Comparative Study on Biochemical Effects of Natural and Synthetic Pesticides on Preserved Phaseolus lunatus in Male Albino Rats

Chibuzor Caroline Nweze, Titilayo Oluwayemisi Bamidele, Bawa Yusuf Muhammad, Bisola Lateefat Adedipe, Wandoo Tseaa, Eneh William Nebechukwu, Rahima Yunusa, and Happy Abimiku Manasseh

ABSTRACT

The legume Phaseolus lunatus production is hindered by pest infestation which may have reduced its quality and quantity. To this effect, pesticides come into play to kill these pests. The purpose of the study was to determine how various preservatives affected the biochemistry of male albino rats. Exactly 36 male albino rats of 200-250 g were grouped into six. They were fed with a dietary intervention for 8 weeks with 4 different methods of selected preserved diets. The groups are Group 1 (normal control) was rats administered only feed and water. Group 2 (blank) was rats administered only Phaseolus lunatus without preservative. Group 3 was rats administered feeds + Phaseolus lunatus preserved with aluminium phosphate. Group 4 was rats administered feeds + Phaseolus lunatus preserved with wood ash. Group 5 was rats administered feed + Phaseolus lunatus preserved with dichlorvos. Group 6 was rats administered feed + Phaseolus lunatus preserved with pepper. The result showed significant increase in AST and ALT of lima beans preserved with pepper (23.67±2.47\(\mu\)L) (15.38±1.55\(\mu\)L) P<0.01 and ash (34.51±2.04\(\mu\)L) (15.12±3.10\(\mu\)L) P<0.001, respectively. When albino rats were given beans preserved in ash, their CRP levels increased noticeably P<0.01 (39.00±1.00) (49.92±5.30), PCV and platelet levels in albino rats given lima beans preserved with ash significantly decreased P<0.01 (213.31 ±32.31), respectively. The majority of renal function metrics show considerable increases. In conclusion, the study revealed the alteration in the biochemical parameters of the albino rats after consumption of the preserved beans, this may indicate cellular damage.

Keywords: Aluminium-Phospheide, Dichlorvos, Pepper, Phaseolus-Lunatus.

I. INTRODUCTION

Plants in the Leguminosae family are known as legumes because they produce seeds in pods (Kouris-Blazos & Belski, 2016). They are used in many traditional recipes all around the world and can be prepared in a variety of methods, such as boiling, frying, and baking. Kidney beans, lima beans, soybeans, green beans, and peanuts are examples of common legumes used for human consumption. They are known as food legumes or grain legumes (Yorgancilar & Bilgici, 2014). These seeds are highly valued throughout the world and are regarded as the second most significant food source after cereals (Kouris-Blazos & Belski, 2016).

An infestation of pests hinders the production of phaseolus lunatus, lowering both its quality and quantity. In order to eradicate these pests, pesticide is used. The pesticides or...
preservatives utilized include Aluminium phosphide, sniper, pepper and ash. In has been shown in research that pepper has antimicrobial activity (Bawa & Webster, 1992) and some have already produced compounds, effective against antibiotic resistant strains of bacteria (Bawa & Webster, 1992). There have been reports of the use of regional spices to regulate the activities of bacteria in food by researchers (Akpomedaye & Ejechi, 1988). Since the 1940s, large-scale applications of aluminum phosphide that releases phosphine have been used to manage pest infestation in both commercial and farm-level storage systems. It is very poisonous to all stages of insects, making it a low-cost and suitable grain fumigant. The seed viability is not affected by Aluminium phosphide treatment (Wahab et al., 2009).

Organophosphates, such as dichlorvos or 2, 3-dichlorovinyl dimethyl phosphate (DDVP), are frequently used as insecticides to manage household pests, protect food from insects, and improve public health.

Ash has been used as a preservative to increase the longevity of beans. The insects that live in the grain experience hypoxia when ash is used as a preservation method. The growth of insects is halted by hypoxia, which also affects development. Moreover, it kills 98% of the adults and larvae that are dwelling inside the grains.

