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IMPACT OF ZINC, SELENIUM AND MAGNESIUM ON MATERNAL AND FETAL OUTCOME

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ABSTRACT

Micronutrients play an important role in prenatal care by minimizing pregnancy-related problems and reducing the risk of miscarriage and death for mother and baby. The present study aimed to examine the status of the following components (manganese, zinc and selenium) in pregnant and non-pregnant women in a deprived country and investigate its association with challenges for mother and child. Blood serum concentrations of 70 pregnant women and 50 nonpregnant snake controls were tested for the presence of selenium, zinc and manganese. The inductively coupled plasma optical output spectroscopy (ICP-OES) strategy was used to conduct a quantitative review of the following components. Dietary relapse assessment was used to collect information about the dietary habits of survey members. The findings showed a marked decrease in zinc and selenium concentrations. in pregnant women compared to the control group (21. 82 ± 72 vs 2952 ± 76 µmol/L, p<0001, 223 ± 112 vs 273 ± 1, 18 µmol/L, p = 0. 0293), with no difference in manganese concentration (1. 37 ± 012 vs 135 ± 012 log10 nmol/L, p = 0. 4023) Regarding maternal and neonatal complications, higher manganese concentrations were associated with an increased risk of maternal complications (OR = 3. 172, p = 0. 036) Milk consumption is associated with a decrease in selenium and manganese values. Pregnant women have lower serum selenium and zinc concentrations, as well as elevated serum manganese concentrations, which may be associated with the mother's risk of later complications during pregnancy/childbirth, although further examination is needed to evaluate this association.

KEYWORDS: Selenium, Zinc, Manganese, Pregnancy, Maternal complications, Child complications.

1. INTRODUCTION

For every organic and metabolic organ, tissue growth, cell signaling, motility, multiplication and migration depend on micronutrients, which include the following components.[1] As an integral part of antenatal care, these help minimize pregnancy-related problems, helping to minimize the risk of horror and death in mothers and children.[2] In order for the fetus to grow strongly and repair any cell damage during pregnancy, it is necessary to fully provide the following ingredients.[3] For example, selenium is essential for both mother and infant to have a convincing antioxidant defense system.[4] In particular, selenium contains the essential ingredient glutathione peroxidase, an antioxidant, which helps reduce negative outcomes in the fetus and mother such as unsuccessful labor, neural tube defects, pre-eclampsia, rupture premature amniotic membranes, fallopian tube defects and gestational diabetes.[5] On the other hand, low levels of selenium in the mother's plasma may lead to an inability of the placenta's antioxidant capacity, which may increase the risk of preterm birth in gestational age infants.[6] Adequate zinc intake has been shown to be fundamental to proper embryogenesis and to reduce the frequency of preterm birth, increasing selenium intake.[7] More broadly, zinc may be an essential component in development, antioxidants, protein binding, cell signaling, and tissue maintenance.[8] Zinc deficiency can cause immediate negative effects and can be alleviated by increasing zinc intake due to altered homeostasis during the prenatal period.[9] Findings from a subsequent comprehensive study showed an association between higher zinc intake in the mother's diet and increased problems during pregnancy.[10] It is widely accepted that infants who are low birth weight and small for gestational age are more likely to be born to mothers who are zinc deficient.[11]

Another imperative follow metal that's show in essentially all tissues and is required for haemostasis, blood sugar administration, assimilation, and propagation is manganese.[12] It is one among the foremost common follow elements that are known to be included within the advancement of bones, the safe framework, cellular vitality, and within the suitable digestion system of carbs,

proteins, and fats.[13] Manganese may be a component of both Mn-superoxide dismutase (Grass) and manganese catalase, which offer assistance to decrease oxidative push by detoxifying free radicals shaped by superoxide.[14] Manganese is fundamental for a assortment of enzymatic forms as well as homeostatic frameworks, be that as it may an over the top body buildup of this component can be destructive and hinder neurological function.[15] Manganese is respected as a crucial mineral supplement amid pregnancy that's required for solid fetal improvement.[16] In any case, there's moreover prove of an converse U-shaped relationship between infant engine and cognitive capacities and maternal blood manganese.[17] Seemingly, both, raised as negative birth results are connected to moo manganese levels as well.[18] One conceivable chance figure for gestational hypertension has been connected to expanded manganese presentation.[19]

On the other hand, maternal manganese levels rise in the middle of the third trimester Class may increase the likelihood of having low birth weight infants.[20]

