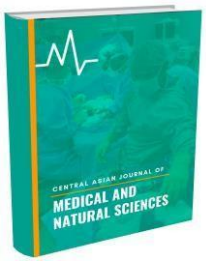

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Article

The Effect of Intestinal Parasite Infection on Enzyme Antioxidants and on The Level of Their Supporting Elements

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Abstract: A gastrointestinal infection can significantly disrupt the metabolism of antioxidants and minerals. This study aimed to assess the levels of superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT) in patients with intestinal parasite infections. This study also evaluated minerals such as zinc, copper, and selenium. The study included collecting 227 stool samples from patients with chronic diarrhea who came to Samarra General Hospital and some private laboratories, whose ages ranged from 16 to 59 months during the period between the beginning of June 2025 and the end of November 2024. The results of the study indicate that the percentage of intestinal parasite infection was 37.9% of the total 227 samples, while 91% of the samples tested negative for the presence of the parasite. Furthermore, the most prevalent intestinal parasite was *E.histolytica* (59.3%), followed by *G.lamblia*(26.7%), and the lowest prevalence was *Trichomonas. Hominis*(1.2%). The present study showed decrease level of SOD, CAT, Zinc, Copper, Selenium in patients with intestinal parasite (13.31 ± 1.23, 35.97 ± 3.55, 52.90 ± 3.55, 491.89 ± 78.99, 211.49 ± 33.48), as compared with control (16.87 ± 1.14, 47.39 ± 1.79, 73.66 ± 5.59, 822.19 ± 86.24, 415.32 ± 78.06) at p-value <0.001, while increase GPX in patients with intestinal parasite (1.67 ± 0.36) as compared with control (0.84 ± 0.20) at p-value <0.001. The present study concluded prevalence rate of intestinal parasite in diarrheal patients. In addition, the female more infected than male. Furthermore, the older age more infected than younger. Among the detected parasite, *E.histolytica* more prevalent than other parasite. The present study also concluded a significant decreas level of antioxidants and minerals in patients with intestinal parasite, while increase GPX in patients with intestinal parasite.

Keywords: Intestinal Parasite, Diarrhea, Antioxidants, Minerals

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1. Introduction

Intestinal parasites are widespread pathogens throughout the world, comprising two groups: parasitic protozoa, which are unicellular, and parasitic helminthes, which are multicellular and possess body systems and other mechanisms that enable them to live parasitically [1]. Children are often more susceptible to parasitic infections in general, and intestinal parasites in particular, for several reasons, including a lack of health awareness and attention to hygiene, as well as a lower immune response compared to adults[2]. Intestinal parasitic infections cause numerous health problems, such as anemia and vitamin deficiencies. Diarrhea is also a serious illness resulting from intestinal parasitic infections[3].

The interplay between host and parasite variables influences metabolism, hence deteriorating the nutritional state of immunocompromised or malnourished patients. A

reciprocal association between infection and malnutrition is present. Malnourished people' reaction to giardiasis triggers the generation of free radicals as oxidative stress agents, resulting in modifications to lipoprotein composition and metabolic alterations[4]. In malnourished or immunosuppressed individuals, the extent of immunosuppression influences the host's susceptibility to certain infections and may enhance their pathogenicity[5].

Oxidative stress (OS) profoundly impacts the growth and dynamics of parasitic infections, influencing both the host organism and the enduring parasite. The parasite simultaneously utilizes complex defense strategies and develops tolerance to reactive oxygen species (ROS) to ensure its survival within the infected host organism[6, 7]. This adaptation involves the strategic use of available resources and the host's environment to promote its growth while simultaneously compromising the host organism. Reactive oxygen species (ROS) are essential in combating parasitic and microbial invasions[8-10]. The host exploits the detrimental impact of reactive oxygen species on the parasite's cells to eliminate it. Phagocytic cells, such as granulocytes, monocytes, and macrophages, exhibit a substantial rise in oxygen consumption, termed oxygen shock, in reaction to the presence of an intruder in the body, potentially escalating several dozen times. This aims to generate and release substantial quantities of superoxide anion ($O_2^{\bullet-}$) and hydrogen peroxide (H_2O_2) to combat bacterial, viral, and parasite infections[7].