Investigation of the biochemical effects of Phaseolus lunatus preserved with Aluminum phosphide, sniper, pepper, and ash in the blood of male albino rats is the study's main objective.

II. MATERIALS AND METHODS

A. Sample Collection

In the Faculty of Natural and Applied Science, Plant Science and Biotechnology Department, Nasarawa State University Keffi, Nigeria, the samples were identified. Matured Phaseolus lunatus was collected from the area of cultivation in Lafia Local Government Area, Nasarawa State, Nigeria. The bean sample was collected in bags and transported to the laboratory. The bean sample was cleaned and sorted to remove stones and dirt. Sniper and Aluminum phosphide was obtained from standard agro-allied store in Keffi, Nasarawa state. Fresh birds eye pepper (Capsicum frutescens) was purchased from the market and dried in the sun.

B. Sample Preparation

The stem from neem tree (Azadirachta indica) was burnt to ash. The cooled ash was sieved to remove dirt and 100 g was weighed and packed into nylon bags. 100 g of the sun dried pepper was weighed and packed into nylon bags. The cleaned seeds were divided into six sections. The beans of about 200g were kept in a bucket with lids carefully air tight. The seeds were stored for a period of six (6) months and properly labeled. During the storage period, the seeds were checked periodically. Each treatment including the control was milled into powder, using petrol-powered grinding machine. They were then packed in a clean polythene bag, labeled and sealed.

The powdered bean was used for the analysis.

C. Experimental Design

Thirty six (36) adult male albino rats weighing 200 g to 250g acquired from the Human Physiology Department of the Ahmadu Bello University's College of Medicine in Zaria, Nigeria were used for the experiment. With unlimited access to food and water, the animals were given time to acclimate in typical settings. The experiment involved the use of Dichlorvos (sniper), Aluminum phosphide, ash, and pepper as preservatives of Phaseolus lunatus: Six groups of six rats each were created from the 36 rats:

- Group I (Normal control): Rats were administered only feeds and water.
- Group II (Blank): Rats were administered only Phaseolus lunatus without preservative.
- Group III: Rats were administered feeds and Phaseolus lunatus preserved with Aluminium phosphide.
- Group IV: Rats were administered feeds and Phaseolus lunatus preserved with pepper.
- Group V: Rats were administered feeds and Phaseolus lunatus preserved with Sniper.
- Group VI: Rats were administered feeds and Phaseolus lunatus preserved with wood ash.

The rats were sacrificed after exposure to feeds and the preserved samples three months after. Blood and serum samples of each group were collected and taken to the laboratory for an assay to determine changes in any of the parameters.

D. Blood Sample Analysis

The conventional approach outlined by Ochei and Kolhatkar was used to calculate the packed cell volume (Ochei & Kolhatkar, 2008). Capillary action was used to transfer rat blood samples into heparinized PCV tubes. When the blood was collected, one end of the tube was sealed with plasticine, and the tube was centrifuged using the hematocrit centrifuge for 5 minutes at 3000 rpm. A PCV hematocrit reader was used to read the test results.

The Miale technique was used to calculate the Hb (Miale, 1972).

Twenty liters of thoroughly mixed anti-coagulated whole blood were put into a 4 milliliter Drabkins solution in a test tube. The tube was inverted-mixed, then, left to sit at 25 °C for 5 minutes. At 540 nm, the solution's absorbance was measured against a blank for the reagent. The amount of hemoglobin present was calculated by multiplying the absorbance with a factor of 36.8. Hb = A540 X 36.8.