Follow component accessibility is affected by pregnancy-related changes in absorption, retention, and utilization as well as changes in digestion system. Besides, there's a solid relationship between perinatal issues and unfavorable pregnancy results and the awkwardness of all the follow components recorded over.[21] Be that as it may, varieties in these follow components in Pakistani pregnant ladies have not however been examined due to statistic, way of life, nourishment, and living environment changes. Pakistan, being a low-income country, has documented a tall predominance of micronutrient lacks in its most helpless socioeconomics, counting moms and children.[22] For occasion, we illustrated in a earlier consider that, in comparison to controls, pregnant Pakistani ladies had diminished sums of the press capacity marker ferritin and pee iodine levels.[23]

To the finest of our information and based on a audit of the writing, exceptionally small is known approximately the status of follow elements and how they influence the course of pregnancy in Egyptian ladies. Furthermore, moderately few research works have coordinates the examination of specific follow components inside a single population. Therefore, we surveyed the selenium, zinc, and manganese status of Egyptian ladies, taking into consideration both the conceivable open wellbeing burden of lack of healthy sustenance and the scarcity of information accessible within the country. This think about pointed to evaluate the maternal serum levels of zinc, manganese, and selenium all through pregnancy, compare them to sound non-pregnant controls, and look at the relationship between these follow components and complications for both the mother and the unborn child. The results would getbetter. the information illustrating the noteworthiness of having a adequate level of follow components amid pregnancynation. The outcomes would get better. The data demonstrating how crucial it is for pregnant women in impoverished nations to have an appropriate level of trace elements.

2. MATERIALS AND PROCEDURES

2.1. The Sample Population and Study design

The purpose of this cross-sectional comparative study was to evaluate the current state of a chosen trace components in women aged 26 ± 4 and 25 ± 4 years, respectively, who were not pregnant and pregnant.

Table 1 displays the characteristics of the study participants. 70 pregnant women in the third trimester who lived in the same area were chosen from Mosul hospitals Obstetrics and Gynecology Department. An additional 50 healthy, age-matched As a control group, non-pregnant women registered at the same hospital for a standard obstetrical assessment were asked to take part.

Table 1: Shows demographic data between the studied groups.

	Control Group No (50)	Pregnant Women No (70)	P value
Age Mean ±SD	26 ± 5	27 ± 5	0.315
BMI Mean ±SD	25.3 ± 4.3	27.5 ± 2.4	**≤0.001**
Marital status			
Yes	29(58%)	70(100%)	0
No	21(42%)	0(0%)	
Education			
No education	24(48%)	40(57%)	0.322
Primary or high school education	26(52%)	30(43%)	
Occupation			
Housewife	27(54%)	68(97%)	**≤0.001**
working	23(46%)	2(3%)	
Family type			
Single family	30(60%)	16(23%)	**≤0.001**

Joint family	20(40%)	54(77%)	
Children number	2.1 ± 1.6	2 ± 1.7	0.762

2.2. Food Frequency Questionnaire and Sociodemographic information

Numerous factors, including as lifestyle and sociodemographic aspects, could potentially skew the association between foetomaternal nutritional deficits and pregnancy outcomes. Consequently, Personal and sociodemographic information, including age, residence, educational attainment, family size, income, socioeconomic status, and lifestyle factors like smoking (none of the participants smoked), physical activity, and following any particular diet (none of the participants followed any diets), were gathered using a pre-made questionnaire. The goal of exercising for at least 20 minutes most days of the week was utilized to gauge the study population's level of physical activity.[24] At the time of delivery, the body mass index (BMI) was determined. Obstetric information was also recorded, including gravidity, parity, antenatal visits, immunization history, and obstetric problems from prior pregnancies or deliveries. Ladies who were engrossed in Five women were reported to have used folic acid supplements throughout their pregnancies, but vitamin and mineral supplements were not included. A 17-item food frequency questionnaire (FFQ) was used to assess the nutritional intake of both research groups in order to gather details about the eating habits of the chosen women. The Haftenberger et al. study from the past served as the foundation for the food frequency questionnaire. [25]

The FFQ included information on food intake (daily, weekly, monthly, and never) related to the consumption of processed foods, meat, fish, eggs, dairy products, grains, rice or noodles, legumes and pulses, vegetables, and grains. Fruits, salads, nuts, oils, candies, and snacks along with hot and cold beverages.

2.3. Complications for Mothers and Children

Details on the baby's sex, parity, and anthropometrics—such as birth weight, skin color, pulse (heart rate), and grimace response—as well as the time and manner of delivery.

Two trained nurses from the chosen institution recorded (reflexes), activity (muscle tone), and respiration. Based on criterion scales ranging from 0 to 2, the Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) score was computed from the last five parameters. The resulting scores ranged from 0 to 10. Scores of 7 and higher were regarded as typical for this purpose, scores of 4 to 6 as fairly low, and scores of 3 and lower as dangerously low.

