

**LIVER FUNCTION ASSESSMENT OF FEMALE WISTAR ALBINO RATS ADMINISTERED
WITH BANANA AND PLANTAIN PETALS**

BY

JANET MARY ALUNYOR

LSC2103709

DEPARTMENT OF BIOCHEMISTRY,

FACULTY OF LIFE SCIENCES,

UNIVERSITY OF BENIN,

BENIN CITY,

EDO STATE.

OCTOBER, 2025.

**LIVER FUNCTION ASSESSMENT OF FEMALE WISTAR ALBINO RATS ADMINISTERED
WITH BANANA AND PLAINAIN PETALS**

BY

JANET MARY ALUNYOR

LSC2103709

**A RESEARCH PROJECTSUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY,
FACULTY OF LIFESCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF
SCIENCE (B.Sc.) DEGREE IN BIOCHEMISTRY**

OCTOBER, 2025.

CERTIFICATION

This is to certify that this project work was carried out by **JANET MARY ALUNYOR. MAT.NO.LSC2103709** in the Department of Biochemistry, Faculty of Life Sciences, University of Benin, Benin City, as part of the requirements for the award of Bachelor of science in biochemistry.

PROF.B.O.AGOREYO

(PROJECT SUPERVISOR)

DATE

PROF .E.C. OYENEKE

(HEAD OF DEPARTMENT)

DATE

DR.SAM OJEABURU

(PROJECT COORDINATOR)

DATE

EXTERNAL EXAMINAR

DATE

DEDICATION

This project work is dedicated to GOD ALMIGHTY who has been my source of strength and support and also to my family whom God used to be my support system throughout my undergraduate years.

ACKNOWLEDGEMENT

My profound gratitude goes to my Supervisor, Prof (Mrs.) B.O. Agoreyo for her endearing love, support, mentorship and prayers during the course of this project work. My special thanks to Mr. Samuel and Mr. Akpe who showed guidance and assistance towards the success of this project.

I also want to extend my sincere gratitude to all my lecturers who in one way or the other provided the knowledge; I eventually made use of during this project work.

My heartfelt gratitude go to my Parents Mr. and Mrs. Alunyor Patrick and also to my siblings, the person of Alunyor Shedrack, Alunyor Joseph, Alunyor Precious and Alunyor Peculiar, indeed their support had really been of great help towards the completion of my undergraduate studies and this project work. They've all contributed in helping out financially, emotionally, spiritually, mentally, morally and physically. Indeed family is everything and this wouldn't have meant anything if I was not having them by my side. I may not have been saying it all the time but I love them so much.

Also special thanks go to my Pastor, Pst. Paul who has been of great help to me both spiritually and academically and also to all the Zion excos. Lastly special thanks go to Bro Samson Ikechukwu, Bro Caleb Okon and Miss Priscilla Obadoni whose assistance has been of great help towards the completion of this project work.

I also want to use this medium to appreciate my BCSF family and course mates (Azubuike Peter, Adewumi Julius, Chanwi Favour, Ogah Merryjane, Emiator Maranatha Ebosetale) God indeed blessed me by letting our path cross.

And finally to my team members Jessica, Patrick, Natasha, Favour, Emmanuel, and Kamsi. I want to say a very big thank you to you all for your support and contribution to the success of this work and to God Almighty I say thank you.

TABLE OF CONTENT

Title page	i
Certification	iii
Dedication	iv
Acknowledgement	v
Table of content	vi
List of table	ix
List of plates	x
Abstract	xi
CHAPTER ONE	
Introduction	
1.1 Background of study	1
1.2 Aim and Objectives	3
1.2.1 Literature Review	3
1.2.2 Overview of Banana and Plantain Petals	3
1.2.3 Nutritional and Phytochemical Properties	6
1.2.4 Liver function and Hepatotoxicity Indicators	8
1.2.4.1 Liver definition and location	8
1.2.4.2 Liver disease	10
1.2.4.3 Drug induced liver injury	10
1.2.4.4 Liver function assessment	10