The method of Dacie and Lewis was used to calculate the white blood cell count (Dacie & Lewis, 1975). Turk's solution, which contains 2% glacial acetic acid, was diluted (1:20) with the blood sample. A Pasteur pipette was used to load the diluted material into a Neubauer counting chamber. The requisite number of squares on the counting chamber were counted using a (x1000) magnification microscope to determine the total WBC. This was accomplished by the typical haematological technique outlined by Ochei and Kolhatkar. The 10% Na2CO3 solution was diluted 1:20 with well-mixed anticoagulated blood. In a later step, the mixture was placed into a better Neubauer counting chamber. The total number of red cells was calculated by counting and adding the appropriate squares. This was accomplished using the technique outlined by Umarani and Shashidhar (Umarani...
Platelets are easily stained by Leishman stain, which makes them visible enough to count. From each sample, thin smears were air-dried and stained with Leishman’s solution. Under a light microscope equipped with an x100 oil immersion lens, these PBS (Platelets Blood Stains) were examined.

Platelets and RBC were counted simultaneously in a monolayer zone of the smear until 1000 RBC were counted. The result of multiplying the number of platelets per 1000 RBC by 15000 was obtained. Using the Leishman staining technique, the differential count was calculated (Chuckerbuti, 1928). On one end of the glass slide, a drop of blood was applied with an applicator stick. Using the push wedge method, a smear of the blood was made on the glass slide using the cover slip. The blood film was covered by the stain, which was then allowed to stand for 2 minutes. After that, the thin layer of blood was flooded with distilled water in a ratio of two times the stain's volume. The setup was gently shaken for 2 minutes, after which the stain was left to remain for 15 minutes before being rinsed. After allowing the slide to dry, it was viewed under a microscope with a 100x oil immersion objective lens. Using a tally counter, the cells were counted and separated. With a microscope, the different blood cells were seen.

The ALT concentration was determined using the method of Reitman and Frankel (1957) as outlined in Teco Kit Test tubes for the sample and the blank were arranged in pairs. The sample tubes will be pipetted with 0.1 ml of serum. The sample tubes received 0.5 ml of a buffer solution containing phosphate buffer, L-alanine, and -oxoglutarate. The mixtures were completely combined and incubated at 370 °C and pH 7.4 for precisely 30 minutes. After adding 0.1 ml of sample to the sample blank tube, 0.5ml of reagent containing 2, 4-dinitrophenylhydrazine was added to both tubes. After fully mixing the tubes, they were incubated at 250 °C for exactly 20 minutes. Afterwards, each tube received 5ml of sodium hydroxide solution, which was combined. After 5 minutes, at 540 nm, the absorbance was measured against a blank. The ALT action was read up on.

The AST concentration was determined using the method of Reitman and Frankel (1957) as outlined in Teco Kit Test tubes for the blank and sample were arranged in pairs. Serum in the amount of 0.1 ml was pipetted into the sample tubes, and reagent 1 in the amount of 0.5 ml was pipetted into the sample and blank tubes. After completely blending the mixtures, the solutions were incubated at 37 °C and pH 7.4 for exactly 30 minutes. 0.5ml of Reagent 2, which contains 2, 4-dinitrophenylhydrazine, was added to each test tube, followed by 0.1ml of sample to the control tubes.5.0 ml of sodium hydroxide solution was then added to each tube and properly mixed after the tubes had been thoroughly mixed and had been incubated at 250 °C for exactly 20 minutes. After 5 minutes, at 546 nm, the absorbance was measured against a blank. The Bartels and Bohmer approach, which is detailed in the Randox Kit, was used to determine the concentration of urea (Bartels & Bohmer, 1972). Three test tubes were filled with the sample, the standard calibrator (urea), and ten microliters (10l) of distilled water (blank).100 l of reagent1 were then added to each of the test tubes after this. These were then combined and incubated for 10 minutes at 370 °C. At 546 nm, the absorbance of the sample (Asample) and standard (Astandard) in comparison to the blank was measured.

**Urea Concentration**

\[
\text{Abs of Sample} \times \text{Standard Concentration (mg/dl)} = \frac{\text{Abs of Standard}}{\Delta \text{Abs of Standard}}
\]

Urea nitrogen weighs 0.467 mg for every milligram of urea.

