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Relationship between Serum Zinc Level with Immunoglobulin a Plasma Level in Pregnant COVID-19 Patients

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Abstract: Background: In maintaining mucosal immunity, Immunoglobulin A (IgA) serves a crucial function. The entry points for infectious pathogens in the respiratory and digestive systems count on IgA as the preeminent immunoglobulin for defense. A proper intake of dietary zinc is pivotal for strong immune competence and resistance to viral infections, ultimately having an impact on IgA levels.

Aim: COVID-19 patients who are pregnant were evaluated to see if there is a correlation between their plasma IgA levels and their serum zinc levels.

Patients and methods: A study was carried out by a private obstetrician clinic between January 2022 and December 2022, with 179 pregnant women split into two groups. 102 women in the first group had acquired COVID-19 at some point throughout their pregnancies. As a control, the second group consisted of 77 pregnant women in good health. IgA and zinc levels were taken during the pregnant women's evaluation in order to compare the two groups and determine the effect of COVID-19 on these parameters. The purpose of this case control study was to ascertain how pregnant women's levels of zinc and IgA were correlated with COVID-19 infection.

Results: Among the cases and controls, variations were found in trimester, parity, family history of COVID-19, presence of COVID-19, and history of vaccination ($p<0.05$). Analysis of Zinc and IgA levels demonstrated significantly lower levels in pregnant women with COVID-19 compared to those who were healthy ($P=0.0001$). In both groups, there was a noticeable but weak link between IgA and Zinc levels.

Conclusion: Among pregnant women who had COVID-19, the IgA levels were observed to be lower. Both groups had a weak positive correlation between their Zinc level and IgA level. Protecting a pregnant woman from Covid 19 is important, and research suggests Zinc and IgA can play a role in this protection. Pregnant women have a weakened immune system, making them more vulnerable to illness, so finding ways to boost their immunity is crucial. Zinc has been linked to improved immunity, and some studies indicate that pregnant women who take Zinc supplements can reduce the risk of infection. IgA is an antibody that helps defend mucus membranes, where viruses like Covid 19 enter the body. Studies show that pregnant women who have high levels of IgA are less likely to be affected by Covid 19. By focusing on these key factors, we can help ensure the health and safety of pregnant women and their babies.

Keywords: Pregnant women, Covid 19, Immunoglobulin A (IgA), and Zinc.

Introduction:

1-The Coronavirus Disease 2019(COVID-19)

As one of the worst pandemics of the century, COVID-19, a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, has wrought havoc. It was deemed a pandemic by the WHO on March 11, 2020 [1]. As of April 24, 2022, there were over 600,000 confirmed cases and over 6 million recorded deaths worldwide [2]. Pregnancy can aggravate the COVID-19 course [3,4]. Coronaviruses can be found in a variety of animal species, including cats, bats, camels, and cattle. Rare cases of animal coronaviruses infecting humans and then spreading between people have been documented, with examples being MERS-CoV, SARS-CoV, and recently SARS-CoV-2.[5]. Through the transfer of respiratory droplets carrying infectious virus, individuals come into contact with SARS-CoV-2 (typically within a range of 6 feet), while other transmission methods also exist, including contact transmission (e.g., through handshake) and airborne transmission through droplets that persist in the air over longer distances (usually greater than 6 feet) [6]. The virus is released in respiratory secretions (e.g., via coughing, sneezing, talking) and can infect others through the exposure of their mucous membranes [7]. Infectivity can last for different periods and degrees on surfaces, but it doesn't seem to be the main transmission route. Detectable traces of SARS-CoV-2 have been found to linger on some surfaces for up to 72 hours, although its infectivity decreases over time. Copper surfaces and cardboard surfaces showed no viable SARS-CoV-2 after 4 hours and 24 hours, respectively, according to a study [8]..

2- Immunoglobulin A (IgA)

Mucosal immunity relies heavily on the presence of Immunoglobulin A (IgA). Essentially, IgA is the primary immunoglobulin that fights off infectious pathogens in both the digestive and respiratory systems at the point of pathogen entry, making it a crucial part of our immune response. Acting as an immune barrier, secretory IgA is capable of neutralizing SARS-CoV-2 before it even has a chance to bind with epithelial cells. Therefore, the prevalence of IgA in respiratory mucosa acts as a telltale sign of a strong immune response in the host, which can be easily measured in saliva and tears. This indicates that IgA detection could potentially serve as a reliable early diagnosis marker, making it all the more important. [9] In the colon, IgA2 reigns supreme, while in the airways, it's IgA1. Those who lack IgA production or immunoglobulin A antibody-mediated responses are more vulnerable to respiratory and gastrointestinal infections. They're also at greater risk of developing chronic respiratory diseases and experiencing periodic upper respiratory tract colonization [10]. All isotypes mediate virus-specific antibody responses, but IgA seems to play a more prominent role in virus neutralization and protection against reinfection, surpassing even IgG [11]. The submucosal plasma cells are responsible for producing IgA, which is then conveyed to the intestinal epithelial cells' apical surface through a highly effective mechanism involving the polymeric immunoglobulin receptor [12].

