were 78 pregnant women consisting of 38 preeclamptic pregnant women and 40 pregnant women without preeclampsia where the age differences between the two groups were insignificant. (p=0.10); work (p=0.91); education (p=0.68); income per month (p=0.31); Parity and gestational age (p=0.12 and p=0.16), while BMI was significantly different between the preeclampsia and non-preeclampsia groups with p = 0.02 (Table 1).

Correlation between Serum Zn Level and The Incidence of Preeclampsia

The preeclampsia group's average serum Zn level was 48.32 g/dL, which was lower than the non-preeclampsia group's level of 50.85

Table 1 Lists the Traits of Research Participants

Characteristics	Preeclampsia		Non-preeclampsia		Total		p-value
	n	%	n	%	n	%	
Age (years)							
< 20	0	0.00	0	0.00	0	0.0	
20-35	20	52.60	29	72.50	49	62.80	0.10[a]
> 35	18	47.40	11	27.50	29	37.20	
Employment status							
Working	7	18.40	7	17.50	14	17.90	0.91[a]
Unemployed	31	81.60	33	82.50	64	82.10	
Educational level							
< 9 years	7	18.40	6	15.00	13	16.75	0.68[a]
≥ 9 years	32	81.60	34	85.00	65	83.25	
Income per month							
< minimum worker wage	30	78.90	35	87.50	65	83.75	0.31[a]
≥ minimum worker wage	8	21.10	5	12.50	13	16.25	
Gestational age							
Preterm	10	26.31	5	12.50	15	19.23	
Fullterm	24	63.19	26	65.00	50	64.10	0.16[a]
Postterm	4	10.50	9	22.50	13	16.67	
Parity							
0	9	23.68	16	40.00	25	32.05	
1-2	21	55.26	21	52.50	42	53.85	0.12[a]
3-5	8	21.06	3	7.50	11	14.10	
BMI							
Underweight/Normal	7	18.42	17	42.50	24	30.77	0.02[a]
Overweight/Obesity	31	81.58	23	57.50	54	69.23	

[a]Pearson chi-square, [b]Fischer exact test

g/dL. According to the findings, there was no discernible difference between preeclampsia and non-preeclampsia in pregnant women's serum Zn levels, with p = 0.63 (p> 0.05) (Table 2).

Preeclampsia and severe preeclampsia are two categories for pregnant people with the condition. Serum Zn levels in pregnant women with severe preeclampsia, preeclampsia, and non preeclampsia are compared in Table 3.

The severe preeclampsia group had an average serum Zn level of 47.73 g/dL, which was lower than the preeclampsia group's 50.50 g/dL and the group without preeclampsia's 50.58 g/dL. According to the comparison test results, there was no discernible difference in serum Zn levels between pregnant women with severe preeclampsia, preeclampsia, and non-preeclampsia, with p-value of 0.62 (p > 0.05) (Table 3).

Blood Zn Levels and Non-Modifiable Preeclampsia Risk Factors: A Connection

Pregnant women's serum Zn levels were examined for associations with non modifiable risk factors for preeclampsia

Table 2 Preeclampsia Incidence and Serum Zn Levels in Relation to Each Other

Group	n	Min	Max	Mean ± SD	p-value[a]
Preeclampsia	38	16.00	67.00	48.32 ± 11.62	0.63
Non-preeclampsia	40	25.00	76.00	50.85 ± 10.12	

[a]Mann Whitney Test

Table 3 Serum Zn Levels and the Likelihood of Developing Severe Preeclampsia

Group	n	Min	Max	Mean ± SD	p-value[a]
Severe preeclampsia	30	16.00	62.00	47.73 ± 11.23	0.62
Preeclampsia	8	24.00	67.00	50.50 ± 13.59	
Non-preeclampsia	40	25.00	76.00	50.58 ± 10.12	

[a]Kruskal Wallis Test

Table 4 The Relationship between Unmodifiable Preeclampsia Risk Factors and Serum Zn Levels

