

Effect of selenium and vitamin (E) on some blood parameters and liver enzymes(GPT,GOT)

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Abstract

The results of blood factor analysis of rabbits given (10) micrograms of selenium orally, and those given (10) micrograms of selenium with 0.4 mg of vitamin E added for (30) days showed a clear significant decrease in the values of hemoglobin Hb, the number of red blood cells RBC, and the values of packed red blood cell volume PCV in the treated rabbits. MCV and MCH values also significantly increased in rabbits given selenium, and then significantly increased in rabbits treated with selenium supplemented with vitamin E compared to the control group. A significant increase in the number of white blood cells was also observed in the selenium and vitamin E group compared to the selenium and control groups at a probability level of $P = 0.05$. Regarding the differential count, the number of lymphocytes was significantly higher compared to the control group (Figure (7)). The values of the GPT and GOT enzymes also significantly increased ($P = 0.05$) in the selenium-treated rabbits, while these values decreased in the selenium and vitamin E group but remained higher than in the control group.

Key words: selenium ; vitamin (E) ; blood

Introduction

Selenium (Se) is a metallic element with an atomic weight of 79. It is found in Group VI of the periodic table and is essential for animals and humans (Sheehan and Halls, 1999).

Selenium is widespread in the Earth's crust at a rate of 7×10^5 weight percent, ranking seventeenth in abundance among the elements in the periodic table (Pago *et al.*, 1999).

Research over the past two decades has demonstrated that selenium is essential for various animals. This discovery has led to a

focus on selenium deficiency diseases (A.P.E., 1998). It has been identified as an essential nutrient, the third factor after sulfur amino acids and vitamin E, and a deficiency of these three factors causes hepatic necrosis (E.P.A., 1998) Liver necrosis).

It has been found that bacteria, plants, and animals require small amounts of this element to form highly specialized compounds that combine with specific functional proteins in cells (Hartwell, 1997). Selenium has also been found to be a common component of enzymes, proteins, and aminoacyl transfer ribonucleic acid (Sappington, 2002). In general, selenium is a

component of some proteins discovered in red blood cells, including glutathione peroxidase and selenocysteins. Selenium protects biological membranes from oxidative damage (Davis *et al.*, 2001). It is also considered an anticarcinogenic element. Interest in the toxic properties of selenium has increased despite its low concentration in the Earth's crust (Hamilton and Lemly, 1999). Selenium is absorbed from the soil, albeit in very small quantities, during plant growth, causing harm to plants and animals that eat them (Dunbar *et al.*, 1999). Selenium toxicity can be acute, causing blind staggers, or chronic, causing alkali disease. (Garcia *et al.*, 2000; Davis, 2001).

There are risks associated with the use of selenium in industry due to inhalation (Bowie *et al.*, 1996). Hydrogen selenide is a toxic agent that irritates the eyes, nasal mucosa, and upper respiratory tract, and causes respiratory distress in humans. This compound is ten times more dangerous than hydrogen sulfide. As for vitamin (E), it is considered as essential nutrient for human and animals because it is not created in the body.

The levels of vitamin E and lipoproteins in plasma and in phospholipids in mitochondria and plasma membranes in humans depend on the biological activity of vitamin E consumption. The biological activity of vitamin E and selenium is to prevent or inhibit damage to cells and cell molecules caused by peroxidation (Scott, 1998).

Materials and methods

Experimental animals

(18) domestic rabbits of the *Lepus lepus* were used, weighing (1500-1750) g and with an average age of (6) months. They were housed in iron cages with dimensions of 0.5 x 0.5 x 1 m with metal mesh faces. Each group was left for a week to force

acclimatization. They were provided with natural food and water, then the animals were distributed into three groups, each group consisting of (6) animals.

The first group was fed with natural food as a comparison group. The second group was fed with a comparison food, in addition to giving them (10) micrograms of selenium orally. The third group was fed with a comparison food in addition to giving them (10) micrograms of selenium with 0.4 mg of vitamin E given in the form of small capsules orally. After (30) days, the animals were dissected and samples were collected from them.

