RESEARCH ARTICLE

Alterations in the Serum Trace Element Levels in Women Infected with Chlamydia Trachomatis

Qais Lazgin Barany[1], Marwan Khalil Qader[2*], Ashti Asim Mohamed[3]

[1]*Scientific Research Center, College of Sciences, University of Duhok, Duhok, Kurdistan Region- F. R. Iraq*

[2]*Directorate of Preventive Health Affairs, Duhok, Kurdistan Region- F. R. Iraq*

[3]*Biology Department, College of Sciences, University of Duhok, Duhok, Kurdistan Region- F. R. Iraq*

***Corresponding author's email:** Marwan.qader@uod.ac

Received: 09-07-2020 **Accepted:** 25-11-2020 **Available online:** 31-12-2020

ABSTRACT

Most infectious diseases are accompanied by changes in the levels of several trace elements in the blood. A total of 88 female patients referred to the Nawroz Private Laboratory in the Duhok province, Kurdistan Region, Iraq, were enrolled in this study. The enrolled patients were sent to the laboratory for investigation of their hormone levels because they were suffering from various gynecologic abnormalities. The serum levels of anti-chlamydia immunoglobulin (Ig) G and IgM antibodies were estimated using enzyme-linked immunosorbent assay (ELISA) tests, and the serum trace element levels were evaluated by atomic absorption spectroscopy.The results showed that 10 (11.4 %) of the samples tested positive for the presence of anti-chlamydia IgG antibodies, whereas none of the samples tested positive for anti-chlamydia IgM antibodies. Furthermore, a significant reduction in the serum potassium levels was observed in response to the chlamydia infection, whereas no significant changes were observed in any of the other elements.

Keywords: Chlamydia Trachomatis, Trace Elements, Infectious Diseases

1. INTRODUCTION

Chlamydia trachomatis is an obligate intracellular bacterium that causes several severe and debilitating diseases in humans. *C. trachomatis* is responsible for a variety of genitourinary tract infections in both men and women, but as observed in general for other sexually transmitted infections (STIs), it is primarily a woman's healthcare issue because the clinical picture of the infection and outcomes are more damaging to the reproductive health of women than that of men (Paavonen and Eggert-Kruse, 1995). Trace elements such as iron (Fe), copper (Cu), and zinc (Zn) play an essential role in the metabolic activities of both prokaryotic and eukaryotic cells. During infection, serum trace element levels are known to be altered in response to the infection process. An alteration in trace element levels during an infection may occur to deprive the pathogens of these elements (Pekarek and Engelhardt, 1981).

There is a fine balance between the infected host and the microorganism with regard to nutritional needs, with competition for various nutrients between them. The human body requires a number of minerals in trace (milligram) amounts, whereas other minerals are needed in ultratrace (microgram) quantities. Usually, a mineral deficiency involves more than one element, and these combined deficiencies have a serious effect on human health (Halme et al., 2000).

Access this article online

DOI: 10.25079/ukhjse.v4n2y2020.pp65-68 **E-ISSN:** 2520-7792

This study aimed to detect the incidence of the *C. trachomatis* infection in women and to study the effect of the infection on serum trace elements.

2. MATERIALS AND METHODS

A total of 88 female patients referred to the Nawroz Private Laboratory in Duhok province, Kurdistan Region, Iraq, were enrolled in this study. The patients were sent to have their reproductive hormone serum levels analyzed. Blood was collected from each individual patient and the hormone(s) of interest was investigated according to the referral report.

The serum samples were divided into 2 aliquots. One aliquot was used for ELISA analysis to investigate the presence of anti-chlamydia IgG and IgM antibodies. For this purpose, 2 kits, namely the NovaLisa *Chlamydia trachomatis* IgG-ELISA kit (Nova Tec Immunodiagnostica GmBH, Dietzenbach, Germany) and the NovaLisa *Chlamydia trachomatis* IgM-ELISA kit (Nova Tec Immunodiagnostica GmBH) were used. Both kits were used according to the manufacturer's instructions. The samples were considered positive if the absorbance was at least 10% above the cutoff and negative if the absorbance was at least 10% below the cutoff. The remaining serum aliquots were used for the detection of serum trace elements (Zn, Cu, Na, K, Fe, and Ca) using atomic absorption spectrophotometry (PG instruments AA500 Atomic Absorption Spectrophotometer, Leicestershire, United Kingdom). The slit width was 0.4 nm, lamp flow was 5.0 mA, and the wavelengths were 213.9, 589.0 nm (width 0.2 nm), 766.5 nm, 248.3 (width 0.2 nm) and 422.7 nm, respectively.