The Bartels and Bohmer method were used to determine the serum creatinine (Bartels & Bohmer, 1972).

The working reagent was combined with 1 milliliter (1ml) of the standard (creatinine) and incubated for 30 seconds. The blood sample underwent the same procedure. At 492 nm, the absorbance of the sample and the standard were measured. The absorbance A2 of the sample and standard was measured once more exactly two minutes later. Hence, the serum creatinine was determined:

**Serum creatinine Concentration**

\[
\text{ΔAbs of Sample} \times \text{Standard Concentration (mg/dl)} = \frac{\text{ΔAbs of Standard}}{\text{Abs of Sample}}
\]

where

Abs1 = absorbance 1;
Abs2 = absorbance 2;
ΔAbs = A2-A1 = change in absorbance (ΔAbs sample or ΔAbs standard).

This could either be in mg/dl or μmol/L.

Sodium ion was determined using the method of Trinder and Maruna as outlined in Teco Kit (Trinder, 1951; Maruna, 1958). Labeling of four test tubes was done thus: blank, standard, control and test sample.

Following the addition of 50 μl of sample to each tube, one milliliter (1.0 ml) of filtrate reagent (Uranyl acetate 2.1 mM and Magnesium acetate 20 mM in ethyl alcohol) was piped out into the tubes. Distilled water was used as a blank. For three minutes, all of the mixtures in the test tubes were shaken ferociously. The reaction mixtures were then centrifuged for 10 minutes at a high speed (1500G). In order to generate the color, test tubes that matched the filtrate tubes mentioned above were labeled. The appropriate test tubes were set up. One milliliter (1.0 ml) of acid reagent was pipetted into each tube, followed by 50 μl of supernatant in each tube and 50μl of color reagent in each tube, which was then mixed. All of the tubes were read at 550 nm after the colorimeter was zeroed with distilled water.

The following formula was used to calculate sodium ion:

\[
\frac{\text{Na}^+ \left(\text{mEq} \right)}{\text{L}} = \frac{\text{Blank Abs} - \text{Abs of S} \times \text{Conc of STD (mEq/L)}}{\text{Abs of Blank} - \text{Abs of STD}}
\]

The method of Terri and Sesin, which is detailed in Teco diagnostic kit was used to determine the potassium ion concentration (Terri & Sesin, 1958).

Test sample, control, and standard were written on three test tubes, respectively. One milliliter (1.0 ml) of potassium reagent (Sodium Tetraphenylboron, 2.1 mM) was pipetted into each tube, and then 0.01 ml (10 μl) of the samples were...
added to the appropriate tubes, mixed, and incubated for 3 minutes at room temperature. A reagent blank was used to zero the colorimeter after three minutes, and all of the tubes were then read at 500 nm.

$$K = \frac{(\text{mEq/L})}{\frac{\text{Abs of Unknown} \times \text{Conc of STD (mEq/L)}}{\text{Abs of STD}}}$$

where STD = Standard.

Potassium Standard is equivalent to 4 mEq/L.

CRP quantitative and qualitative test was determined by using the method of (Wellcome Diagnostics kits method) (Cole et al., 2008).

E. Qualitative Test

Before the tests began, all reagents and the serum sample were kept at room temperature, and the latex reagent was gently mixed before use. Serum and the controls weren’t diluted. Using a (disposable pipette) dropper, 1 drop of serum was placed in the positive control and negative control reaction circles on separate glass slides. Each circle on each slide received 1 drop of CRP latex reagent. The serum and CRP latex reagent were uniformly mixed over the entire slide. The mixing stick was used to mix the diluted serum sample and controls, one drop of CRP latex reagent was added. The mixing stick was used to mix the sample and latex reagent uniformly all around the circle. Immediately, the stopwatch switched on and for 2 minutes, the slide gently rocked back and forth for two minutes. The clump or agglutination was macroscopically visible.