Collecting blood samples

Rabbits from (control and experimental animals) were dissected after being anesthetized with ether and blood was collected directly from the heart by heart puncture, then part of blood was placed in (5) ml plastic tubes equipped with the anticoagulant Ethylene Diamine tetra acetic acid (EDTA), while the remaining part of the blood was placed in clean glass tubes free of the anticoagulant to obtain serum to determine liver enzymes.

Measurement of blood parameters

Hemoglobin percentage was measured according to the method of (Back, 1955). The number of red blood cells (RBCs) was calculated using a hemocytometer according to the method of (Hoff Meyer, 1907). While the white blood cells (WBCs) were counted according to the method of Marsh and Gorham (1906), their types were calculated (differential W.B.C. count) according to the method of (Entienne, 1974).

The packed cell volume (PCV) was measured using the micro hematocrit method and the blood indices (MCV, M.C.H.C, and M.C.H.) were estimated according to the method of (Anderson, 1980).

Estimation of Glutamate Oxaloacetate transaminase activity (GOT)

The activity of this enzyme in serum was estimated using the substrate (aspartic acid and alpha-keto glutaric acid), as the enzyme works on this substance to produce pyruvic acid, which reacts with the coloring agent Dinitrophenyl hydrazine (DNPH) to form a colored compound (red-brown). Its color intensity was measured at a wavelength of (510) nanometer , and then the activity of the enzyme was calculated from the following equation:

$$67 \times (\text{test sample absorbance}) / (\text{standard solution absorbance}) \quad (\mu \text{ mole/liter}) \text{ GOT Enzyme Activity}$$

Glutamate Pyruvate Transaminase (GPT) activity assessment

Alanine and alpha-keto glutaric acid were used as a substrate on which the enzyme (GPT) works to produce pyruvic acid, which reacts with the coloring agent (DNPH) to form a colored complex (red-brown) whose color intensity was measured at a wavelength of (510) nanometer , then the activity was calculated to apply the following equation:

$$133 \times (\text{test sample absorbance}) / (\text{standard solution absorbance})$$

$(\mu \text{ mole./liter})$ the enzyme activity

The activity of the enzymes GOT and GPT was converted from $(\mu \text{ mole/min/liter})$ to the international unit (IU/L) using a special table.

Statistical analysis

Two-way analysis of variance was used:

2-Way ANOVA using Minitab to determine significant differences between the control group and the treatment groups. The least significant difference test with RLSD was also used to determine these differences.

Results

The results of statistical analysis of blood parameters from the rabbits subjected to the experiment showed that selenium and selenium supplemented with vitamin E had a clear significant effect on these parameters. Selenium and selenium supplemented with vitamin E led to a clear decrease in hemoglobin and red blood cells count in local rabbits at a probability level of 0.05, as shown in Figure (2.1).

While the packed red blood cell volume decreased in the selenium group and the selenium plus vitamin E group compared to the control group, as shown in Figure (3). The MCV values in rabbits increased significantly, reaching 58.85 microliters cubic meters when selenium was given, and 70.58 microliters cubic meters in the selenium and vitamin E group, compared to 47.66 microliters cubic meters in the control group, as shown in Figure (4). The MCH values also increased in the same direction, while the MCHC values decreased slightly compared to the control group, as shown in Figures (3) and (5). The white blood cell counts significantly increased in the selenium and vitamin E group compared to the selenium group, and the comparison was at a probability level of 0.05, as shown in Figure (6).

The percentages of different types of white blood cells were also affected by treatment with selenium and selenium plus vitamin E, as the number of lymphocytes increased significantly compared to the control group, while the decrease in neutrophil white blood cells was significant in the selenium and vitamin E treatment compared to the control

group and the selenium group, as shown in Figure (7).

