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Effect of aqueous extract of strawberry fruit on some enzymatic changes of liver and heart in male white rabbits subject to Oxidative stress induced with paracetamol

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Abstract

The current study aimed to test the hepatic effect of strawberry fruits in male rabbits treated with paracetamol and to try to determine the mechanisms of this action on liver enzymes and some other factors under study. According to the findings, ceruloplasmin levels in blood serum significantly decreased as oxidative stress caused by paracetamol developed in the white male rabbit. The findings also showed a significant increase in phospholipids in the serum of acetaminophen-treated rabbits when compared to the healthy control group, as well as a significant rise in serum CK enzyme activity, alanine aminotransferase enzyme activity, and a significant rise in aspartate aminotransferase AST enzyme activity. And Significant variations in the activity of alkaline phosphatase in the blood serum of the rabbits treated with paracetamol compared to the healthy control group, together with a significant rise in the gamma-glutamyltransferase enzyme activity.

Introduction

Strawberry is one of the most popular fruits and one of the most cultivated around the world. Strawberry is characterized by a distinct taste and aroma [1]. Strawberries are almost safe for most people within the limits of natural quantities. But strawberries cause some people allergies and they are among the most sensitive fruits, as they may cause itching and red skin [2]. And because strawberries include a certain amount of oxalate, persons with renal or gallbladder issues should limit how frequently they consume them to prevent stone formation.

Fruits with antioxidant qualities include strawberries. Pantothenic acid, vitamin C, and vitamins A, E, and K may all be found in strawberries. Additionally, strawberries include a number of minerals, including calcium, iron, magnesium, manganese, zinc, sodium, and potassium. In addition to having nutrients including fiber, folic acid, vitamin C [3], and flavonoids that lower cholesterol, which are good for the heart. Additionally, strawberries contain vitamin B, which supports the heart muscle. Additionally, it has anti-inflammatory and antioxidant properties that help it fight cancer [4].

It is important to note that it includes a lot of vitamin C, which helps to boost the body's defenses and prevent cell damage brought on by free radicals. Due to the high salt content, it also includes potassium and magnesium, both of which lower blood pressure. Additionally, it

has medicinal benefits for preventing anemia and leukemia. It is abundant in vitamins and minerals that cleanse the body and blood of pollutants [5].

In this investigation, paracetamol-induced toxic liver and cardiac symptoms were compared to the preventive effects of strawberry plants. The funding will go toward a test for oxidative-induced stress prevention in acetaminophen.

Materials and methods

Study experience:

The 24 animals of male white rabbits were used in this study, randomly divided into 4 groups. Each group included 6 animals, and their weights ranged between 1-1.5 kilograms, and their ages and with close weights.

The first group: (control group) This group was treated with 1 milliliter of distilled water and this group was given regular drinking water for 30 days.

The second group: I was administered daily with Paracetamol at a concentration of 600 mg/ kg of body weight by tube feeding for 30 days.

The third group: I was administered daily with aqueous extract of strawberry plant fruits only at a concentration of 200 mg / kg of body weight by tube feeding for 30 days.

Fourth group: Dose daily with Paracetamol at a concentration of 600 mg / kg body weight by tube feeding for 30 days with daily dosing from the aqueous extract of strawberry fruit only at a concentration of 200 mg / kg of body weight by tube feeding for 30 days.

After the experiment continued for 30 days, the animals starved for 24 hours, after which the blood was drawn from the heart after placing it in the confining box to prevent it from moving and the blood was collected in test tubes free of anticoagulants and then the serum was separated by Centrifuge at a speed of 3000 cycles / Minutes for 15 minutes, and the serum was kept at -20 ° C for the purpose of carrying out chemical analyzes of the levels of triglycerides and others.

Preparing the aqueous extract of Strawberry fruits:

Weight (500 g) of ripe strawberry fruits, which were cut into small parts and crushed by a Blender machine with distilled water in a ratio of (1 weight: 3 volume) and for a period of (10) minutes, after which the mixture was mixed for two hours under the influence of the electric motor taking into account the cooling then Filter the solution through several layers of gauze and separate the extract with a centrifuge to get rid of insoluble materials, and reduce the volume to a third by the incubator at a temperature of 25 ° C. Thus the raw aqueous extract was obtained [6].

Estimation of the activity of liver enzymes in blood serum:

Determination of alkaline phosphates (ALP) concentration in serum

The enzymatic approach was used to calculate the alkaline phosphatase activity utilizing a number of ready-made analyses from the French business Biomerienx.