Additionally, information about preterm birth, tiny for gestational age, premature membrane rupture, miscarriages, length of gestation, intrauterine growth restriction, and preterm weight at birth and the placenta were also noted. Regardless of gestational age, a low birth weight was defined as less than 2500 g, whereas small for gestational age infants were described as those with birth weights that, according to the World Health Organization (WHO), fall below the 10th percentile for the mother's gestational age.[26]

2.4. Trace elements analysis

The designated trained nurses of the hospital collected the blood samples from expectant mothers at the time of delivery and, in the event of a suggested caesarean delivery, 24 hours prior to delivery. Similar to this, 50 reproductive-age, healthy, age-matched women served as the control group, and their blood samples were collected for analysis by skilled hospital workers. Samples were collected in gel vials, separated into serum samples by centrifuging at 3000 rpm for 10 minutes. Serum samples were then kept at -20 °C until analysis.

By directly aspirating liquid samples into an inductively coupled plasma-optical emission spectrometry (ICP-OES) apparatus, the serum contents of zinc, manganese, and selenium were measured and compared to certified reference material (Multi elements, Merck, Burlington Massachusetts, USA).

Prior to performing sample analysis, various concentration standards (0.1 µg/L to 500 µg/L) were produced and aspirated into the ICP-OES system. With a correlation coefficient >0.999, the concentration-response curves for every trace element were all well linear. The multichromator was purged using a little nitrogen or argon flow in order to identify emission lines with short UV wavelengths. Version 1.0 of the ICP Expert II software was utilized for instrument operations. A total of three duplicate readings were obtained, each lasting 30 seconds.

2.5. Approaches to statistics

Prerequisites for determining sample size include detecting an effect size of Cohen's d = 0.7 at the 5% overall significance level, 80% power, and a 2:1 ratio between pregnant women and controls. was put into action. It was then determined that in order to detect an odds ratio of 2.5 for maternal and child problems, the necessary sample sizes were determined to be 77 and 39, with rounded figures to 80 and 40. Chi-squared tests and unpaired t-tests were used to assess the statistical differences between the research groups. For each trace element, a preliminary analysis of variance was conducted, taking into account both the covariates and the main independent variables. By using Lilliefors' adjusted p-values in conjunction with Kolmogorov-Smirnov tests, the residuals of these analyses were examined for normality. Logarithmic Manganese required change since their aberrations from normalcy were so great. The evaluation of the trace element status

between pregnant women and the control group was done using general linear model analyses that took age, BMI, education, income, physical activity, and parity into account. Because having several pregnancies causes a larger maternal nutrient outflow and an accelerated depletion of nutritional reserves,[27] subgroup analysis was performed, controlling for prenatal visits and prior miscarriages in addition to comparisons between primi- and multipara. To look at the relationship between the trace element status and complications for mothers and children, binary logistic regression analysis were carried out. In order to achieve this, all mother problems, trace element concentrations (selenium, zinc, and manganese) were employed as the independent variable, and all child complications were included as the dependent variable (yes/no) in the model. Pregnancy visits, age, parity, financial position, education levels, and physical activity were considered as data were shown as odds ratios with 95% confidence intervals along with variables.

For both pregnant and non-pregnant women, the effect of food intake on trace element status was examined using a stepwise multiple regression analysis. In this sense, weekly consumption statistics and data from the FFQ were standardized. Data were adjusted for age, marital status, income, BMI, and physical activity.

IBM Corp., Armonk, NY, USA used SPSS, version 25, for all statistical analyses. A p-value of less than 0.05 was deemed significant.

3. RESULT

Table 2: Shows medical history between the studied groups.

	Control Group No (50)	Pregnant Women No (70)	P value
Pregnancy complications			
Yes	0(0%)	21(30%)	**≤0.001**
No	50(100%)	49(70%)	
Previous miscarriages			
Yes	10(20%)	22(31%)	0.1628
No	40(80%)	48(69%)	
Physical activity			
Low	23(54%)	9(13%)	**≤0.001**
Moderate/high	27(46%)	61((87%)	

According to medical history between the studied groups there was statistically significant between the studied groups regarding previous miscarriages, while there was highly statistically significant between the studied groups regarding pregnancy complications and physical activity.

Table 3: Shows Concentrations of selenium, Zinc and Manganese in blood serum between the studied groups.