Figure (8) shows the measurement of the effectiveness of the two liver enzymes GOT and GPT in the serum of the rabbits that were subjected to the study. The values of the GOT enzyme witnessed a clear significant increase ($P = 0.05$) in the rabbits treated with selenium, while this percentage decreased when vitamin E was added to the selenium,

but it remained higher than the control group, as the value of GOT in the control group reached 8.66 KUL, KUL 19.33 in the selenium group, and KUL 12 in the selenium group with added vitamin E. GPT enzyme values also increased in the same manner in the selenium plus vitamin groups compared to the control group.

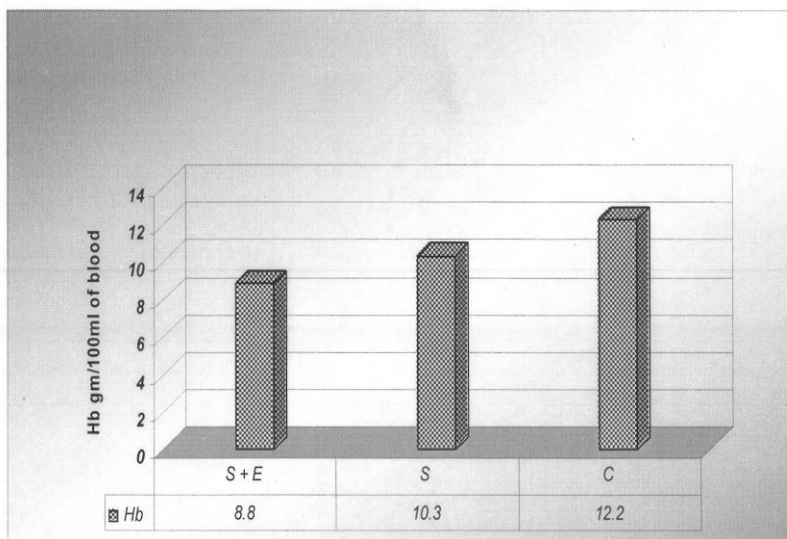


Fig (1): - Effect of selenium and selenium with vitamin E on Hb in local rabbits.

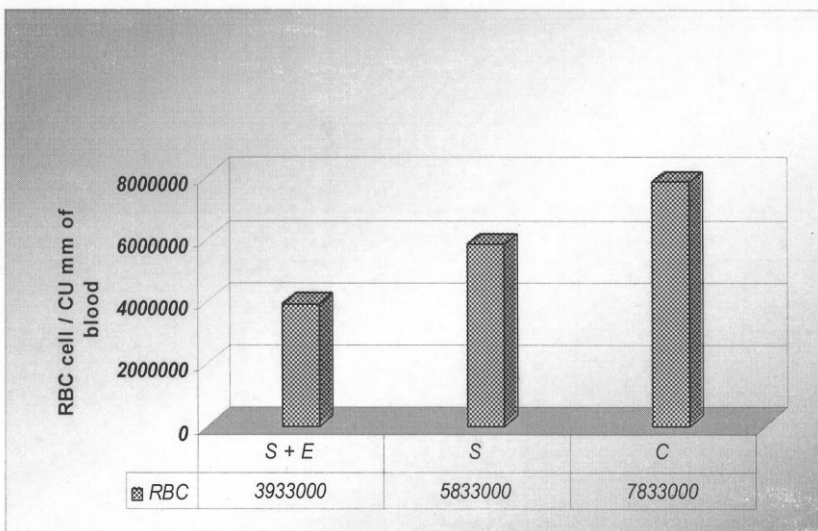


Fig (2): - Effect of selenium and selenium with vitamin E on red blood cell number in local rabbits.

