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# Novel biochemical study of the impact of trace elements (zinc & magnesium) in polycystic ovary syndrome (PCOS)

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**Abstract**--The study focused on the zinc and magnesium and its relationship with the Polycystic Ovary Syndrome (PCOS) in women. Where was it collected 61 samples of PCOS women and 45 samples as a control group. The results showed a significant decrease in zinc at ( $P = 0.001$ ), in women with PCOS. The findings in this study revealed the presence of a link between high insulin levels and polycystic ovarian syndrome, the statistical results demonstrate a positive significant association between insulin and estrogen at ( $p=0.008$ ), and also found a significant negative correlation between zinc and magnesium with insulin at ( $p=0.018$ ) and ( $p=0.001$ ), respectively, for those with the syndrome, due to the high level of insulin in their blood and the inability of zinc and magnesium to play their role in controlling the insulin and blood sugar level. Finally, the study showed that there is a new strong relationship between zinc and magnesium on PCOS and abortion.

**Keywords**--- Polycystic ovarian syndrome, magnesium, zinc, Glucose, Sex hormones.

## 1 Introduction

Polycystic Ovarian Syndrome (PCOS) is the most prevalent endocrine condition in women of reproductive age, caused by endocrine diseases, including gonad dysfunction and metabolic issues (Abedini, Ghaedi, Hadi, Mohammadi, & Amani, 2019; Al-Ttaie & Al-Jawadi, 2021) Magnesium is essential for the autophosphorylation of the insulin receptor tyrosine kinase (Kostov, 2019), which plays a significant role in glucose absorption in muscle and adipose tissue, and its presence improves the sensitivity of ATP receptors by boosting the activity of

tyrosine kinase (Yamanaka et al., 2016). The autophosphorylation of tyrosine alters Kinase's transport of GLUT-4 to the plasma membrane, allowing glucose to enter cells more quickly and reducing blood glucose levels (Morakinyo, Samuel, & Adekunbi, 2018).

Some drugs, including birth control pills, might impair magnesium absorption (Gröber, 2019). Hormonal treatment is commonly used in PCOS women who have irregular menstruation, reproductive issues, and other PCOS symptoms including acne and excessive face and body hair (Hamilton, Zelig, Parker, & Haggag, 2019). However, research into the involvement of blood magnesium in the metabolism of glucose and testosterone in women with the condition is limited (Luo et al., 2021). Zinc is involved in several activities inside the pancreas, including the synthesis and release of insulin in beta cells, as well as the generation and storage of insulin (Kim, Shin, & Pae, 2016). It is necessary for the immune system, and it increases the perceptions of smell and taste, engages in metabolism and stimulates tissue growth and cell proliferation, acts as an antioxidant to protect cells from harm, and functions as a cofactor in hundreds of enzymes (Fukunaka & Fujitani, 2018). Serum zinc levels in PCOS patients have yet to be determined. According to researches, studies have reported that blood levels are greater in women with the syndrome than in healthy women (Kurdoglu, Kurdoglu, Demir, & Sahin, 2012). Other research has revealed that its circulating levels are lower in women with the syndrome, while others have discovered that there is no significant difference in zinc levels in the blood between women and control samples (Abedini et al., 2019). The purpose of this study is to find out how zinc and magnesium affect PCOS.

## 2 Materials and Methods

### Sample Collection:

From October 1, 2021, through April 20, 2022, hospitals in AL-Salaam/ Al-Mosul, Iraq, conducted this study according to the Helsinki Declaration's standards.

#### 1. PCOS Patients Group:

This study included 61 PCOS women patients. Their ages ranged from 20 to 43.

#### 2. Control Group:

As a control group, 45 women aged 20 to 42 years old took part in this study.

Blood samples were taken in the morning after 12 hours of fasting (day 2 or 3 of the menstrual cycle) for sex hormones (estrogen E2), insulin, glucose, zinc, and magnesium during the early follicular phase. progesterone during ovulation (day 13 or 14 of the menstrual cycle) for both groups (Dere, Djoupo, Menin, Coulibaly, & Tiahou, 2021). A specialized kit (Bio Merieux Kits) from Minividas-France was used to assess PRG, E2 variables. In addition to employing Roche kits for INS, Cobas-e411 employs a Spectrophotometer to detect glucose, zinc (Zn), and magnesium (Mg) using bespoke kits. Finally, SPSS software was used to analyze the data (Ali & Bhaskar, 2016).