	Control Group No (50)	Pregnant Women No (70)	P value
Selenium (µmol/L) Mean ±SD	2.73 ± 1.18	2.23 ± 1.12	0.0293
Zinc (µmol/L) Mean ±SD	29.52 ± 7.6	21.82 ± 7.2	**≤0.001**
Manganese (log10 nmol/L) Mean ±SD	1.35 ± 0.12	1.37 ± 0.12	0.4023

According to this table there was non-statistically significant between the studied groups regarding Manganese, while there was statistically significant between the studied groups regarding Selenium and there was highly statistically significant between the studied groups regarding Zinc.

Table 4: Concentrations of selenium, Zinc and Manganese in blood serum of pregnant women (primipara vs. multipara).

	Primipara	Multipara	P value
Selenium (µmol/L) Mean ±SD	2.46 ± 1.2	2.23 ± 1.2	0.3357
Zinc (µmol/L) Mean ±SD	21.58 ± 8.06	22.45 ± 8.06	0.5872

Manganese (log10 nmol/L) Mean ±SD	1.4 ± 0.13	1.35 ± 0.13	0.0549

According to this table there was non-statistically significant between the studied groups.

Table 5: Association of selenium, Zinc and Manganese in blood serum of pregnant women with the risk of maternal and child complications.

	Odds Ratio	P value
Selenium		
Maternal Complications	1.004	0.979
Child Complications	0.726	0.391
Zinc		
Maternal Complications	0.919	0.069
Child Complications	0.995	0.952
log10-Manganese		
Maternal Complications	3.172	0.036
Child Complications	1.418	0.411

This table shows that, although not statistically significant, higher zinc levels were linked to lower odds ratios of maternal complications. Conversely, it was discovered that elevated manganese levels were linked to a greater odds ratio of difficulties for mothers (p = 0.036). For kid issues, there was, however, no correlation discovered.

Table 6: Stepwise multiple linear regression analyzing the association of the intake of different Foods and Beverages on the status of selenium, Zinc and Manganese.

Trace Element	Food Item	β-Coefficient	P Value
Selenium			
	Dairy Products	−0.055	0.027
Zinc			
	Fruits	−0.46	0.032
	Cold Drinks	0.967	0.004
Manganese (log10)			
	Grains	0.505	0.005
	Vegetables	−1.043	0.001
	Dairy Products	−0.635	<0.001
	Sweets	1.42	0.016

Selenium and dairy products showed a significant negative correlation, zinc and fruits showed a significant negative correlation, and zinc and cold drinks showed a significant positive correlation. Manganese (log10) and grains and sweets showed a significant positive correlation, while manganese (log10) and vegetables and dairy products showed a highly significant negative correlation.

4. DISCUSSION

The reason of our investigate was to compare the sums of manganese, zinc, and selenium in pregnant and non-pregnant ladies from a creating country. Examine the association to challenges confronting mothers and kids. One of the essential conclusions of our ponder was that the serum concentrations of zinc and selenium were lower in Egyptian pregnant ladies than in a control bunch. Additionally, past ponders.[28,29] found that pregnant ladies had lower zinc and selenium statuses than non-pregnant control ladies, which is in line with our discoveries. In any case, a investigate by Kassu and colleagues[30] found no variety within the cruel serum zinc and selenium levels all through pregnancy. An examination of the third trimester's zinc levels uncovered that they were greater of pregnancy within the current think about compared to a consider conducted in China.[31]

Moreover, in terms of selenium status, Turkish pregnant ladies had lower cruel serum selenium concentrations, agreeing to inquire about by Kilinc and colleagues.[32]

Distinctive variables, such as age, sexual orientation, body composition, soil, geographic area, nourishment availability, social behaviors (geophagia), and hereditary qualities, may contribute to varieties in follow component concentrations.[33] Plants are the implies by which selenium enters the nourishment chain, consequently the soil.

An individual's selenium status is generally decided by the concentration and assortment of their nourishment

sources.[34] The varieties in selenium status all through pregnancy, be that as it may, may be brought approximately by plasma volume development or by the raised selenium utilization for the blend of antioxidant atoms like selenoprotein P and glutathione peroxidase to turn away oxidative harm.[35]

Moreover, a diminishment in zinc-binding protein levels or the affect of other follow components can be utilized to clarify potential causes of zinc deficiency amid pregnancy.[36] Moreover, a tall utilization of nourishment inhibitors, such as nourishments overwhelming in fiber, calcium, and cereal, diets overwhelming in phytate appear to discourage and confine the assimilation of zinc.[37] In expansion to these, another noteworthy figure that brings down zinc levels amid pregnancy is acute maternal push.[32] The component may well be an hoisted intense stage reaction within the nearness of maternal stretch, which appears to increase metallothionein generation and subsequently lower zinc levels.[38]

Due to a more prominent maternal supplement deplete and an prior consumption of dietary saves, numerous pregnancies are connected to an expanded chance of perinatal issues.[39][27,27] The affiliation portrayed over is for the most part upheld by our perceptions, as we recognized moo manganese levels. in comparison to primipara ladies, (additionally, to a few degree, selenium) in multigravida ladies. In this setting, a earlier ponder found that diminished levels of ferritin and hemoglobin within the blood are connected to an increase in maternal equality.[40] In any case, there's not sufficient information to draw a firm conclusion approximately the relationship between numerous births and maternal follow component status, especially manganese, and more inquire about is required in this range.