CHAPTER TWO

Materials and Method

2.1	Materials	14
2.1.1	Equipment use for this study	14
2.1.2	Chemicals and reagent	14
2.2	Sample Collection	14
2.2.1	Preparation of the sample	14
2.2.2	Preparation of the aqueous extract	16
2.3	Experimental Animals	16
2.3.1	Experimental Design	17
2.4	Liver function test	18
2.4.1	Determination of Alanine Aminotransferase	18
2.4.1.2	Determination of Aspartate Aminotransferase	19
2.4.1.3	Determination of Alkaline Phosphatase	20
2.4.1.4	Determination of albumin	20
2.4.1.5	Determination of bilirubin	21
2.4.1.6	Determination of total protein	22

CHAPTER THREE

Results

3.1	Effect of Aqueous Banana and Plantain Petals extract on the body weight of female Wistar albino rats	24
3.2	Effect of Aqueous Plantain Petals extracts on the body weight of female Wistar albino rats	24
3.3	Effect of Aqueous Banana Petals extracts on the body weight of female Wistar albino rats	25

CHAPTER FOUR

Discussion

4.1 Conclusion 33

REFERENCES 34

APPENDIX 41

LIST OF TABLES

Table 1:	Effect of aqueous Banana Petals on the Body weight of Female Wistar Albino Rats	25
Table 2:	Effect of aqueous Plantain Petals on the Body weight of Female Wistar Albino Rats	26
Table 3:	Effect of aqueous Plantain Petals on ALT, AST, and ALP activities in Female Wistar Albino Rats	28
Table 4:	Effect of aqueous Plantain Petals on Total protein, direct bilirubin, total bilirubin and albumin levels in female Wistar albino rats	28
Table 5:	Effect of aqueous Banana Petals on ALT, AST and ALP activities in Female Wistar Albino Rats	29
Table 6:	Effect of aqueous Banana Petals on total protein, direct bilirubin, total bilirubin and albumin levels in female Wistar albino rats	30

LIST OF PLATES

Plate 1:	A picture showing the liver	9
Plate 2.1:	A picture showing the Banana petals	15
Plate 2.2:	A picture showing the Plantain petals	16

ABSTRACT

Banana and Plantain petals are plants commonly found in Africa, it is consumed locally and reportedly use for diverse medicinal purposes. This study was carried out to determine the effect of the extract of these banana and plantain petals on the liver function of female Wistar albino rats. A total of 42 female Wistar albino rats were used to carry out this study. The rats were acclimatized for 2 weeks before being randomly assigned into 7 groups, with 6 rats per group. Group 1 served as the control group, while groups 2 to 7 were designated as the experimental test groups. The experimental test groups were further subdivided into 2 groups: groups 2, 3 and 4 were administered doses of 2.0ml, 1.0ml, and 0.5ml, of plantain petal extract respectively, whereas groups 5, 6, and 7 were administered 2.0ml, 1.0ml and 0.5ml of banana petal extract respectively. The extracts were administered daily for duration of 28 days. At the end of the experimental period, the rats were anesthetized with chloroform, blood sample was collected from the abdominal aorta and the heart and the rats were then sacrificed. The results revealed a non-significant change ($p > 0.05$) in alanine aminotransferase (ALT), alkaline phosphatase (ALP), aspartate aminotransferase (AST) and total protein activities in experimental groups relative to the control group. This result also showed a mild increase in bilirubin levels in some of the groups administered with banana petal extract, albumin levels of the experimental groups administered with the banana petals extracts showed a significant increase ($p < 0.05$) relative to the control. In conclusion, aqueous banana and plantain petals extract has no negative impact on the liver.

CHAPTER ONE

INTRODUCTION

1.1 Background of study

Banana and plantain, belonging to the *Musaceae* family, are extensively cultivated in tropical and subtropical areas. They are valued not only for their nutritional benefits but also for their potential medicinal use (Pereira&Maraschin,2015). Researchers have examined different components of these plants, including the peels, stems and pulp, for their bioactive substances, which includes; flavonoids, alkaloids and phenolics. These bioactive substances are recognized for their antioxidant properties and ability to protect the liver.(Imama&Akter, 2011). For example, studies have shown that the aqueous extract from banana peels (*Musa acuminata*) is safe for liver and kidney functions in Wistar rats when administered at doses up to 100mg/kg, suggesting its potential for therapeutic applications (Edentet.al.,2014). In a Similar manner, ethanolic extracts from the pulp of unripe plantains (*Musa paradisiacal*) have demonstrated a protectiveeffect against liver damage in rats caused by CC14, which is likely attributedto their antioxidant properties (Onyema *et al.*, 2019). Furthermore, extracts from banana peels have found to mitigate liver and kidney damage in female Wistar rats exposed to heavy metals by reducing oxidative stress inflammation (Eddie-Amadiet *al.*, 2022).