F. Quantitative Test

Dilution of the specimen 1:2, 1:4, and so on was prepared by using normal saline 0.9%. Each dilution of the serum sample and control (positive and negative control) was pipette on to separate reaction circle. For every drop of diluted serum sample and controls, one drop of CRP latex reagent was added. The mixing stick was used to mix the sample and latex reagent uniformly all around the circle. Immediately, the stopwatch switched on and for 2 minutes, the slide gently rocked back and forth (at a speed of 120 rpm). The clump (agglutination) was observed macroscopically. A positive reaction was indicated by agglutination. Agglutination is a sign that the CRP level is equal to or higher than the reagent sensitivity (mg/L CRP).

For the quantitative calculation, the dilution table for each sample was used.

How to calculate titer values:

1. The following equation was used to determine the patient sample’s approximate CRP concentration:

   $$\text{CRP ug/ml} = \frac{7 \times D}{\text{where D is the highest serum dilution at which agglutination is visible and 7 is the sensitivity in ug/ml.}}$$

2. ANOVA, or one-way analysis of variance, was used to analyze the data (SPSS v.21) statistical method. Significant difference was taken at 5% level of confidence (P<0.05).

III. RESULTS

The results in Table I show a significant increase in AST of lima beans preserved with pepper (23.67±2.47) (15.38±1.55) (P < 0.01) and ash (49.40±3.31) (15.38±1.55) (P<0.001). The ALT level of lima beans preserved with pepper (34.51±2.04) and ash (37.16±1.23) increases significantly when compared to the control (15.12±3.10) (P<0.001). All other parameters are not significantly different (P>0.05).

<table>
<thead>
<tr>
<th>TABLE I: EFFECTS OF ALUMINUM PHOSPHIDE, SNIPER, PEPPER AND ASH ON PHASEOLUS LUNATUS IN THE LIVER ENZYMES OF MALE ALBINO RATS</th>
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</thead>
<tbody>
<tr>
<td>Group</td>
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<tr>
<td>Control</td>
</tr>
<tr>
<td>L.B AL</td>
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<tr>
<td>L.B S</td>
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<tr>
<td>L.B P</td>
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<tr>
<td>L.B A</td>
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<td>L.B B</td>
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</table>

Data is presented as mean±SD.

The results in Table II show a significant increase in Na level of lima beans preserved with Aluminium phosphide (147.42±5.04) (P<0.05), sniper (176.20±14.10), pepper (165.38±3.78), and ash (200.00±1.97) (P<0.001) respectively, compared to control (128.41±1.99). The K level of lima beans preserved with pepper (11.94±2.54) and lima beans without preservative (blank) (11.63±1.41) are remarkably different (P<0.05) compared to control (7.02±2.45). Significant increase in creatinine level of lima beans preserved with aluminium phosphide (5.89±1.44) (P<0.01), Sniper (5.96±1.05) (P<0.01) and ash (4.39±0.33) (P<0.05) were observed in comparison to the control (2.01±1.31). All other parameters are not significantly different (P>0.05).

<table>
<thead>
<tr>
<th>TABLE II: EFFECTS OF ALUMINUM PHOSPHIDE, SNIPER, PEPPER AND ASH ON PHASEOLUS LUNATUS IN THE KIDNEY FUNCTION OF MALE ALBINO RATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
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<tr>
<td>Control</td>
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<tr>
<td>L.BAL</td>
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<tr>
<td>L.B S</td>
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<tr>
<td>L.B P</td>
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<tr>
<td>L.B A</td>
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<td>L.B B</td>
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</tbody>
</table>

Data is presented as mean±SD.

The outcome in Table III indicates that lima beans preserved with ash have a significantly higher CRP level (69.94±1.64) when compared to the control (62.97±5.30) (P<0.05). All other parameters are not significantly different (P<0.05).