3-Zinc

SARS-CoV-2 infections can potentially be diminished in the risk, duration, and severity via Zinc intake due to its capacity to impede RNA dependent RNA polymerase of RNA viruses. Its activities are multinomial, exerting immunomodulatory, antioxidant, anti-inflammatory, and antiviral effects. Despite the pressing need for additional clinical research into the efficacy of zinc supplementation in combatting COVID-19 [13]. Zinc is an essential mineral for normal body functions and systems, such as blood clotting [14]. Because zinc is essential for the synthesis of components of the bone matrix, deficiencies in zinc may play a role in the development of osteoporosis in older adults. Furthermore, zinc supports various aspects of the innate and adaptive immune systems, which include the main defenses against invasive pathogens: antibody responses, cellular fortifications, and epithelial defenses [15]. Utilizing its strong immunomodulatory and antiviral qualities, zinc could be a useful COVID-19 therapy option [16]. It has been postulated based on pre-clinical investigations that zinc has the ability to hinder replication of RNA viruses, such as SARS-CoV-1, by directly impeding RNA-dependent RNA polymerase. With that in mind, it may be plausible to consider that zinc could also hamper SARS-CoV-2 replication. Droplet spread serves as a similar mode of transmission for coronaviruses and influenza viruses. Research indicates that a zinc insufficiency

facilitates the interplay between ACE-2 and SARS-CoV-2 spike protein, while an elevated level of zinc has the power to decrease ACE-2 expression, ultimately leading to a decrease in viral interaction [17,18]..

Patients and methods:

Throughout ThiQar Governorate, a case control study aimed to measure IgA and Zinc levels in pregnant women both infected and uninfected with COVID-19. The 179 participants were divided into two groups: Group A consisting of 102 pregnant women with a history of COVID-19 infection during pregnancy, and Group B consisting of 77 healthy pregnant women serving as the control group. Direct interviews were conducted with all participants using a split questionnaire. Data from the assessment will provide insight into potential correlations between IgA and Zinc levels and COVID-19 infection in pregnant women.,they have two parts:

Part One: Baseline demographic data at time of examination: age, trimester based on last ultrasound report, parity, history of family infection of COVID -19 and contact, history of vaccination, and history of travel.

Part Two: 2ml of fresh blood with draw from each participatns to assess:

1-Zinc level

2-IgA level

Statistical Analysis

Version 23 of the SPSS software was utilized to enter and analyze data. To differentiate the groups, both person correlation coefficient and independent sample t test were employed.

Statistical significance was declared for P -value <0.05..

Results:

Table -1: Demographic characteristics for studied groups

		Case (N=102)		Control (N=77)		P value
		Count	N %	Count	N %	
Age	Mean ± SD Range	31 ± 6.6 18 – 43 years		34 ± 6.2 19 – 42 years		0.09
Trimester	Mean ± SD Range	5.8 ± 2.1 2 – 9 months		7 ± 2.1 2-9 months		0.001
Trimester	1st	19	18.6%	6	7.8%	0.002
	2nd	40	39.2%	18	23.4%	
	3rd	43	42.2%	53	68.8%	
Gravida	1-2	22	21.6%	11	14.3%	0.09
	3-4	58	56.9%	33	42.9%	
	≥ 5	22	21.6%	33	42.9%	
Parity	0-2	62	60.8%	29	37.7%	0.003
	3-4	34	33.3%	34	44.2%	
	≥ 5	6	5.9%	14	18.2%	
Family history of COVID infection And Contact	No	53	52.0%	11	14.3%	0.0001
	Yes	49	48.0%	66	85.7%	
HX of Vaccination	No	77	75.5%	42	54.5%	0.003
	Yes	25	24.5%	35	45.5%	
HX of Travel	No	76	74.5%	58	75.3%	0.09
	Yes	26	25.5%	19	24.7%	

Table -2: Zinc levels for studied groups

	cases	N	Mean	SD	P value*
Zinc	Case	102	49.36	21.67	**0.0001**
	control	77	76.23	23.86	