Reliable with other investigate,[28,41] no significant relationship was seen between zinc and selenium concentrations and distinctive pointers of unfavorable pregnancy results with respect to troubles for moms and children. Still, other inquire about uncovered that maternal zinc inadequate increments the chance of fetal development confinement amid pregnancy.[11] In a comparative vein, moo serum selenium levels may be connected to moo birth weight,[42] little for gestational age babies,[43] pre-eclampsia,[44] and pregnancy-induced hypertension.[45]

At the same time, we noticed that pregnant ladies with higher manganese concentrations had the next chances proportion for maternal issues. All things considered, the discoveries relating to manganese were simply a relationship and must be translated with caution, as relationship does not infer causality in a vital way. Without a doubt, more investigate is required to survey the affect of manganese status on results for moms and newborns.

Due to the scarcity of data with respect to the impacts of manganese presentation amid pregnancy, A few prior examinations have archived an reverse U-shaped relationship between birth results and maternal manganese levels.[18] In any case, extra think about recommends that higher manganese concentrations amid pregnancy may be a chance figure for pregnancy-related hypertension,[19] intrauterine development confinement,[45] and preeclampsia.[46] Manganese-induced cellular free radical harm, responsive oxygen species, poisonous metabolites, changed mitochondrial work, and ATP blend can all lead to manganese harmfulness, which can show as the manganese dialect.[47] The chemical Mn-superoxide dismutase (MnSOD), which shields the energy-producing mitochondria from oxidative stretch, requires manganese as a essential component.[14] Expanded levels of manganese amid pregnancy may be related to expanded erythropoiesis, intestinal retention, or tissue mobilization.[48] Particularly, Asian females have been found to contain more manganese than females from other ethnic bunches.[49]

Utilizing an FFQ, we found that Egyptian ladies for the most part ate grains—whole wheat—which is the essential staple feast expended within the country. In differentiate, our sample's utilization of angle was moreover moo, in expansion to meat and nuts. Except in a couple of uncommon cases, we did not distinguish considerable connections between the status of follow components and the utilization of certain diets. Our information tend to bolster prior thinks about, which show that dairy items and vegetables have reverse connections with selenium and manganese levels, individually.[50]

Moreover, we found a negative relationship between natural product utilization and serum zinc levels. It has been illustrated that a assortment of dietary components, such as nourishment phytate levels, influence zinc bioavailability.[36]

Phytate is generally display in grains, in spite of the fact that it is additionally broadly dispersed in nuts, vegetables, natural products, and plant-based diets.[51] Moreover, we found that entire grain utilization and manganese levels were emphatically connected. Entire grains have been illustrated to be a wealthy source of manganese in human diets,[52] a dietary component that our consider members reliably expended. Depending on the zone and level of defilement, drinking water contains different amounts of manganese.[53] Thus, the WHO recommended a manganese level of 0.4 mg/l to guarantee secure drinking water and anticipate harming.[54] In a comparative vein, soil selenium levels are impacted by regular changes, nourishment preparing, geographic area, and protein composition.[55] Hence, it is prompted to eat at slightest 40 µg of selenium each day in arrange to advance the most elevated conceivable expression of the selenium proteins.[56]

5. CONCLUSION

In contrast to non-pregnant women, pregnant women had a lower serum intake levels of zinc and selenium, but there was no differentiation in manganese concentrations. Furthermore, findings suggest that maternal problems may be affected by high blood manganese concentrations. Depletion of dietary supplements from food intake and future health interventions should be considered at the population level, as a variety of natural and sociodemographic factors have been shown to influence the correct intake of micronutrients and the resulting blood concentrations during pregnancy.[59] Although other studies in many parts of the world have examined concentrations of follow-on components in pregnant women, none have likely taken into account the relationship between a woman's follow-up component status and the problems she and her fetus experience. A child in Iraq. To improve the intake of maternal nutrition, nutritional supplements, or nutritional power, consideration should be encouraged to clarify the impact of nutritional use on the constituent status of follow-up pregnant women in in-country arrangements.

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