3. RESULTS

The results of the ELISA measurements revealed that all the samples were negative for the anti-chlamydia IgM antibodies. Five samples (5.7%) were positive for the anti-chlamydia IgG antibodies, whereas 7 samples (7.9%) were indeterminant or in the gray zone. ELISA testing was repeated for the indeterminant samples after one month, following which 5 of the 7 patients tested positive for anti-chlamydia IgG antibodies, and the other two remained indeterminant and were thus considered to be negative. Collectively, 10 samples (11.4%) tested positive for anti-chlamydia IgG, whereas 78 samples (88.6%) were negative (Table 1).

Table 1: ELISA results for anti-Chlamydia IgM and IgG antibodies

ELISA	Indeterminant	Negative	Positive	Total
Anti-chlamydia IgM	0	88	0	88
Anti-chlamydia IgG	7	76	5	88
Repeat for indeterminant	2	0	5	7

The results showed that only the K levels were affected by the chlamydia infection. In individuals without the chlamydia infection, the mean serum K level was 4.6 mmol/L, whereas in the women with the chlamydia infection, the mean level was reduced to 3.9 mmol/L. This reduction in the K level was statistically significant ($p = .019$; 99% confidence interval, 0.016–0.023). No significant changes were observed in the other elements related to the chlamydia infection.

4. DISCUSSION

Several trace elements are important co-factors of multiple enzymes and are important for immune cell production, activation, and function. Most infections are accompanied by an alteration in the trace element levels, which is reflected in serum measurements. A well-documented and common response to infection is a reduction in the levels of Zn and Fe in the serum with a concomitant increase in Cu levels (Beisel et al., 1974).

Trace elements play an important role in immune response (Deveci and Ilhan, 2003; Kassu et al., 2006; Mohan et al., 2006). Fe is a component of enzymes critical for the functioning of immune cells and is involved in the regulation of cytokine production and action. Cu is involved in the maintenance of the intracellular antioxidant balance, suggesting an important

role of Cu in inflammatory response. Zn is essential for highly proliferating cells, especially in the immune system, and is involved in the protection against oxidative stress (De Moraes et al., 2011).

It is well known that an infection may cause micronutrient deficiencies and these deficiencies may alter the risk of infectious disease morbidity (Scrimshaw et al., 1968; Tomkins and Watson, 1989). The effects of an infection are mediated through the acute response phase and localized lesions, leading to decreased intake and absorption of micronutrients, in addition to the increased utilization and loss of micronutrients. A micronutrient deficiency may affect the risk of infection by a specific infectious agent and also the severity of the disease morbidity. These effects are mediated via the pathogenicity of the infectious agent, host risk behavior, or the host defense, and may be either synergistic or antagonistic (Friis, 2001). A synergistic relationship exists when a specific micronutrient deficiency increases the infectious disease morbidity, in which case either improved micronutrient intake or treatment of the infection will break the vicious circle. An antagonistic relationship exists when a specific micronutrient deficiency reduces or increased intake increases the infectious disease morbidity (Scrimshaw et al., 1968). In fact, a micronutrient may act synergistically in moderate doses but antagonistically in high doses. For example, Zn, although essential for the optimal functioning of the immune system (Shankar and Prasad, 1998), is immunosuppressive at high doses (Chandra, 1984).

The results of the current study were inconsistent with those of others who stated that changes in serum trace element levels had also been noted in individuals with different infectious diseases. Lower respiratory tract infections and diarrhea among Indian infants were associated with low plasma Zn levels (Bahl et al., 1988). Increased Cu levels along with reduced Zn levels were recorded in patients diagnosed with *Plasmodium vivax* malaria (Seyrek et al., 2005). Patients with pulmonary tuberculosis showed an increase in serum Cu levels (Ciftci et al., 2003). Such changes could be the direct or indirect effect of the defense strategies employed by the host system to prevent growth or adhesion of the pathogen, or to improve the host immune defense mechanism.