Measuring the alanine aminotransferase enzyme's activity

The French company Biomerieux's pre-made test kit was used to gauge the amount of the enzyme alanine aminotransferase in the blood serum [7].

Estimation of blood total protein content: The Biuret Method was employed to calculate the quantity of protein, and kits made by the Spanish business Spinreact were utilized [8].

Determining the content of serum phospholipids in (10) When calculating the concentration of phospholipids, the following equation was used, which depicts the regression line for these lipids and their direct link with the concentration of total cholesterol: (TC x 0.89) + (68) yields the serum phospholipid concentration (mg/dl) [11].

Calculating the serum ceruloplasmin concentration

Using the researchers' modified approach, serum ceruloplasmin concentration was calculated [12].

Statistical analysis

The SPSS statistical program was used to examine the results statistically. Using the statistical software, the data were statistically evaluated using the analysis of variance (ANOVA) test. To see if there were any changes, the arithmetic averages were compared to the control group's mean [13].

Results and Discussion

Calculation or Measurement of Phospholipids

According to the findings in Figure 1, there was a substantial ($P \leq 0.05$) rise in phospholipids (PL) serum in the paracetamol-treated rabbits compared to the healthy control group. In comparison to the group given paracetamol alone, there was a significant reduction (P 0.05) after treatment with 200 mg/kg of strawberry fruit aqueous extract and 600 mg/kg of paracetamol. Additionally, administration of the aforementioned strawberry extract alone did not significantly vary from the control group.

The fact that phospholipids play a crucial role in the formation of atherosclerosis when they are oxidized and accumulate in the sub-epithelial layer of blood vessels may account for the considerable rise in the (PL) content in the blood serum of animals treated with paracetamol. [14]

The fact that phospholipids, when oxidized, play an active role in the development of atherosclerosis as they accumulate in the sub-epithelial layer of the arteries and stimulate the process of phagocytosis, stimulating the formation of free radicals and foam cells, may account for the significant increase in the (PL) concentration in the blood serum of animals treated with paracetamol [15]. which are crucial in the development of the erosion plate. The rise in phospholipid peroxidation, particularly in cell membranes, may be the cause of the elevated (PL) content; this causes its oxidation and transfer to the circulation [16].

When paracetamol is used to treat groups of animals given strawberries, the content of phospholipids (PL) decreases significantly compared to the infected control group for a variety of reasons, including the presence of high amounts of key components that neutralize free radicals. This may be because strawberries contain vitamins like vitamin C, which work to remove free radicals and inhibit lipid peroxidation and its products, especially (MDA), which in turn results in a decrease in the concentration of (PL) in the blood. Lipid

peroxidation and its products, particularly (MDA), work to protect phospholipids and cholesterol from oxidation. By stopping the progression of peroxide reactions [17].

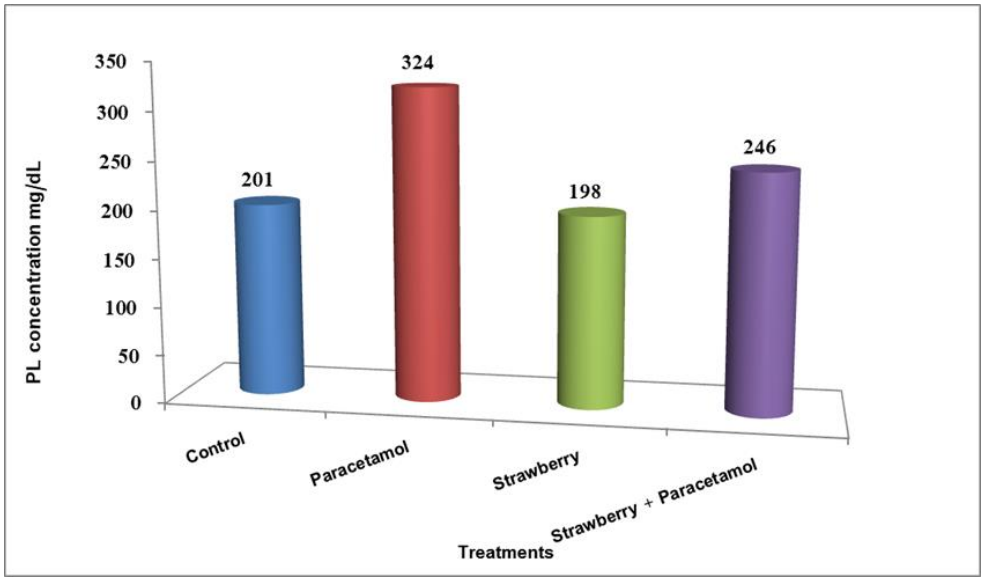

Figure 1: shows the impact of a 30-day treatment with a 200 mg/kg body weight aqueous strawberry fruit extract on the level of phospholipids (PL) in the blood of white male rabbits subjected to paracetamol-induced oxidative stress.