Table 1  
Zinc and magnesium levels in women with PCOS compared to the control group

Biochemical Variables	PCOS Group (Mean±SD)	Control group (Mean±SD)	P-value
Mg (mg/dL)	2.01 ± 0.2	2.05 ± 0.1	0.90
Zn (µg/dL)	198.9 ± 43.2	287.1 ± 30.9	0.001**

\*\*Significant differences at  $P \leq 0.001$

Table 2  
Correlation of the effect of INS for PCOS women, depending on hormonal and biochemical variables

Biochemical Variables	r correlation value	P-Value
Mg (mg/dL)	0.493-	0.001**
Zn (µg/dL)	-0.303	0.018*
Glu. (mg/dL)	0.070	0.59
Estrogen (E2) (pg/ml)	0.336	0.008**
Progesterone (P4) (ng/ml)	0.082	0.532

\* Significant differences at  $P \leq 0.05$ , \*\* Significant differences at  $P \leq 0.001$

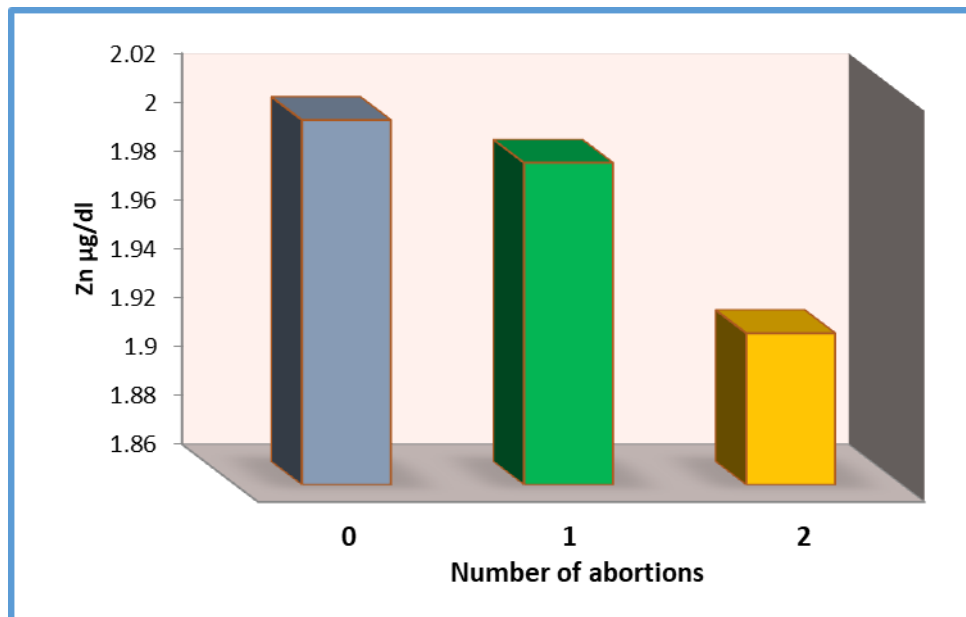


Figure (1): The effect of zinc level on the number of abortions

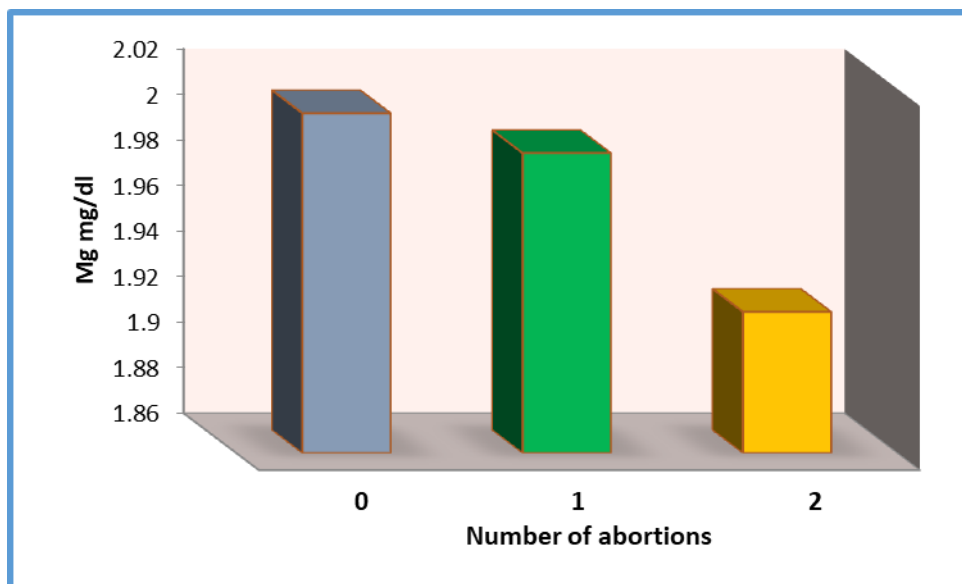


Figure (2): The effect of magnesium level on the number of abortions

### 3 Results and Discussions

The results in Table (1) showed a significant decrease in zinc at ( $p=0.001$ ) among women with the PCOS syndrome. The reason for the low level of zinc in women with the syndrome may be the main reason for insulin resistance, as studies have confirmed that it is a cofactor for antioxidant enzymes such as (catalase and dismutase superoxide) (Hassan, Sada, Ketheeswaran, Dubey, & Bhat, 2020), which participate in many processes within the pancreas, and the roles of zinc have been confirmed. It has different levels of insulin formation, secretion and signaling (Cruz et al., 2018), so many systemic disorders such as hyperlipidemia,, insulin resistance and diffuse follicular developmental arrest in PCOS may be related to zinc deficiency (Nasiadek, Stragierowicz, Klimczak, & Kilanowicz, 2020). While the results did not show a statistically significant difference in the level of magnesium.