Finally, we should emphasize that serum K levels reflect the general condition of the body and should not be considered as a specific diagnostic parameter for genital chlamydia infection in these women. This reduction could also be attributed to other co-existent conditions in the body. The resampling technique proved useful in circumventing the issue of small sample size in our study; however, more readings will provide better inferential power. It should also be emphasized that within the infected group, there were only 11 readings and that two of them were outliers as determined by boxplots, which could have introduced some variation in the permutation test. Collectively, these results should encourage future studies with larger sample sizes to support the current findings and also to investigate in more depth the mechanism(s) by which the chlamydia infection could affect serum K levels in humans.

REFERENCES

Bahl, R., Bhandari, N., Hambridge, K. M. & Bhan, M. K. (1988). Plasma zinc as a predictor of diarrhoeal and respiratory morbidity in children in an urban slum setting. Am. J. Clin. Nutr. 68(2), 414S–417S.

Beisel, W. R., Pekarek, R. S. & Wannemacher, R. W. (1974). The impact of infectious diseases on trace element metabolism in the host. In: Hoekstra G, Gauther HE, Mertz W (eds) Trace element metabolism in animals. University Park Press, Baltimore: 217.

Chandra, R. K. (1984). Excessive intake of zinc impairs immune responses. JAMA. 252 (11), 1443–1446.

Ciftci, U. V., Ciftci, B. & Yis, O., Guney, Y., Bilgihan, A. & Ogretensoy, M. (2003). Changes in serum selenium, copper, zinc levels and Cu/Zn ratio in patients with pulmonary tuberculosis during therapy. Biol. Trace Elem. Res. 95 (1), 65–71.

De Moraes, M. L., Canellas, C. G. L., Marcelino J. Anjos, M. J., Ramalho, D. M. P., Delogo, K. N., Miranda, P. F. C., Mesquita, E. D. D., Kritski, A. L., Oliveira, M. M. & Lopes, R. T. (2011). Trace elements status of pulmonary tuberculosis patients compared with healthy voluntarees. International Nuclear Atlantic Conference - INAC 2011 Belo Horizonte,MG, Brazil, October 24–28.

Deveci, F. & Ilhan, N. (2003). Plasma malondialdehyde and serum trace element concentrations in patients with active pulmonary tuberculosis. Biological Trace Element Research. 95(1), 29–38.

Friis, H. (2001). Micronutrients and infections: an introduction. In: Friis, H. ed. Micronutrients and HIV infection. Boca Raton. CRC Press: 1–21.

Halme, S.; Latvala, J.; Karttunen, R.; Palatsi, I.; Saikku, P. and Surcel, H. M. (2000). Cell-mediated immune response during primary *Chlamydia pneumoniae* infection. Infect. Immun. 68(12), 7156–7158.

Kassu, T., Yabutani, Z. H., Mahmud, A., Mohammad, A., Nguyen, N., Huong, B. T. M., Hailemariam, G., Diro, E., Ayele, B., Wondmikun, Y., Motonaka, J. & Ota, F. (2006). Alterations in serum levels of trace elements in tuberculosis and HIV infections. European Journal of Clinical Nutrition. 60 (5), 580–586.

Mohan, G., Kulshreshtha, S. & Sharma, P. (2006). Zinc and copper in Indian patients of tuberculosis. Biological Trace Element Research. 111, 63–69.

Paavonen, J. & Eggert-Kruse, W. (1995). *Chlamydia trachomatis*: impact on human reproduction. Hum Reprod. Update. 5(5), 433–447.

Pekarek, R. S. & Engelhardt, J. A. (1981). Infection-induced alterations in trace metal metabolism: Relationship to organism virulence and host defense. In Powanda, M.C., Canonico, P.G. (eds.), Infection: The physiologic and metabolic responses of the host. Biomedical Press, Elsevier: North Holland. pp. 131–146.

Scrimshaw, N. S., Taylor, C. E. & Gordon, J. E. (1968). Interactions of nutrition and infection. Geneva, World Health Organization.

Seyrek, A., Kocyigit, A. & Erel, O. (2005). Essential trace elements selenium, zinc, copper, and iron concentrations and their related acute-phase proteins in patients with vivax malaria. Biol. Trace Elem. Res. 106 (2), 10715.

Shankar, A. H. & Prasad, A. S. (1998). Zinc and immune function: the biological basis of altered resistance to infection. American Journal of Clinical Nutrition. 68, 447S–463S.

Tomkins, A. & Watson, F. (1989). Malnutrition and infection. A review. Geneva, ACC/SCN.