Determination and calculation of ceruloplasmin

The findings in Fig. 2, show that the activity of the Ceruloplasmin (Cp) levels in the blood serum significantly decreased as oxidative stress, which was mediated by paracetamol, developed in the white male rabbit. Cp is a protective antioxidant that inhibits the production of new free radicals by attaching to metals like (Fe^{+2} and Cu^{+2}) and stopping them from reacting, which is the cause of the drop in ceruloplasmin concentration in these situations. the production of free radicals when combined with paracetamol [18].

Acute hepatitis and nephrotitis are inflammatory illnesses and complications caused by diabetes or therapy with paracetamol that produce large quantities of free radicals. Ceruloplasmin accelerates the elimination of these radicals, such as the superoxide negative radical and other radicals. decreased blood concentration [19].

In addition, the treatment of groups of animals exposed to oxidative stress with strawberry aqueous extract and treated with strawberry aqueous extract only showed a significant increase in the concentration of Cp compared to the treated group. When treating animal groups with strawberry and paracetamol, this led to a significant increase in the concentration of ceruloplasmin compared to the infected control group. Using just paracetamol [20].

The high content of polyphenols and flavonoids, as well as glycosides and vitamin C, all work to reduce oxidative stress by removing free radicals (ROS, RNS), increasing and activating antioxidant concentrations, and may be the cause of this rise in ceruloplasmin concentration in the blood serum in these cases, antioxidant enzymes, in particular catalase, superoxide dismutase (SOD), and glutathione peroxidase, may lessen the impact of oxidative stress on ceruloplasmin and raise its blood content [21].

Additionally, the antioxidant activity of vitamin C in strawberries for animals under oxidative stress increases the concentration of ceruloplasmin in the blood serum as it eliminates free radicals, particularly ($O_2^{-\bullet}$, H_2O_2), as well as inhibiting the process of lipid peroxidation and lowering cholesterol and LDL-C concentrations from the body. boosting the level of ceruloplasmin (CP) in the blood serum by interrupting the cycle of free radicals' diffusive reactions [22].

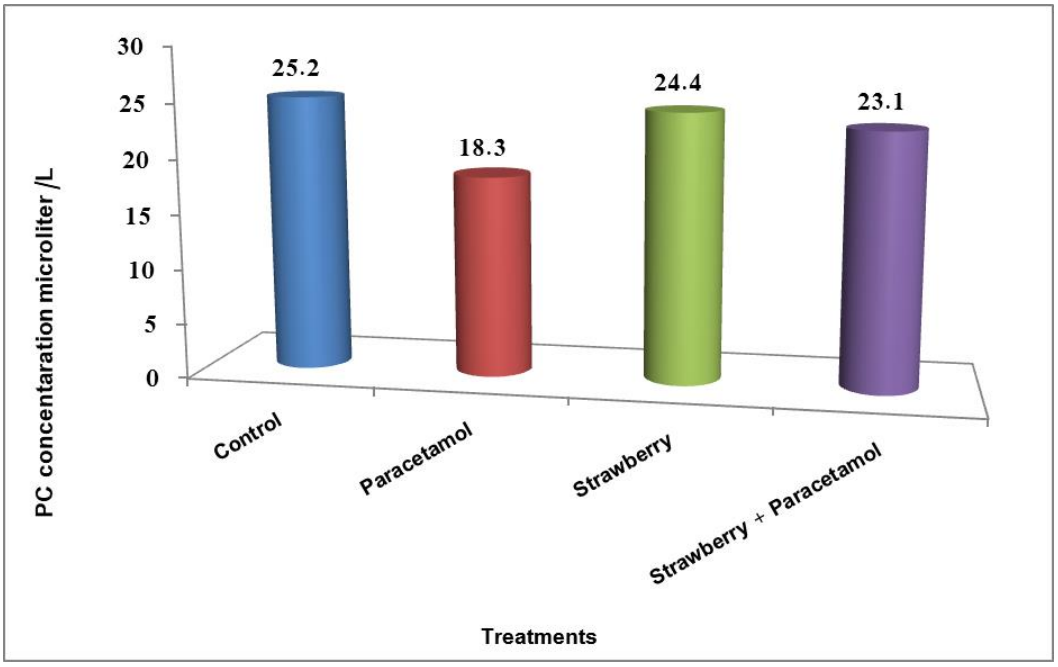

Figure 2: shows the impact of a 30-day course of treatment with a strawberry fruit aqueous extract (200 mg/kg body weight) on the levels of ceruloplasmin (Cp) in the blood of white male rabbits subjected to paracetamol's 600 mg/kg-induced oxidative stress.