Group	n	Min	Max	Mean ± SD	p-value
Risky age (> 35 years)					
Yes	49	16.00	76.00	50.41 ± 11.87	0.17[b]
No	29	30.00	63.00	48.27 ± 9.00	
Gestational age					
Preterm	15	30.00	72.00	48.60 ± 11.99	0.47[c]
Fullterm	50	16.00	76.00	49.34 ± 10.93	
Postterm	13	24.00	60.00	51.84 ± 9.88	
Nulliparity					
Yes	24	30.00	76.00	51.33 ± 10.84	0.46[b]
No	54	16.00	67.00	48. 85 ± 10.92	
Pregnancy interval					
< 10 years	73	24.00	76.00	49.68 ± 10.26	0.83[a]
≥ 10 years	5	16.00	63.00	48.60 ± 19.58	
Multiparous with new husband					
Yes	10	38.00	63.00	50.50 ± 8.73	0.98[b]
No	68	16.00	76.00	49.48 ± 11.21	
Family history of hypertension/preeclampsia					
Yes	5	46.00	76.00	54.60 ± 12.60	0.63[b]
No	73	16.00	72.00	49.27 ± 10.77	

[a]Independent sample t test, [b]Mann Whitney Test, [c]Kruskal Wallis Test

(Table 4).

Serum Zn levels did not alter statistically significantly (p>0.05) according on the mother's age (>35 years), gestational age, nulliparity, pregnancies interval, multipara with a new spouse, or any family history of hypertension or preeclampsia.

Serum Zn Levels and Modifiable Preeclampsia Risk Factors: A Connection

A number of modifiable preeclampsia risk factors were evaluated for relationships with pregnant women's serum Zn levels. (Table 5). Smoking behavior and FFQ-Zn were significant predictors of blood Zn levels (p<0.05), although BMI and ANC were not (p>0.05). Passive smokers during pregnancy have lower average serum Zn levels than non smokers. Pregnant women who consume less zinc, as determined by the FFQ-Zn, have lower average serum zinc levels than those who consume enough zinc.

Using a Zn food frequency questionnaire (FFQ-Zn), the Zn consumption frequency of pregnant women was estimated. The Zn levels in food were then converted to create an FFQ-Zn score for 1 month. An FFQ-Zn score below 141 is seen as insufficient, while a score above 141 is regarded as adequate.[7] Accordingly, in this study, serum Zn levels of pregnant women 50 ng/mL were deemed

Table 5 The Relationship between Modifiable Preeclampsia Risk Factors and Serum Zn Levels

Group	n	Min	Max	Mean ± SD	p-value
Smoking					
Passive	30	16.00	76.00	45.90 ± 11.58	0.01*[a]
No.	48	24.00	72.00	51.93 ± 9.84	
BMI					
Underweight/Normal	24	25.00	72.00	48.67 ± 10.39	0.61[c]
Overweight/Obesity	54	16.00	76.00	50.04 ± 11.16	
FFQ-Zn (Zn intake)					
Deficient	45	16.00	58.00	42.91 ± 8.55	0.00**[b]
Adequate	33	48.00	76.00	58.75 ± 5.93	
ANC					
< 4 times	16	16.00	65.00	48.68 ± 12.75	0.88[a]
≥ 4 times	62	24.00	76.00	49.85 ± 10.45	

[a]Independent sample t test, [b]Mann Whitney Test, [c]Independent sample t test, *significant with p < 0.05, **significant with p < 0.001.

Table 6 Relationship between FFQ-Zn with Serum Zn Levels and the Incidence of Preeclampsia

FFQ-Zn	Zn Serum Level				p-value	OR (CI)	Preeclampsia				p-value	OR (CI)
	Deficiency		Normal				Yes		No			
	n	%	n	%			n	%	n	%		
Deficient	41	91.11	4	8.89	0.00**	158.87 (27.32-923.74)	19	42.22	26	57.78	0.18	0.53 (0.21-1.32)
Adequate	2	6.06	31	93.94			19	57.57	14	42.43		

Chi-Square Test, **Significant with p < 0.001.

Zn deficient and serum Zn levels of pregnant women 50 ng/mL were deemed normal.[8] Third trimester pregnant women are considered to have insufficient serum Zn levels if it is less than 50 ng/mL. The Zn consumption of pregnant women was compared using preeclampsia incidence and Zn blood levels (Table 6).