<table>
<thead>
<tr>
<th>TABLE III: EFFECTS OF ALUMINUM PHOSPHIDE, SNIPER, PEPPER AND ASH ON PHASEOLUS LUNATUS IN THE INFLAMMATORY MARKER (CRP) OF MALE ALBINO RATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
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<tr>
<td>Control</td>
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<tr>
<td>L.B AL</td>
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<tr>
<td>L.B S</td>
</tr>
<tr>
<td>L.B P</td>
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<tr>
<td>L.B A</td>
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<tr>
<td>L.B B</td>
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</tbody>
</table>

Data is presented as mean±SD.

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In the hematological parameter test (Table IV), the result shows a significant decrease in the PCV level of lima beans preserved with ash (39.00±1.00\%\textsuperscript{a}) when compared to the control (49.92±5.48\%\textsuperscript{a}) (P<0.01). The platelets level of lima beans preserved with ash (95.54±3.45\%\textsuperscript{a}) decreases significantly when compared to the control (213.31±32.31\%\textsuperscript{a}) (P<0.001). The level of Hb, WBC, NEUT, LYMP, EOSI, MONO and BASO are not significantly different in all the preservatives in comparison to the control (P>0.05).

IV. DISCUSSION

This study demonstrated that consumption of pepper and ash, which are employed as lima bean preservatives, respectively raises AST and ALT levels in albino rats. In patients with cirrhosis and other liver illnesses, AST and ALT increase frequently prevail; an increase in these levels could indicate the presence of these conditions (AGA Technical Review, 2002). According to one study, the use of sniper, pepper, and ash on animals' results in liver injury by increasing AST and ALT activity (Shivaraj et al., 2009). A rise in ALT is a distinct feature of hepatocellular necrosis, which ultimately results in hepatic damage in situations of myocardial infarction and chronic liver disease. An increase in mitochondrial AST in the blood strongly implies tissue necrosis in these conditions (Charles, 2012).

Because they are produced by hepatocytes into the extracellular space, AST and ALT are frequently utilized as indicators of injury in the liver (Ozer et al., 2008). Rats fed samples preserved with dichlorvos in this study displayed a non-significant increase in ALT and AST blood levels. Contrary to earlier findings, Wahab et al. (2008) and Kingsley et al. (2016) found that rats exposed to dichlorvos had considerably higher levels of AST and ALT.

Dichlorvos inhibits acetylcholinesterase irreversibly at cholinergic junctions of the central nervous system, resulting in liver damage and oxidative stress in rats (Brown et al., 2015). Which in turn increases the enzymes (Onyinychukwu et al., 2017).

The report on the non-significant increase in liver enzymes is supported by Yang et al. (2012). The dose may be the determining factor in the lack of significance, and the liver, which is the site of biotransformation, may have reduced the toxicity by converting the toxic chemical into an inactive metabolite.

In this investigation, a portion of the sample was preserved using aluminum phosphide, and after exposure to the preserved samples, a non-significant increase in liver enzymes was found. This is closely related to a study by Morteza et al. (2013) who found that individuals with aluminum phosphate poisoning had higher levels of liver enzymes. Also, Inioibong et al. (2017) assessed the effect of aluminum phosphate on the transferases of the Parophiocephalus obscure's muscles and liver, and it was discovered that aluminum phosphate causes significant changes to the transferases (ALT and AST) in the liver and muscles of this species.

Inflammation causes blood arteries to dilate, which draws phagocytes (Wittmann et al., 2012). This could have caused a systemic inflammatory response, in which IL-1, IL-6, and TNF-acted on the liver to enhance the synthesis of CRP. Plasma CRP levels may rise as a result of lesions caused by organophosphates in the body's tissues and organs (Xinkuan et al., 2016). The small rise in CRP level ash-preserved lima beans seen in this study may be partially explained by this.