Amount of proteins overall

According to the findings in Fig. 3, there is a significantly higher level of blood serum in the group of rabbits treated with paracetamol than in the healthy control group ($P \leq 0.05$) according to the results.

Animals treated with paracetamol caused a significant difference from the group treated with paracetamol alone($P \leq 0.05$) in the levels of total proteins. Animals treated with 200 mg/kg of aqueous strawberry fruit extract also experienced a significant difference from the group treated with paracetamol alone. Additionally, administration of the aforementioned plant extract alone did not significantly vary from the control group [23].

The fact that paracetamol has oxidized proteins and created protein hydroxy peroxidase by removing a hydrogen atom from the protein may be the cause of this rise. A glomerulopathy may develop in order to replace missing albumin or to explain the high level of total proteins [24].

A substantial drop in the quantity of total proteins was seen in the treatment groups as compared to the control group treated with paracetamol alone in male rabbits subjected to oxidative stress generated by paracetamol. Different parts of the rabbit's body include proteins [25].

The plants utilized in the study include vitamin C, which acts as an efficient antioxidant by lowering lipid peroxide, enhancing catalase, and avoiding oxidation in the plants since vitamin C significantly reduces proteins. Blood albumin decreases due to vitamin insufficiency. based on the plasma's albumin and total protein levels [26].

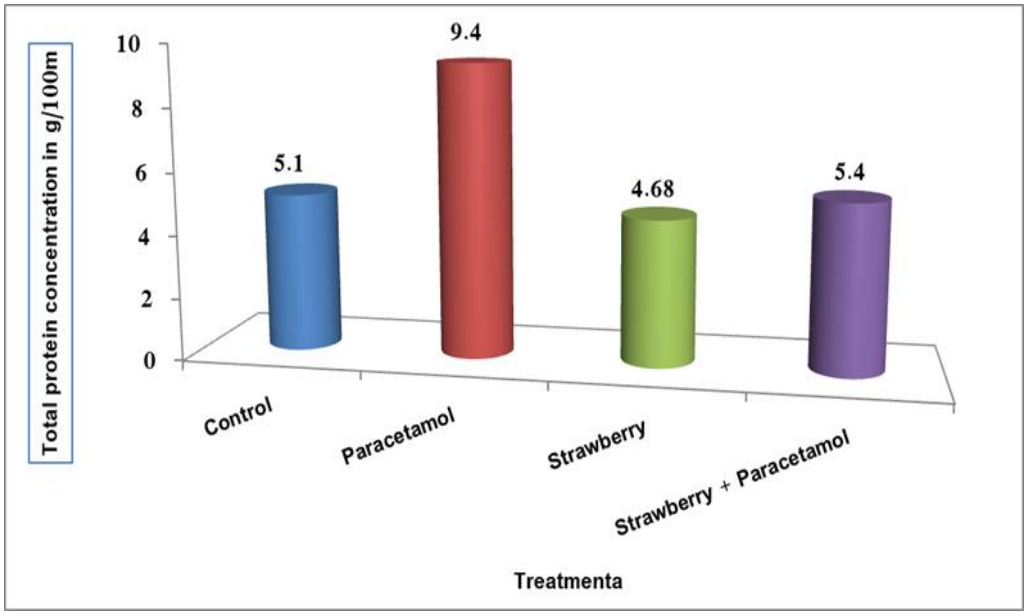

Figure 3: shows how the concentration of total proteins in the blood of white male rabbits subjected to oxidative stress caused by paracetamol 600 mg/kg changed after treatment for 30 days with an aqueous strawberry fruit extract (200 mg/kg body weight). estimation of cardiac and liver enzyme concentrations

Efficacy of Creatine Phosphokinase

The findings in Fig. 4, show that the activity of the CK enzyme in the blood serum is significantly higher ($P \leq 0.05$) in the group of rabbits treated with paracetamol than in the healthy control group.

A substantial difference was seen between the group given paracetamol alone and the group given a 200 mg/kg aqueous strawberry fruit extract. Additionally, administration of the aforementioned plant extract alone did not significantly vary from the control group.