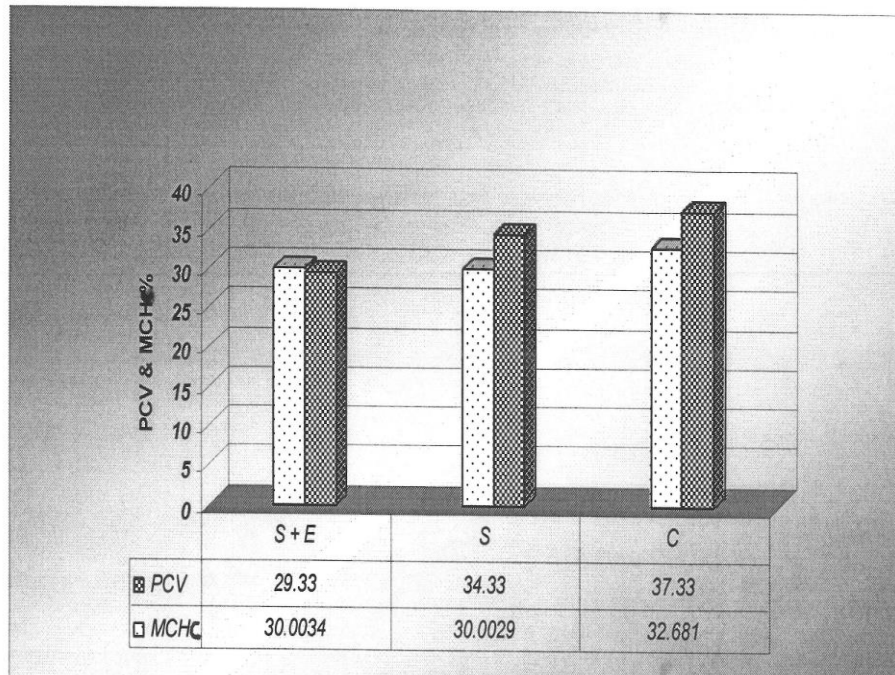


Fig (3): - Effect of selenium and selenium with vitamin E on packed cell volume and mean corpuscular hemoglobin concentration in local rabbits.

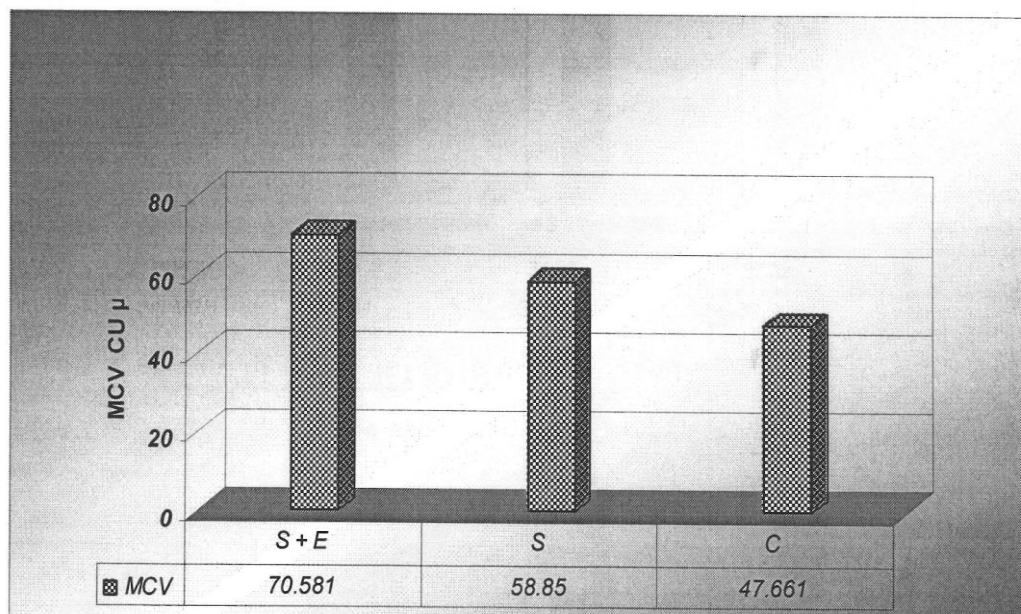


Fig (4): - Effect of selenium and selenium with vitamin E on mean corpuscular volume in local rabbits