Table 6 shows a significant association between the FFQ-Zn and blood Zn levels, with $p=0.000$ ($p<0.05$). Pregnant women who had insufficient FFQ-Zn exhibited a 158-fold increased probability of having low serum Zn levels compared to those who did (OR: 158.87; CI: 27.32-927.74). With a comparison test result of $p=0.18$ ($p>0.05$), it was determined that there was no significant correlation between FFQ-Zn and the incidence of preeclampsia.

Discussion

The findings revealed that preeclampsia had a slightly lower average Zn serum level than non-preeclampsia, but not considerably lower. Severe preeclampsia has an average serum Zn serum level lower than preeclampsia but not significantly. This is because zinc deficiency is not the only cause of deficiency in serum zinc levels in preeclampsia compared to non-preeclampsia, one of which is a decrease in albumin concentration.[9] Most of the zinc in plasma is associated with albumin. During healthy pregnancy and more so in preeclampsia, serum albumin levels decrease. In preeclampsia and particularly in normal pregnancy, lower maternal plasma Zn concentrations are thought to be caused by lower levels of Zn-binding albumin or lower serum albumin's affinity for Zn.[10]

Serum Zn levels of preeclampsia were lower than those of non-preeclampsia indicating a role for zinc in the incidence of preeclampsia. The lower serum Zn concentration in preeclampsia is related to the role of Zn as an antioxidant that can reduce oxidative stress. Because oxidative stress is considered to be the main etiology in the development of preeclampsia, nothing can be done to reduce oxidative stress when serum zinc levels are low.[11]

The role of Zn in protection as an antioxidant, there is an important role of Cu-Zn. Zn deficiency causes damage to the Cu-Zn SOD enzyme system, and the body experiences oxidative stress, which exacerbates some disease situations. Reduced Cu-Zn SOD activity will result in free radical scavenging, oxidative stress, and lipid peroxidation. Even by itself, oxidative stress can cause cell apoptosis. Production of synctiotrophoblast is inhibited, synctial degeneration increases, and inflammatory mediators are released into the maternal circulation through excessive apoptosis. This will interfere with the process of placentation and eventually result in the mother's endothelial cells not functioning, which will lead to preeclampsia.[12]

Zinc deficiency also indirectly affects the disruption of cytotrophoblast invasion. This relates to how Zn controls the activity of matrix metalloproteinase (MMP) enzymes, which are critical for implantation. MMP levels are increased in cases with Zn insufficiency. MMP elevation and tissue inhibition of these metalloproteinases control and limit trophoblastic invasion to appropriate depths in the uterus at the same time. Preeclampsia is characterized by endovascular invasion that is limited to the superficial uterine spiral arterioles and leaves thin, high-resistance arteries. Placental insufficiency, endothelial dysfunction, and preeclampsia are all symptoms of the whole hypoxic condition brought on by defective spiral artery remodeling. Therefore, preeclampsia is characterized by endothelial dysfunction, which arises from aberrant cytotrophoblast invasion, placental ischemia, placental factor release, and angiogenic imbalance.[3]

Zinc regulates angiogenesis through influencing cell proliferation, cell division, and death.[13] Zinc plays a function in placental morphogenesis and the regulation of maternal blood pressure during pregnancy, which means that a zinc deficit impairs fetal growth and results in blood pressure problems.[14] In addition, low serum Zn levels lead to oxidative stress and lower superoxide dismutase activity, both of which increase blood pressure due to increased Zn transfer from the mother to the developing fetus, low Zn levels, and higher urine Zn excretion in preeclampsia females. On the other hand, preeclampsia's enhanced lipid peroxidation lowers the amounts of transporter proteins and estrogens, which lowers serum Zn levels.[15]