The majority of these enzymes exit from the heart muscle's cell membrane into the blood vessels, increasing their activity in the blood serum as a result of oxidative stress, which causes the release of active oxygen species like the single oxygen radical, the hydroxyl radical, and the negative superoxide [27].The presence of antioxidants in CPK, such as polyphenols, which shield the surface of the cell membrane from oxidative damage brought on by lipid peroxidation as a result of oxidative stress, is thought to be the cause of its diminished efficiency [28]. Oxidative stress boosts the activity of these enzymes within the cell and causes a rise in a number of enzymes that help and contribute in the breakdown of proteins, lipids, and carbohydrates.

CPK is also used to produce energy in the case of stress that needs the anaerobic pathway in the metabolism. Severe oxidative stress leads to the liberation of effective oxygen classes, including single oxygen radical, hydroxyl radical and negative superoxide [29].

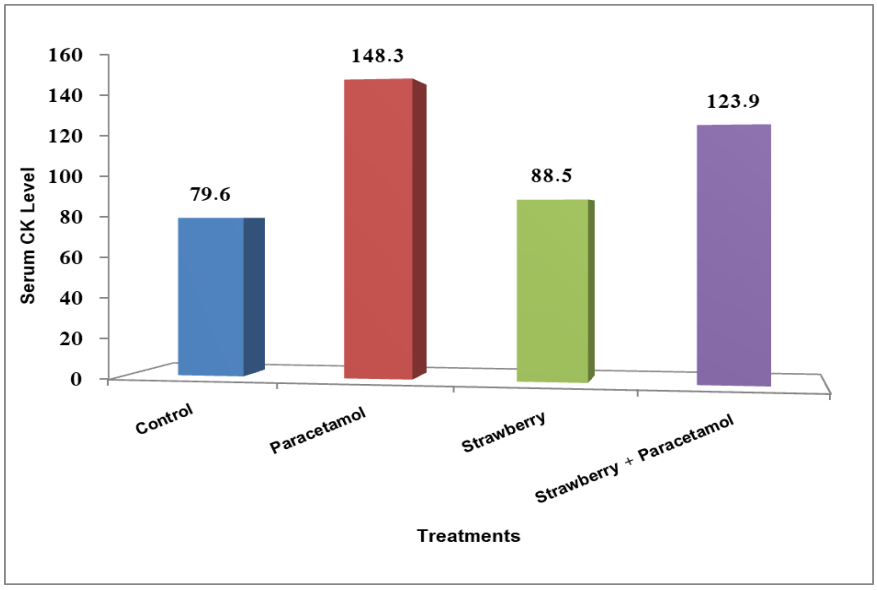

Figure 4: shows the impact of a 30-day regimen of aqueous strawberry fruit extract (200 mg/kg body weight) on the level of creatine phosphokinase (CPK) The effectiveness of paracetamol 600 mg/kg on the serum of white male rabbits subjected to oxidative stress

Alanine aminotransferase activity

According to the findings in Fig. 5, there were no appreciable differences (P≤0.05) between the paracetamol-treated group of rabbits and the healthy control group in the alanine aminotransferase enzyme's activity in the blood serum. A substantial difference was seen between the group given paracetamol alone and the group given a 200 mg/kg aqueous strawberry fruit extract. Additionally, administration of the aforementioned plant extract alone did not significantly vary from the control group [30]. Similar to the control group, therapy with plant extracts alone had no discernible effect. It was found that just the difference of 200 makes a big effect [31].