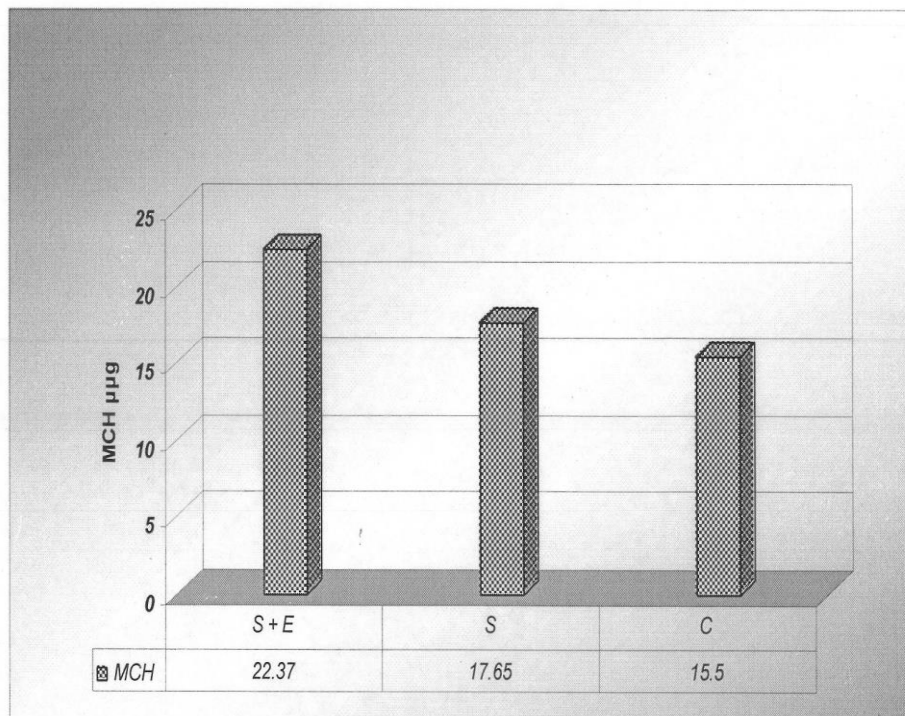


Fig (5): - Effect of selenium and selenium with vitamin E on mean corpuscular hemoglobin in local rabbits.

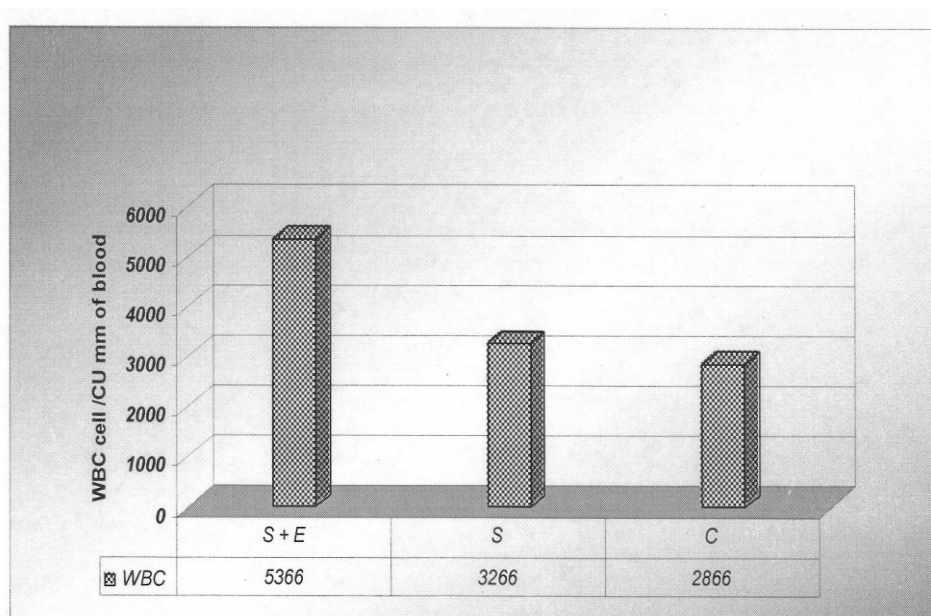


Fig (6): - Effect of selenium and selenium with vitamin E on white blood cell count in local rabbits.