Preeclampsia had greater serum Zinc levels when compared to cases of severe preeclampsia. This demonstrates how the severity of preeclampsia and zinc levels are connected. The insignificant difference in Zn levels is probably due to the habit of eating seafood which is a rich-zinc source. All pregnant women, preeclamptic and non-preeclamptic, have higher serum zinc levels when they eat foods high in zinc. As serum Zn levels are lower in severe preeclampsia than in preeclampsia, they can be used as a marker to predict the severity of preeclampsia.[16] This is due to the actions of Zn transporters, such as Zn-associated proteins, which may regulate Zn levels both inside and outside of the cell, which govern the normal homeostasis of zinc. More than 300 distinct enzymes can function at their best because of the responsibilities that Zn plays.[17] Protein synthesis, maintaining the enzymes' catalytic activity, and cell division are only a few of the many bodily tasks that zinc carries out. Mild zinc deficiency can delay age-related macular degeneration, protect skin integrity, and vision loss through its effects on neutrophils, natural killer (NK) cell activity, and macrophages.[11] Because of this interference with Zn's function or role, the decline in Zn levels is linked to many additional issues that can be seen in cases of severe preeclampsia.

In this study, serum Zn levels in preeclampsia and severe preeclampsia are not significant differences from non-preeclampsia. It was explained by the correlation between nutritional status, disease onset or progression, and nutritional insufficiency contributing to the development of preeclampsia. Nutrients can reduce the effects of oxidative stress by altering the amounts of free radicals or antioxidants, or by supplying substrates for the creation of free radicals.[18] Cytotrophoblasts in preeclamptic pregnancies do not mature into their endothelial subtypes, which results in poor remodeling of spiral arterioles. A low-flow circulation coupled with high resistance and relative ischemia leads to oxidative stress and placental villi destruction. The release of inflammatory cytokines and antiangiogenic substances, which result in extensive endothelial dysfunction and related clinical symptoms, characterize the maternal response to placental hypoperfusion. Disease development is a protracted process rather than something that immediately happens, one with potentially significant morbidity and even mortality to both mother and baby.[19] Identifying those at high risk of developing the condition is helpful as there is evidence that the incidence of preeclampsia can be reduced with low dose aspirin taken in pregnancy. Accurately predicting the risk of preeclampsia allows for more targeted aspirin prophylaxis and a greater opportunity for early detection of maternal and/or fetal complications associated with impaired placentation through a schedule of enhanced antenatal surveillance. Traditional preeclampsia prediction models use maternal characteristics and risk factors and have been shown to be of low predictive value. Multiparametric screening tests combine patient characteristics with serum biomarkers and ultrasound Doppler indices and have been shown to be more effective at detecting those at high risk of preeclampsia – more specifically, early-onset preeclampsia (onset of preeclampsia <34 weeks' gestation). This is supported by evidence that vasoconstriction and poor peripheral vascular compliance lead to the development of hypertension in pregnancy. Pregnancy's first and second trimesters only show secondary signs of preeclampsia, specifically hypertension. Maternal factors such as weight, height, age, race, smoking, family and personal history of preeclampsia, and history of chronic hypertension influence first trimester arterial pressure. Preeclampsia develops in the second and third trimesters as a result of a sharp rise in MAP between weeks 11 and 13 of pregnancy.[20]

Preeclampsia develops as a result of a disease process that is influenced by a number of variables during the first trimester of pregnancy, such as diet, low Zn levels, maternal weight, height, age, racial origin, smoking, family and prior history of preeclampsia, and hCG levels. As a result, a non-significant difference in Zn levels between severe preeclampsia, preeclampsia and non-preeclampsia, some pregnant women may start making dietary changes during illness, including increasing their intake of zinc and taking zinc supplements. Since there is no Zn storage in the body, the serum Zn level found during an examination represents the Zn level consumed or received by pregnant women. Moreover, although Zn has antioxidant abilities, other micronutrients, such as manganese, selenium, magnesium, and copper, can also explain the effects of oxidative stress on the pathogenesis of preeclampsia with the etiopathogenesis, which is not just tied to the Zn micronutrient. According to a study conducted in Nigeria, shortages of copper, selenium, and magnesium were linked to preeclampsia incidence, while deficiencies of zinc and manganese were not.[21]

This study found no statistically significant relationship between serum Zn levels and non-modifiable preeclampsia risk factors, such as mother age, gestational age, parity, spacing of pregnancies, multipara with new husband, or family history of hypertension/preeclampsia. Only smoking and Zn intake (FFQ-Zn) were found to have a significant connection with blood Zn levels among the modifiable risk factors for preeclampsia, which include smoking, BMI, Zn intake (FFQ-Zn), and ANC.