It has been demonstrated that pepper possesses antibacterial properties, and certain strains have already synthesized chemicals that are effective against bacteria strains that are resistant to antibiotics (Ogori et al., 2015). It has a strong flavor and, according to research, has active compounds that can delay pest invasion (Ogori et al., 2015). After exposure to the pepper-preserved sample, the liver enzymes ALT and AST dramatically elevated.

Black pepper had negative side effects including stinging, scarring, and tissue necrosis, and it may be the cause of liver cell necrosis (Ebye et al., 2007). This could be the cause of the rise in liver enzymes seen in this study. The outcome here is in contrast to a study by Friday et al. (2015) entitled Impact of Aqueous Extract of Piper Guineese Seeds on Certain Liver Enzymes, Antioxidant Enzymes, and Several Hematological Parameters in Albino Rats, which found that treatment resulted in a drop in the level of liver enzymes. Additionally, this study's CRP results showed no discernible differences between the sample preserved with pepper and the control sample. There was only a very minor reduction. Contrary to what Hend et al. (2014) stated, who studied the potential anti-inflammatory effect of lemon and hot pepper extracts on adjuvant-induced arthritis in mice, they found that the CRP level was raised.

Studies on the effects of pepper-treated samples on renal function have shown a considerable rise in the levels of sodium and potassium following exposure.

The rise in K\textsuperscript{+} levels here is consistent with the findings of Nwangwa et al. (2016). The rise in electrolytes may be related to kidney injury. After therapy, there was no discernible difference in the levels of creatinine or urea.

This runs counter to the 2016 study by Nwangwa et al. (2016) on the parameters affecting renal function caused by chili peppers. Another all-natural seed preserver used by

### Table IV: Effects of Aluminium Phosphate, Sniper, Pepper and Ash on Phaeolus Lunatus in Hematological Parameters of Male Albino Rats

<table>
<thead>
<tr>
<th>Group</th>
<th>Packed Cell Volume</th>
<th>Hemoglobin</th>
<th>White Blood Cell</th>
<th>Platelets</th>
<th>Neutrophil</th>
<th>Lymphocyte</th>
<th>Eosinophil</th>
<th>Monocyte</th>
<th>Basophil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>49.92±5.48%\textsuperscript{a}</td>
<td>25.34±9.86%\textsuperscript{a}</td>
<td>7468.33±389.80%\textsuperscript{a}</td>
<td>213.31±32.31%\textsuperscript{a}</td>
<td>67.25±5.93%\textsuperscript{a}</td>
<td>27.54±5.15%\textsuperscript{a}</td>
<td>3.33±1.53%\textsuperscript{a}</td>
<td>1.67±1.15%\textsuperscript{a}</td>
<td>0.33±0.58%\textsuperscript{a}</td>
</tr>
<tr>
<td>L.BAL</td>
<td>47.67±1.53%\textsuperscript{a}</td>
<td>17.70±1.84%\textsuperscript{a}</td>
<td>6814.00±231.10%\textsuperscript{a}</td>
<td>216.20±12.89%\textsuperscript{a}</td>
<td>65.35±4.51%\textsuperscript{a}</td>
<td>27.67±5.86%\textsuperscript{a}</td>
<td>2.00±1.00%\textsuperscript{a}</td>
<td>1.67±0.58%\textsuperscript{a}</td>
<td>1.00±0.00%\textsuperscript{a}</td>
</tr>
<tr>
<td>L.B S</td>
<td>44.00±3.00%\textsuperscript{a}</td>
<td>17.33±4.12%\textsuperscript{a}</td>
<td>7096.00±547.64%\textsuperscript{a}</td>
<td>183.17±14.42%\textsuperscript{a}</td>
<td>67.00±4.58%\textsuperscript{a}</td>
<td>28.33±2.89%\textsuperscript{a}</td>
<td>3.00±1.00%\textsuperscript{a}</td>
<td>3.00±0.00%\textsuperscript{a}</td>
<td>1.00±0.00%\textsuperscript{a}</td>
</tr>
<tr>
<td>L.B P</td>
<td>44.67±2.31%\textsuperscript{a}</td>
<td>18.75±0.72%\textsuperscript{a}</td>
<td>7154.67±24.70%\textsuperscript{a}</td>
<td>235.33±13.01%\textsuperscript{a}</td>
<td>66.6±74.73%\textsuperscript{a}</td>
<td>32.67±1.15%\textsuperscript{a}</td>
<td>2.00±1.00%\textsuperscript{a}</td>
<td>2.00±0.00%\textsuperscript{a}</td>
<td>1.00±0.00%\textsuperscript{a}</td>
</tr>
<tr>
<td>L.B A</td>
<td>44.00±1.00%\textsuperscript{a}</td>
<td>18.79±1.28%\textsuperscript{a}</td>
<td>7232.67±110.11%\textsuperscript{a}</td>
<td>95.54±3.45%\textsuperscript{a}</td>
<td>67.72±0.64%\textsuperscript{a}</td>
<td>30.34±0.57%\textsuperscript{a}</td>
<td>1.33±0.58%\textsuperscript{a}</td>
<td>1.67±1.15%\textsuperscript{a}</td>
<td>0.67±0.15%\textsuperscript{a}</td>
</tr>
<tr>
<td>L.B B</td>
<td>42.67±3.51%\textsuperscript{a}</td>
<td>19.67±2.52%\textsuperscript{a}</td>
<td>7455.00±153.63%\textsuperscript{a}</td>
<td>210.36±10.02%\textsuperscript{a}</td>
<td>65.67±3.51%\textsuperscript{a}</td>
<td>27.67±4.04%\textsuperscript{a}</td>
<td>1.33±0.58%\textsuperscript{a}</td>
<td>1.33±0.58%\textsuperscript{a}</td>
<td>0.33±0.07%\textsuperscript{a}</td>
</tr>
</tbody>
</table>