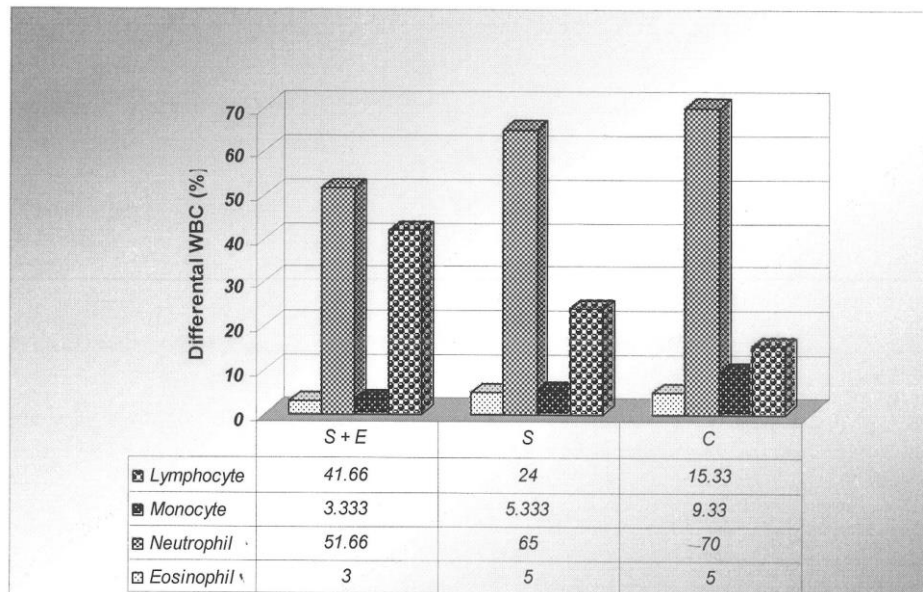


Fig (7): - Effect of selenium and selenium with vitamin E, neutrophil, Monocyte

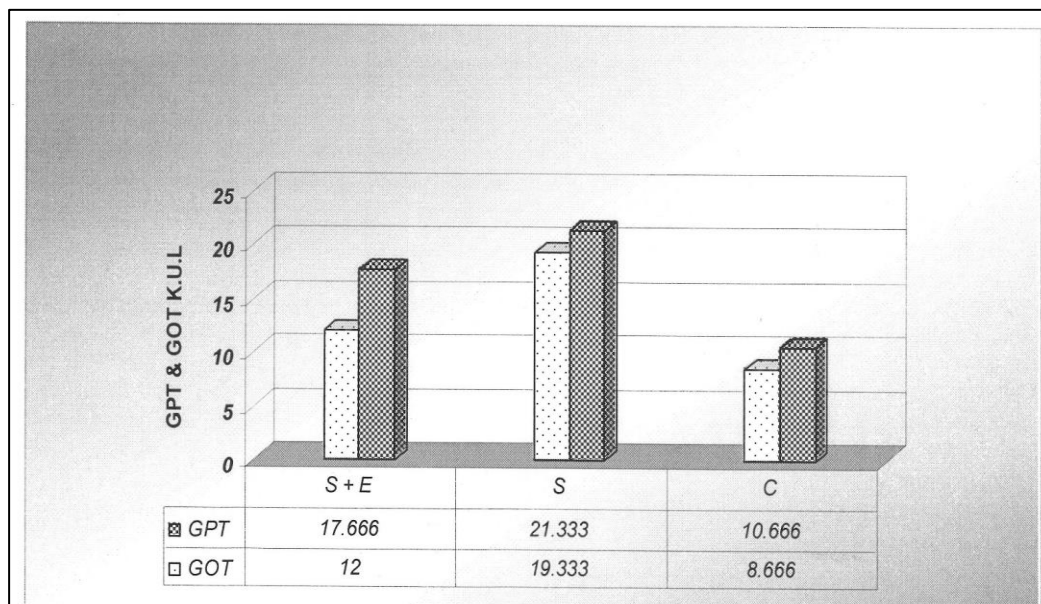


Fig (8): - Effect of selenium and selenium with vitamin E on GPT, GOT enzymes in local rabbit.