Catalase (CAT) is a tetrameric hemoprotein found at elevated amounts in erythrocytes and liver cells. It experiences divalent oxidation and alternating reduction at its active site in the presence of H_2O_2, converting it to water. Similar to CAT, and glutathione peroxidase, decompose and neutralize H_2O_2 and lipid peroxides (ROOR) into less deleterious substances, including H_2O, alcohol, and O_2 [11-13]. This study aimed to assess the levels of superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT) in patients with intestinal parasite infections. This study also evaluated minerals such as zinc, copper, and selenium.

2. Materials and Methods

The study included collecting 227 stool samples using clean, tightly sealed plastic containers with a lid from children with chronic diarrhea and some other intestinal disorders who came to Samarra General Hospital and some private laboratories, whose ages ranged from 16 to 59 months during the period between the beginning of June 2025 and the end of November 2024. The personal information was recorded according to a form prepared for this purpose, which included gender, age, intestinal parasite infection, blood tests and their results, and other observations.

Direct wet smear method

All samples were examined using the direct wet swab method, which is used by many researchers, by following these steps [14].

Blood sample collection

Venous blood samples were obtained from all patients as well as controls after a fasting duration of no less than 12 hours for biochemical examination. Blood was obtained using normal antecubital venipuncture into a tube free of anticoagulant (EDTA) and allowed to coagulate in a water bath at 37°C. Following this, the blood samples were centrifuged at 3000 rpm for 10 minutes, leading to serum isolation, which was subsequently aliquoted into two tubes and stored at –20°C until required for analysis.

Assessment of biochemical parameters and minerals

Insulin serum levels were assessed via ELISA. The plate was pre-coated with antibodies specific to human insulin. The concentrations of human insulin shown a positive connection with the hue of the substrate solution. The procedure culminates with the addition of an acidic stop solution, followed by the measurement of absorbance at a

wavelength of 450 nm. Spectrophotometers were employed for the analysis of iron, zinc, selenium, copper, and blood glucose[15].

Statistical analysis

The Statistical Package for Social Science (SPSS) version 23 was employed to code, enter, and analyze the gathered data. Numerical values and percentages were utilized to analyze qualitative data. The mean and standard deviation were utilized for quantitative data analysis. P-values of 0.001 or below were employed to ascertain the significance of differences.

3. Results

The results of the study, shown in Table (1), indicate that the percentage of intestinal parasite infection was 37.9% of the total 227 samples, while 91% of the samples tested negative for the presence of the parasite.

Table 1. The prevalence of intestinal parasite in diarrheal patients

Total	Infected	Percentage
227	86	37.9%

The results of the current study showed that infection with the parasite in females reached 51.9%, while in males it was 26%, as shown in Table (2).

Table 2. The percentage of infected patients with intestinal parasite according to sex

According to sex	Total number	Positive result	Percentage
Male	123	32	26%
Female	104	54	51.9%

In the current study, the highest infection rate was in the age group of (49-59) at 52.7%, and the lowest rate was in the age group of 38-48 at 24.5% of the total infected samples, as shown in Table (3).

Table 3. The percentage of infected patients with intestinal parasite according to ages

According to ages	Total number	Positive result	Percentage
16-26 years	59	25	42.4%
27-37 years	60	19	31.7%
38-48 years	53	13	24.5%
49-59 years	75	29	52.7%

The most prevalent intestinal parasite was E.histolytica(59.3%), followed by *G.lamblia*(26.7%), and the lowest prevalence was *Trichomonas. Hominis*(1.2%).As shown in Table (4).

Table 4. The percentage of infected patients with intestinal parasite

According to ages	Total number	Positive result	Percentage
16-26 years	59	25	42.4%
27-37 years	60	19	31.7%

38-48 years	53	13	24.5%
49-59 years	75	29	52.7%

The present study showed decrease level of SOD, CAT, Zinc, Copper, Selenium in patients with intestinal parasite(13.31 ± 1.23, 35.97 ± 3.55, 52.90 ± 3.55, 491.89 ± 78.99, 211.49 ± 33.48), as compared with control (16.87 ± 1.14, 47.39 ± 1.79, 73.66 ± 5.59, 822.19 ± 86.24, 415.32 ± 78.06) at p-value <0.001, while increase GPX in patients with intestinal parasite (1.67 ± 0.36) as compared with control (0.84 ± 0.20) at p-value <0.001. As shown in Table (5).