***Independent sample t test**

Table-3: IgA level for studied group

		N	Mean	SD	P-Value*
IgA	Case	102	1.115	0.8	**0.0001**
	control	77	2.64	1.3	

*Independent sample t test

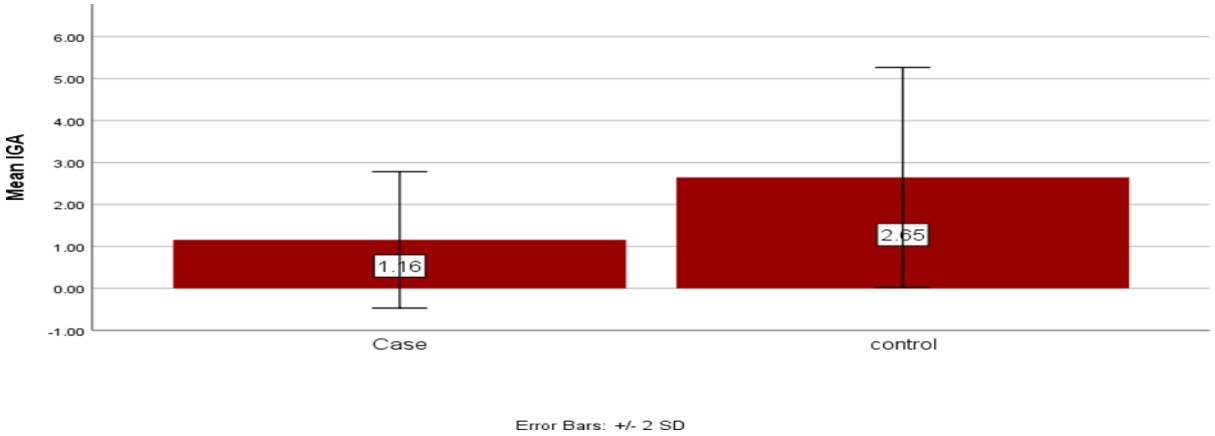

Figure -1: IgA level across studied groups

Table -4: Correlations of IgA level and Zinc level

		Zinc	IGA
	R	0.540	1
IGA	P value	**0.0001**	
	N	179	179

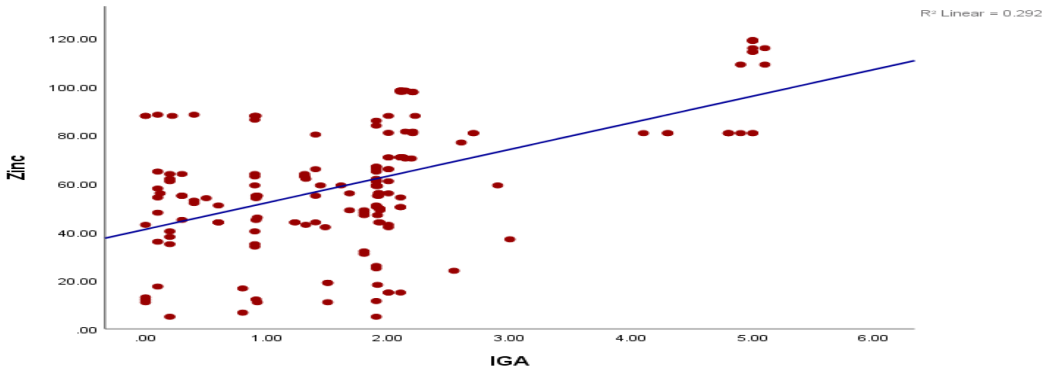

Figure-2. Correlations of IgA level to Zinc level

Discussion:

The average age of COVID-19-infected pregnant females was in their thirties, consistent with a US study that found similar results[19]. Coinciding with these findings, the control group displayed a vaccination rate of over 45%, while only 24% of tested subjects had taken the COVID-19 vaccine. It was also found through another study that the COVID-19 vaccine is an effective and safe option for pregnant women, with no adverse effects on pregnancy or neonatal outcomes [20]. In comparison to healthy pregnant women, it was discovered that those with COVID-19 infections had significantly lower levels of Zinc in a recent study [21,22]. Zinc is known for playing a significant role in the

pathogenesis of viral infections. Notably, the assessment of Zinc levels in pregnant women revealed the afore mentioned discrepancy [23]. IgA antibodies, which are produced shortly after IgM antibodies, play a vital role in combating SARS-CoV-2 infections by acting as the first line of defense against the virus. These antibodies block the virus from infecting critical regions of the human body like the respiratory tract, vagina, and digestive tract [24]. Previous research has already shown a connection between serum zinc levels and infection severity, highlighting the importance of consuming adequate zinc for our immune system's function and resistance to viral infections. Ensuring proper dietary zinc intake is crucial [25]. The results of our investigation revealed a noteworthy finding regarding the correlation between Zinc and IgA levels. Curiously, despite the various groups involved, a considerably weak yet significant positive correlation was observed. This correlation provided compelling proof that Zinc levels have a direct effect on the level of IgA, and consequently renders individuals more susceptible to COVDI-19 infection [26]. Particularly noteworthy is a study conducted by Çölkesen et al, which discovered that individuals with severe IgA deficiency were more vulnerable to COVDI-19 infection [27]. Furthermore, it was also found that vaccination for COVID-19 resulted in an increase in IgA levels [28].

Conclusions: The following conclusions was drawn from the study: there was a notable connection between Zinc level and IgA level, and pregnant women who contracted COVID-19 displayed decreased IgA level and Zinc levels.

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Consent to Participate: All participants provided written informed consent before participating in the study.

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