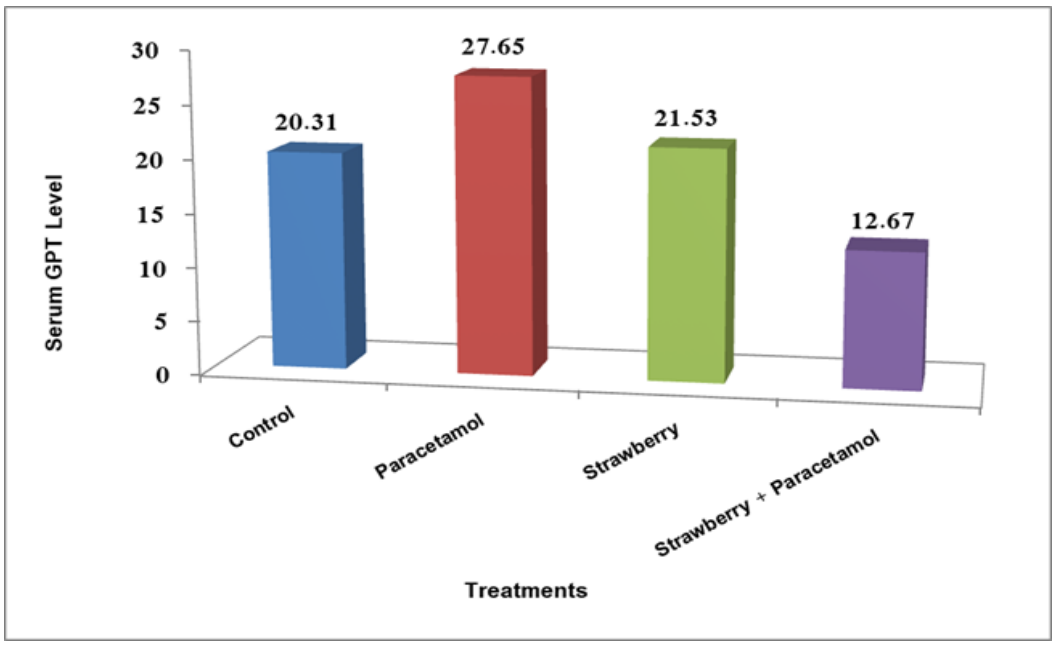

Figure 5: shows the impact of a 30-day course of treatment with aqueous strawberry fruit extract (200 mg/kg body weight) on the levels of the enzyme alanine aminotransferase (ALT)/GPT in the blood of white male rabbits subjected to paracetamol-induced oxidative stress.

Aspartate aminotransferase activity

According to the findings in Fig. 6, the activity of the Aspartate Aminotransferase GOT enzyme in the blood serum was significantly higher in the group of rabbits given paracetamol than it was in the untreated control group (P≤0.05). A substantial difference was seen between the group given paracetamol alone and the group given a 200 mg/kg aqueous strawberry fruit extract. Additionally, compared to the control, the administration of the aforementioned plant extract alone produced a noticeable change [32].

The disintegration of the majority of the covers on hepatocytes, heart cells, and muscle cells as a consequence of oxidative stress brought on by lipid peroxidation and the amount of free radicals produced as a result of oxidative stress, which results in enzyme leakage into the blood serum [33].

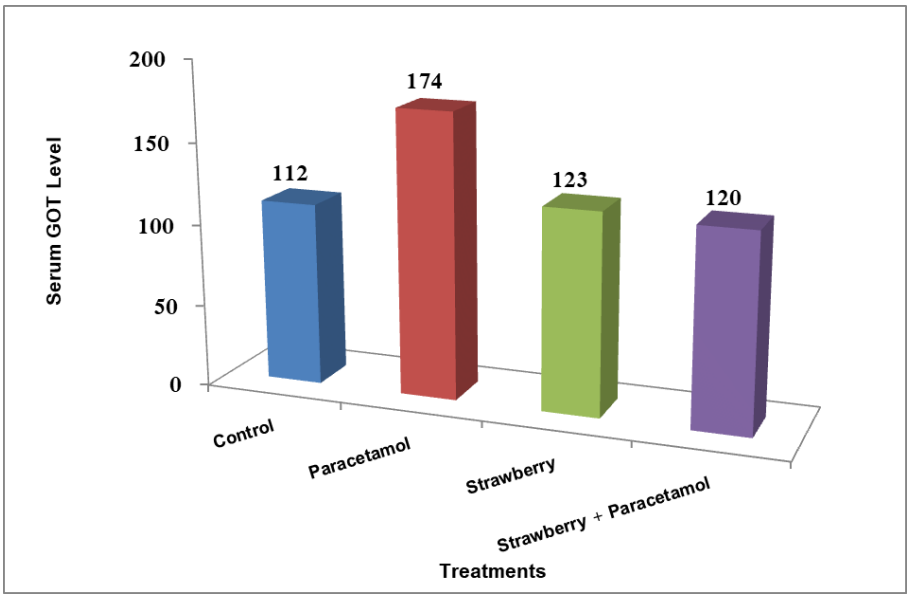

Figure 6: shows the concentration after receiving therapy for 30 days with strawberry fruit aqueous extract (200 mg/kg body weight). White male rabbits treated to oxidative stress caused by paracetamol 600 mg/kg have AST: Aspartate aminotransferase GOT in their blood.

Gamma glutamyl transferase activity

According to the findings in Fig. 8, the paracetamol-treated group of rabbits had significantly higher levels of gamma-glutamyl transferase enzyme activity in their blood serum than the healthy control group. A substantial difference was shown between the group given paracetamol alone and the group given the 200 mg/kg aqueous extract of strawberries, as well as between the strawberry-treated firearm group and the impacted control group given paracetamol. Additionally, the use of the aforementioned plant extract alone did not significantly vary from the control group [34].