Discussion

The current study showed that administering selenium or selenium plus vitamin E to rabbits resulted in a significant decrease in hematological parameters, including a significant decrease in hemoglobin concentration, red blood cell count, and packed cell volume compared to the results recorded in control animals. This, in turn, led to anemia. The decreased hemoglobin concentration in red blood cells is attributed to selenium binding to hemoglobin, which prevents the cell from carrying oxygen (Deforest *et al.*, 1999).

The results of the current study are consistent with those found by Lemly (2002) in this study of the effect of selenium on fish. However, Tars *et al.* (2000) observed no effects on red blood cells, hemoglobin, and packed cell volume in broiler chickens fed selenium and vitamin E. A significant increase in MCV occurred, as confirmed by the results of this study. MCH values also increased, while MCHC values decreased slightly compared to the control group.

The increase in MCV levels is a natural response to the decrease in the number of red blood cells and hemoglobin in the blood (Berlin *et al.*, 1961). The results of the current study also indicate an increase in the number of white blood cells in the two treatment groups compared to the control group. This increase is an immune response resulting from the intake of these elements, thus affecting the percentages of their types in general.

The results of the blood biochemical content showed a clear increase in the activity values of the two hepatic enzymes GOT and GPT in both treatment groups. This may be due to the damage that occurs to the liver tissue as a result of treatment with selenium, as it is an organ responsible for and controlling most metabolic activities. It is the organ that stores

glycogen, fats, and some vitamins, and is responsible for the production of plasma proteins, including factors responsible for blood clotting during wounds. It is also the organ responsible for detoxification (Anderson, 1980).

The increase in the activity values of the two enzymes reflects the extent of damage to the liver tissue. The clinical importance of their estimation in the blood serum comes from their direct relationship with liver diseases. Although both enzymes rise when any defect or damage occurs that threatens the liver, GPT is the enzyme most specific to the liver because its high levels are rarely observed except in liver diseases. The liver is the main source of the GPT enzyme, while the heart is the source of the GOT enzyme (Kaneko *et al.*, 1997).

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تأثير السيلينيوم وفيتامين (هـ) على بعض معايير الدم وإنزيمات الكبد (GPT, GOT)

اقبال عبدالعزيز حزام

كلية العلوم جامعة البصرة

أظهرت نتائج تحليل عوامل الدم للأرانب التي أعطيت (10) ميكروجرام من السيلينيوم عن طريق الفم، وتلك التي أعطيت (10) ميكروجرام من السيلينيوم مع إضافة 0.4 ملجم من فيتامين E لمدة (30) يوماً انخفاضاً واضحاً في قيم الهيموجلوبين Hb وعدد خلايا الدم الحمراء RBC وقيم حجم خلايا الدم الحمراء المكسدة PCV في الأرانب المعالجة. كما زادت قيم MCH و MCV بشكل ملحوظ في الأرانب التي أعطيت السيلينيوم، ثم زادت بشكل ملحوظ في الأرانب المعالجة بالسيلينيوم المضاف إليه فيتامين E مقارنةً بالمجموعة الضابطة. كما لوحظت زيادة كبيرة في عدد خلايا الدم البيضاء في مجموعة السيلينيوم وفيتامين E مقارنةً بمجموعتي السيلينيوم والمجموعتين الضابنتين عند مستوى احتمال $P = 0.05$ وفيما يتعلق بالعدد التفاضلي، كان عدد الخلايا الليمفاوية أعلى بشكل ملحوظ مقارنةً بالمجموعة الضابطة (الشكل (7)). كما زادت قيم إنزيمات GPT و GOT بشكل ملحوظ ($P = 0.05$) في الأرانب المعالجة بالسيلينيوم، بينما انخفضت هذه القيم في مجموعة السيلينيوم وفيتامين E ولكنها ظلت أعلى من تلك الموجودة في المجموعة الضابطة.