While the peels and pulp of banana and plantain have been studied extensively, the petals also have been extensively studied, the petals (or bracts as it is also called) of these plants have received little attention. Often discarded as agricultural waste, these petals may contain unique bioactive compounds with potential liver-protective effects, similar to the other parts of the plant. Initial research on *Musa species* indicates that their antioxidant and anti-inflammatory activities could protect the liver from damage by scavenging harmful free radicals and modulating inflammatory

processes. (Vijay *et al.*, 2022). However, the specific effects of banana and plantain petal extracts on liver function in female Wistar albino rats remain largely unstudied, and thus highlight the need for further investigation to confirm their safety and effectiveness.

The liver is vital for several physiological processes, including metabolism, detoxification, and immune regulation; therefore, assessing its function is crucial in both toxicological and pharmacological studies (Nalbantoglu& Brunt, 2014). Liver diseases, frequently caused by toxic agents such as carbon tetrachloride (CCL4) or alcohol, represent a major global health concern, leading to substantial morbidity and mortality rates (Singalet *et al.*, 2018). Conventional treatments for liver disorders often have side effects and limitations, hence researchers are increasingly exploring natural alternatives, especially medicinal plants, for their hepatoprotective potential. Plantains have been traditionally recognized for their anti-inflammatory, antioxidant and anti-ulcer properties (Imama&Akter, 2011).

Wistar albino rats, most especially females, are commonly used in studies of liver toxicity because of their genetic consistency, physiological similarities to humans, and responsiveness to liver injury (Festing,2010). Researchers often select female rats due to their hormonal variation which contribute to sex-dependent variations in liver enzyme expression, thereby affecting xenobiotic metabolism and liver performance (Mao *et al.*, 2022).

To assess liver health in these experimental models, researchers typically measure biochemical markers such as aspartateaminotransferase (AST), alanineaminotransferase (ALT), alkaline phosphatase (ALP), total bilirubin, and albumin, which provide critical insights into liver cell integrity and overall hepatic performance (Amacher&Schomaker,2020).

This study seeks to fill this research gap by examining the effects of banana and plantain petal extracts to liver function in female Wistar albino rats through biochemical and histopathological

analysis. By exploring the potential hepatoprotective or hepatotoxic properties of these extracts, this research aims to add knowledge of the therapeutic uses of *Musa* species, particularly their underutilized components, in addressing liver-related conditions.

1.2 AIM AND OBJECTIVE

The aim of this study is to determine the effect of banana and Plantain Petals on Female Wistar Albino Rats.

The objective of this study is:

1. To ascertain the effects of Banana and Plantain petals on the Liver function.

1.2.1 LITERATURE REVIEW

1.2.2 OVERVIEW OF BANANA AND PLANTAIN PETALS

Banana petals

The banana plant, the largest among herbaceous species, has a pseudo stem that grows to heights of 2-8 meters in cultivated varieties and can reach 10-15 meters in certain wild types. This striking above-ground structure is supported by an underground stem, approximately 30cm in length.

It is one of the earliest crops domesticated by humans and continues to serve as a staple food for millions in tropical regions. This crop plays a vital role in the diet of rural and working-class populations and ranks fourth globally in terms of production value, following rice, wheat, and maize or milk products. It serves as a major source of high calorie energy and offers easily digestible carbohydrates, along with essential vitamins B and C, and minerals such as potassium, calcium and magnesium. Additionally, it possesses several beneficial medicinal properties (Rajesh, 2017).

Serve multiple purposes, including religious ceremonies, ornamentation, and decoration for important occasions. They are also used in food preparation, as ingredients for essential oils, and in cosmetics products. Beyond domestic applications, flowers have played a vital role in traditional and cultural medicine, being employed either individually or as components in various medicinal formulations. In recent times, aromatherapy using flowers has gained increasing recognition for its benefits to both mental and physical well-being. The therapeutic value of flowers is often assessed based on their health-promoting properties, particularly their color, fragrance, and flavor compounds, which contribute to antioxidant activity and the neutralization of reactive oxygen species (Latha *et al.*, 2022).