This rise is explained by the creation of free radicals, which lead to lipid peroxidation in the cell membrane and a change in its permeability and destruction. This change is proportionate to the length of the dosage and results in the leaking of enzymes into the blood and high serum levels [35].

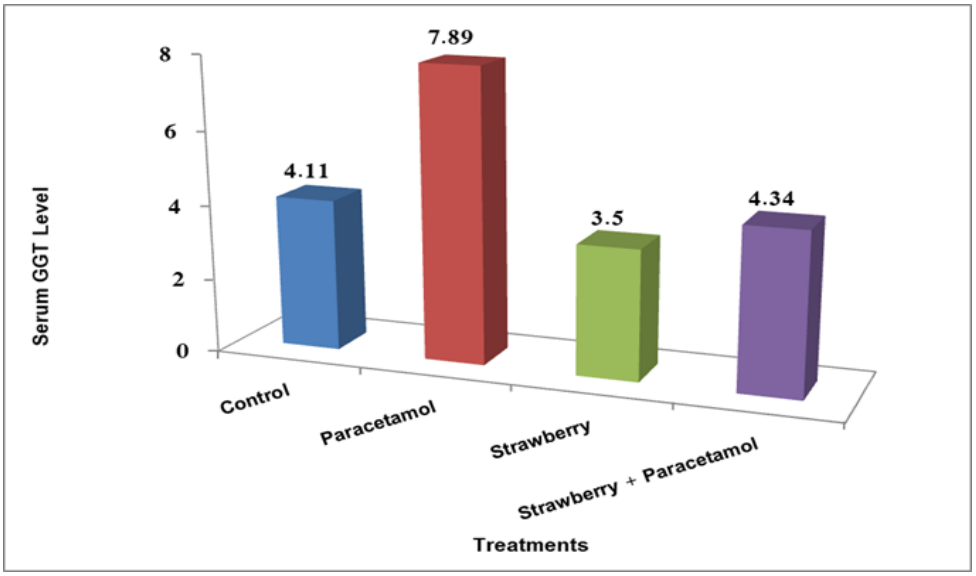

Figure 8: shows how the concentration of Gamma Glutamyl Transferase (GGT) in the serum of white male rabbits subjected to oxidative stress caused by paracetamol 600 mg/kg changed after treatment for 30 days with an aqueous strawberry fruit extract (200 mg/kg of body weight).

The impact of various therapies on serum alkaline phosphatase activity

According to the findings in Fig. 9, there are changes in the activity of alkaline phosphatase (ALP) in the serum between the group of rabbits given paracetamol and the healthy control group that are significant ($P \leq 0.05$). A substantial difference was seen between the group given paracetamol alone and the group given a 200 mg/kg aqueous strawberry fruit extract. Additionally, administration of the aforementioned plant extract alone did not significantly vary from the control group [36].

Due to the oxidative stress it causes, which results in harmful structural and functional changes in the hepatocyte, the effect of membrane permeability, and the occurrence of a defect or disruption in the transport of metabolites, this enzyme is released from the liver cells and enters the bloodstream, which causes the increase and change in its percentage. It is well known that this enzyme is mostly discovered attached to hepatocytes' plasma membranes [37]. The rise was caused by the way paracetamol affected the liver, which caused hepatocytes to invade and release these chemicals into the circulation in higher concentrations than usual [38].