The findings in Table (2) revealed the presence of a link between high insulin levels and polycystic ovarian syndrome, the statistical results demonstrate a positive significant association between insulin and estrogen at ( $p=0.008$ ). The higher the concentration of the first, the higher the concentration of the second. The positive correlation between insulin and estrogen can be explained by the fact that estrogen has a major role in regulating the reproductive system in addition to improving insulin activity (Gupte, Pownall, & Hamilton, 2015). The study also found a significant negative correlation between zinc and magnesium with insulin at ( $p=0.018$ ) and ( $p=0.001$ ) respectively, for those with the syndrome, due to the high level of insulin in their blood and the inability of zinc and magnesium to play their role in controlling the insulin and blood sugar level (Yin, Hong, Ma, Bu, & Liu, 2020). In addition to being an important factor in hormonal health, they are necessary to promote the production of the female hormones estrogen and

progesterone, especially if they have insulin-resistant PCOS(Baltaci, Mogulkoc, & Baltaci, 2019).

Figures (1) and (2) show the relationship between zinc and magnesium levels with the number of abortions for women with the syndrome, as it shows a decrease in the level of elements with an increase in the number of abortions. The cause of abortion is not specified, but there are factors, including disturbance of the immune system and serious infections that may increase Chances of miscarriage(Thaker, Oza, Shaikh, & Kumar, 2019). Magnesium and zinc are the most abundant and required elements for more than one vital reaction within the body. They support healthy immunity and participate in regulating blood sugar levels. They can be valuable predictors of miscarriage. Low levels of these elements may be due to poor diet, malabsorption, or abnormalities in the blood glucose levels. Secretion(Mahmood, Abolhab, & Mohamed, 2013).

#### 4 Conclusion

PCOS is the most frequent endocrine condition among women of reproductive age (polycystic ovarian syndrome). and the study discovered a substantial link between the effects of zinc and magnesium on PCOS(Cutler, Pride, & Cheung, 2019).

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