Flowers have held great significance in human life, since ancient times, and they represent the reproductive organs of plants and have been utilized in many aspects of daily living. (Latha *et al.*, 2022).

The blossom of the banana also considered the “Banana Heart” and “Banana flower”, can be eaten raw or cooked (Komal and kaur,2019). Historically, the banana blossom has tremendous health benefits and is often used as a food additive in several Asian nations, including; Indonesia, Thailand, and Sri Lanka. It is eaten raw and fresh, used as pickles, dehydrated vegetables, and canned foods. It is a popular meal in Sri Lanka, where it is served as curry or as a boiled or fried salad (Salvador, 2018). Simultaneously, the banana blossom is a rich source of minerals and antioxidants that have been used in traditional medicine to treat constipation, bronchitis, and ulcer disorders (Sheng *et al.*, 2010).

The banana blossom is also a good source of high quality protein, dietary fiber, vitamins and minerals like magnesium, iron and copper, all of which have anticancer properties (Tasnimet *et al.*, 2020).Banana blossom contains biologically active compounds such as antioxidant activity, total

phenolics compounds, vitamins and minerals that aid in the treatment of diabetes, weight loss, gastrointestinal health, and the relief of menstrual cramps (Divya *et al.*, 2016; Thaweesang, 2019)

Plantain Petals

Plantain flowers also known as floral bracts or petals are large, pointed, and purple to maroon colored structures that enclose rows of creamy tubular florets. Though often discarded during harvesting, these petals are consumed as vegetables in many tropical regions and feature prominently in traditional cuisines across east and West Africa, Southeast Asia and parts of South America (Vilhena *et al.*, 2020). Nutritionally, 100g of plantain flower yields approximately 51 kcal, with notable contributions from dietary fiber (≈ 5.7 g), protein (≈ 1.6 g), and carbohydrates (≈ 8.8 g), along with an array of minerals such as potassium (≈ 176 mg), iron, calcium, phosphorus, magnesium, zinc, and copper (Vilhena *et al.*, 2020). These petals thrive in tropical and subtropical regions, particularly in Nigeria, Ghana, India, Sri Lanka, Philippines, Indonesia, and Malaysia (Adeleke *et al.*, 2021; Vilhena *et al.*, 2020). Phytochemical profiling of plantain flower extracts and their bracts reveals high levels of secondary metabolites including alkaloids, flavonoids, tannins, saponins, phenolics acids, and anthocyanins (Adeleke *et al.*, 2021). Advanced GC-MS (Gas chromatography-Mass spectrometer) and LC-MS (Liquid chromatography-Mass spectrometer) analyses recently identified bioactive compounds such as hexacenoic acid, squalene, L-(-)-carvone, 4-hydroxybenzaldehyde, and hippastrine in ethanolic extracts of the flower suggesting a repertoire of antimicrobial and antioxidant agents (Mousa *et al.*, 2023). These phytochemicals have been associated with health benefits including antioxidant, antimicrobial, anti-inflammatory, and antidiabetic effects. Notably, methanolic and aqueous extracts of flower and bract exhibited strong free-radical scavenging activity (via DPPH assays), and significantly improved glucose tolerance in streptozotocin-induced diabetic rats effects attributed to flavonol glycosides and anthocyanins (Vilhena *et al.*, 2020). Collectively the nutritional richness and bioactive

profile of plantain petals underscore their potential as functional food ingredients or sources of therapeutic compounds.

1.2.3 NUTRITIONAL AND PHYTOCHEMICAL PROPERTIES

Banana Petals

The banana flower is rich in phytochemical such as vitamins, flavonoids, and protein. They are highly valuable nutritionally, serving as an excellent source of both dietary fiber and protein. These flowers also contain a class of phytochemical known as saponins. Saponins lower bad cholesterol, strengthens our immunity against infections and are able to inhibit the growth of cancer cells. Additionally their antioxidant activity contributes to reducing the risk of chronic diseases, particularly cardiovascular disorders. Banana flowers are also recognized as a rich source of flavonoids (Kavya *et al.*, 2023).

Plantain Petals

Phytochemical Properties

A 2021 study by (Adeleke *et al.*, 2021). Performed phytochemical screening of *Musa paradisiacal* flower extracts, identifying high levels of flavonoids, phenolics extracts, tannins, and alkaloids bioactive constituents known to exert antioxidant, antimicrobial, and anti-inflammatory effects. This phytochemical support mechanistic plausibility for hepatoprotection via oxidative stress reduction.