Table 5. Level of antioxidants and minerals in infected patients with intestinal parasite

Parameters	Patients	Control	P-value
SOD	13.31 ± 1.23	16.87 ± 1.14	< 0.001
CAT	35.97 ± 3.55	47.39 ± 1.79	< 0.001
GPX	1.67 ± 0.36	0.84 ± 0.20	< 0.001
Zinc	52.90 ± 3.55	73.66 ± 5.59	< 0.001
Copper	491.89 ± 78.99	822.19 ± 86.24	< 0.001
Selenium	211.49 ± 33.48	415.32 ± 78.06	< 0.001

4. Discussion

Research indicates that inadequate antioxidant defense mechanisms against oxidative stress lead to substantial oxidative damage in cells, considerably impairing the organism's activities. This alteration may potentially exacerbate the severity of the disease[16].

Epidemiological studies on the prevalence of intestinal parasites in different regions typically aim to identify at-risk communities and diseases that pose a risk to human populations, making further research on infections that threaten human health worldwide essential. Numerous environmental, biological, behavioral, social, economic, and health factors directly or indirectly influence parasitic infections. The quality of infrastructure in a city or village, income, occupation, and education level are also important aspects that affect infection spread, disease transmission, and mortality (Al-Durri). The prevalence of 37.9% which recorded in the present study slightly higher from [17] which reported 27.66% , while higher than which reported 52.0%[18].

This study found that female had a higher infection rate than male. This finding agrees with. [19], who found a higher infection rate in females than in males, but differs from [17, 20]. The difference in infection rates between males and females is attributed to several factors. Biological factors are likely responsible for this variation, as physical differences may affect individuals' susceptibility to or resistance to infection.

As a protective strategy against parasites, reactive oxygen species (ROS) are produced as part of the immune response to parasitic infections. These ROS are critically important for the fight against parasites; nevertheless, their overproduction and sustained presence can lead to oxidative stress, causing tissue damage and worsening the overall pathogenesis of the infection.

This result concurs with [21],which shown a reduction in CAT, GSH, and SOD in parasite infections. In response to parasite infections, the host's immune system frequently produces elevated amounts of ROS as a defensive strategy which including superoxide radicals and hydrogen peroxide, are essential in targeting and eradicating parasites [22]. Antioxidant systems are not capable of completely neutralizing all reactive oxygen species that are created by physiological or pathological activities. In the subsequent stages, oxidative damage takes place, which ultimately results in an increase in lipid peroxidation and, consequently, elevated levels of MDA in patients. The prolonged infection with these

parasites and the accumulation of free radicals that they produce can significantly reduce the levels of both enzymatic and non-enzymatic antioxidants in the body. This can lead to an imbalance in the body's oxidative homeostasis, which in turn can cause oxidative damage in patients[23]. To protect host cells from the extra free radicals that are created by parasite infections, the enzymatic antioxidant defense system does its job [8].

Two previous studies on human parasite infections, specifically T. gondii, both found that the GSH levels detected in this study were consistent with those found in those studies[24, 25] Research demonstrated that persons with fascioliasis had lower levels of glutathione peroxidase activity in their blood and erythrocytes compared to individuals who were not infected with the disease. Glutathione peroxidase enzymes are responsible for converting hydrogen peroxide to water and alcohols by consuming reduced glutathione. The current study's findings showed that there were significant shifts in the levels of superoxide dismutase and catalase enzymes that were present in the blood serum of patients involved in the study across all of the different study groups. It is possible for E. histolytica to cause hemorrhagic colitis by invading and destroying the tissue that lies within the human colon. Although the oxygen pressure in the human colon is quite low, the parasite is still present there. In the fight against microbial diseases, including amoebiasis, the production of reactive oxygen species (ROS) is an essential component of the host's innate immune response system[26].

5. Conclusion

The present study concluded prevalence rate of intestinal parasite in diarrheal patients. In addition, the female more infected than male. Furthermore, the older age more infected than younger. Among the detected parasite, *E.histolytica* more prevalent than other parasite. The present study also concluded a significant decreas level of antioxidants and minerals in patients with intestinal parasite, while increase GPX in patients with intestinal parasite.

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