Data is presented as mean±SD.

farmers in the region is wood ash. Pests are repelled by the natural salts in wood ash. Studies have demonstrated that keeping seeds in wood ash effectively wards off both rot and insect predation in humid settings where seeds are vulnerable to insect infestation.

After albino rats were exposed to beans samples that had been stored with ash, the level of the liver enzymes ALT and AST significantly increased.

Salts in wood ash or the toxicity of chemical compounds (such cadmium, lead, and mercury) in wood ash on the liver and kidneys could be responsible for the increase in sodium electrolyte (Celestina et al., 2021). C-reactive protein levels were significantly higher following exposure to sample that had been treated with ash, according to hematological and CRP analyses. Elevated plasma levels of CRP are a result of inflammation and trauma, and it is described as a reactive chemical in acute lesions.

The rise shown here can be a result of an inflammatory reaction brought on by the harmful compounds in wood ash (Xinkuan et al., 2016).

One of the primary organophosphate chemical targets is the kidney (Misra et al., 1998). This could be as a result of the fact that dichlorvos, like other organophosphates, are often removed through urine and could harm nephrons (Kooman, 2009). According to reports, phosphonate inhibits mitochondrial cytochrome c oxidase, which results in the production of reactive oxygen species (ROS) and cellular peroxides. Renal functions are reduced by excessive ROS generation, which is related to an increase in serum creatinine (Guzman-Mendez et al., 2014). The kidney damage that resulted from exposure to the sample maintained with organophosphates was confirmed by this investigation to have increased significantly, and this may be explained by the increases in Na*, K*, and creatinine levels. Aluminium phosphate poisoning causes anomalies in sodium, potassium, and magnesium levels (Misra et al., 1988). Lima beans preserved with ash had a slight increase in the level of CRP. This could be a sign of inflammation, making the person more prone to illness, particularly coronary heart disease or infection (Koenig et al., 1999). The level of CRP is not significantly different for other preservatives.

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CONFLICT OF INTEREST

There is no conflict of interest.

REFERENCES