The blood Zn levels of pregnant women who did not smoke or who passively smoked were significantly correlated in this study, with passive smokers' serum levels being lower than non-smokers'. This finding supports the work of Wrzesniak et al., discovered a link between blood zinc levels and pregnant women's smoking habits. Pregnant smokers had lower serum zinc levels than pregnant non-smokers. The Zn/Cd ratio was reportedly three times lower in pregnant smokers than in pregnant non-smokers.[22] Reactive oxygen species (ROS) generation can be increased by smoking and pregnancy. ROS interfere with the pro and antioxidant balance, as well as the mineral Zn balance and iron control.[23]

This study discovered a strong relationship between pregnant women's serum zinc levels and their FFQ-Zn measured zinc intake. Pregnant women with high serum Zn levels have high Zn consumption. The likelihood of serum Zn insufficiency in pregnant women is increased by 158 times with less FFQ-Zn. These results indicate a substantial relationship between dietary intake, especially the consumption of foods high in zinc sources while pregnant, and the second and third trimester serum zinc levels of pregnant women. This means that to meet their body's nutritional requirements, particularly those for the micronutrient Zn during pregnancy, pregnant women should be mindful of the foods they eat each day, especially those high in Zn sources. This is particularly true during the second and third trimesters because Zn needs to rise as gestational age does.

Serum Zn status is also determined by diet.[24] Zinc deficiency is common in developing countries and low maternal circulating zinc concentrations have previously been associated with pregnancy complications. We reviewed current literature assessing circulating zinc and dietary zinc intake during pregnancy and the associations with preeclampsia (PE-Zn levels) are primarily influenced by dietary intake because no particular system for storing Zn has been discovered.[11] Additionally, various settings, cultures, and demographics have an impact on the adequate consumption of micronutrients and serum micronutrient concentrations during pregnancy.[25] As essential components of prenatal care, Zn are important to reduce the risk for maternal and child morbidity and mortality by lowering pregnancy-related complications. The present study aimed to investigate the status of the trace elements, i.e., selenium, zinc, and manganese in pregnant and non-pregnant women from a developing country and to evaluate its relationship with maternal and child complications. Selenium, zinc, and manganese concentrations were measured in the blood serum of 80 pregnant women and compared with 40 non-pregnant healthy controls. The quantitative analyses of trace elements were performed by using the inductively coupled plasma–optical emission spectrometry (ICP-OES) confounding factors like stress and infection may have an impact on maternal serum Zn levels.[11] Pregnant women are advised to take 2-4 mg more Zn per day in the United States and Australia than non-pregnant women.[24] Zinc deficiency is common in developing countries and low maternal circulating Zinc concentrations have previously been associated with pregnancy complications. We reviewed current literature assessing circulating zinc and dietary zinc intake during pregnancy and the associations with preeclampsia (PE). In this study, serum Zn deficiency was found in 91.30% of pregnant women with FFQ-Zn values below 141, which was associated with a daily Zn intake deficit of 4.7 mg.

This study's limitations include the use of a cross-sectional design, which prevents it from accurately representing serum Zn levels during pregnancy, as well as the fact that the research data were not normally distributed, necessitating the use of non parametric tests for statistical data processing.

Conclusion

While there was no discernible difference between pregnant women with and without preeclampsia, the pregnant women with preeclampsia had lower serum Zn levels. Severe preeclampsia had lower serum zinc levels than preeclampsia and non preeclampsia however were not statistically significant. Pregnant women's low Zn levels are sometimes caused by passive smokers in addition to their low dietary intake of Zn. Zinc levels must be monitored during pregnancy. Pregnant women are supposed to avoid contact with active smokers and consume more meals high in zinc. As a result of the fact that this was merely a Cross Sectional study, future research should be able to examine data using other research methods, such cohort or case control studies.

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