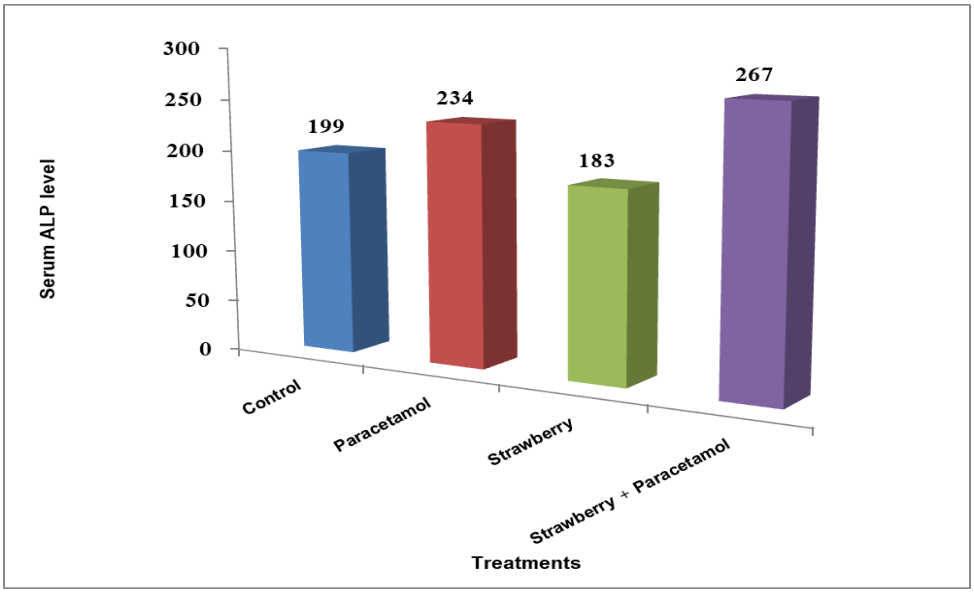

Figure 9: shows how the concentration of alkaline phosphatase (ALP) activity in the serum of white male rabbits subjected to oxidative stress caused by paracetamol 600 mg/kg changed after treatment for 30 days with an aqueous strawberry fruit extract (200 mg/kg of body weight).

The influence of antioxidant molecules, which include vitamins, flavonoids, and other compounds, is primarily responsible for the protection provided by fruits and vegetables to humans, particularly against heart disease and cancer. Some flavonoids have been found to have a considerable anti-oxidation action, particularly peroxyl radical, which has a greater impact than vitamins C and E. The antioxidant molecules that have drawn a lot of interest, particularly at this time, since they defend the human body, are referred to as "free radical scavengers." She is referred to as the "Queen of Fruits" because of the hazards of free radicals, which can cause various ailments, including cancer [39]. Fruits are useful because they include a variety of healthy elements, including fiber, antioxidants, minerals, and vitamins

Vitamin C, manganese, copper, fiber, iodine, magnesium, phosphorous, antioxidants such as anthocyanins, omega-3 acids and the presence of some antioxidants such as christine, camprol and anthocyanins. In lowering blood pressure because it contains a high percentage of potassium. Iodine and complex sugars [40]. In addition, strawberries are rich in many healthy plant compounds, and different types of antioxidants, such as: (pelargonidine), (lacic acid), ellagitannins, and procyanidins [41].

Omega-3 fatty acids, vitamin C, manganese, copper, fiber, iodine, magnesium, phosphorus, antioxidants such anthocyanins, and certain antioxidants including christine, camprol, and anthocyanins are present. Due to the high potassium content, it is effective in decreasing blood pressure. complex carbohydrates and iodine. Strawberries are also a great source of a variety of antioxidants, including ellagitannins, procyanidins, pelargonidine, lacic acid, and many more. [41] [42].

Conclusions

It was found that there is a clear protective effect of strawberry fruits on the liver in male rabbits treated with paracetamol through the effect on liver enzymes and some other factors under study.

The results showed that the oxidative stress induced by paracetamol in male white rabbits led to a significant decrease in the concentration of ceruloplasmin (Cp) in the blood serum with a significant increase in (PL) with an increase in the activity of CK enzyme in the blood and the activity and increase of the enzyme GOT and a significant increase in the activity of Elevated ALP and GGT.

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تأثير المستخلص المائي لفاكهة الفراولة على بعض التغيرات الأنزيمية للكبد والقلب في ذكور الأرانب البيض المعرضة للإجهاد التأكسدي المستحدث بالباراسيتامول

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الخلاصة:
هدفت الدراسة الحالية إلى اختبار التأثير الوقائي لثمار الفراولة في الكبد في ذكور الأرانب المعاملة بالباراسيتامول ومحاولة تحديد ذلك التأثير على إنزيمات الكبد وبعض العوامل الأخرى قيد الدراسة. أظهرت النتائج أن الإجهاد التأكسدي المستحدث بوساطة الباراسيتامول في ذكور الأرانب الأبيض أدى إلى انخفاض معنوي في تركيز السيرولوبلازمين في مصل الدم. كما أشارت النتائج أيضًا إلى وجود زيادة معنوية في الفسفوليبيد في مصل الأرانب المعاملة بالباراسيتامول مقارنة بمجموعة السيطرة السليمة مع زيادة في نشاط إنزيم كرياتين كاينيز في الدم ونشاط إنزيم النين امينوترانسفيريز، وزيادة معنوي في نشاط إنزيم اسبارتيت اينوترانسفيريز وزيادة معنوية في نشاط إنزيم غاما-جلوتاميل وارتفاع في مستوى الفوسفاتيز القلوي في مصل دم الأرانب المعالجة بالباراسيتامول مقارنة بمجموعة السيطرة السليمة.