Nutritional Properties

The plantain flower (*Musa balbisiana Colla*) contains a wide range of vital nutrients, including minerals, vitamins and various phytochemical compounds such as flavonoids. Studies have shown that these components offer numerous therapeutic advantages. The flavonoids, which act as phytoestrogens, help to counter estrogen deficiency and are therefore beneficial for women's health. Despite the abundant

availability of plantain flowers in India, they remain largely underutilized, particularly in the southern regions of the country(Prakash *et al.*, 2023).

The plantain flower nutritional facts are depicted in (Table 1).

Table 1- *Musa BalbisianaColla*(Plantain flower) Nutritional Facts per 100gm

Nutrients	Quantity
Energy	51 kcal
Carbohydrate	8.79 gm
Protein	1.63 gm
Fat	0.50 gm
Fiber	5.7 gm
Beta-carotene	0.19 µg
Calcium	105 mg
Phosphorous	76 mg
Iron	3.5 mg
Copper	13 mg
Potassium	176 mg
Magnesium	56 mg
Flavonoids	137 mg

A scientific investigation analyzed the nutrient composition of plantain flowers using recognized standard techniques and revealed that the flower contains high levels of fiber (70%), carbohydrates (53.78%), and protein (19.60%). The significant fiber content aids in promoting healthy bowel

movement and sustaining intestinal wellbeing. Plantain flowers are also abundant in essential minerals such as potassium, sodium, phosphorus, calcium, magnesium, iron, zinc, and copper (vital cations for intracellular processes). In addition, their rich protein content supports the contraction of smooth, skeletal, and cardiac muscles, regulates nerve excitability, and helps maintain the body pH and electrolyte equilibrium. Also, extracts from plantain flowers are rich in various phytochemicals including flavonoids, coumarins, saponins, terpenoids, steroids, and cardiac glycosides, which contribute to their antimicrobial potential and make them promising candidates for nutraceuticals development. The bioactive compound malic acid found in the flowers exhibits notable antibacterial effects against *Bacillus cereus*, *Bacillus subtilis*, and *Escherichia coli* and also plays a role in inhibiting the proliferation of the malaria parasite *Plasmodium falciparum* within the body.

Studies have shown that plantain blossoms are rich in essential minerals and antioxidant compounds such as flavonoids and phenolics substances, which help strengthen the body's defense against both communicable and non-communicable diseases including ulcers, asthma, cardiovascular disorders, diabetes, hypertension, hyperlipidemia, anemia, cancer, dysentery, and diarrhea. The presence of these antioxidants and minerals in plantain flowers also contributes to the relief of muscle cramps, reduction of excessive menstrual bleeding, and serves as a nutritional supplement for lactating mothers. Additionally, they are beneficial for women with polycystic ovary syndrome (PCOS). The flavonoids compounds, which act as phytoestrogens, help to balance estrogen levels in the body and support overall reproductive health.

1.2.4 LIVER FUNCTION ASSESSMENT AND HEPATOXICITY INDICATORS

1.2.4.1 Liver Definition and Location

The liver is the body's largest organ and also its largest gland, acting as the main regulator of nutrient and substance flow within the bloodstream. It is an essential organ responsible for metabolism,

detoxification, digestion, storage, and the synthesis of vital compounds necessary for sustaining life. Moreover, the liver plays a key role in maintaining homeostasis by controlling numerous biochemical processes essential for survival. Located just beneath the diaphragm in the upper right portion of the abdominal cavity, it receives a rich blood supply from both the hepatic arteries and the portal vein. The liver carries out several crucial physiological functions, including detoxifying harmful substances, transforming nutrients from food, storing vitamins and minerals, producing bile, cholesterol, proteins, and enzymes, aiding in blood clotting, supporting immune defense through antibody production, eliminating bacteria from the bloodstream, regulating hormones, and maintaining stable blood glucose levels.

Problems with the liver can be life threatening and could result in fatigue, weakness or loss of energy, weight loss, jaundice (yellow skin and eyes), fluid collection in the abdomen condition known as **ASCITES**, nausea, diarrhea and Abdominal pain.

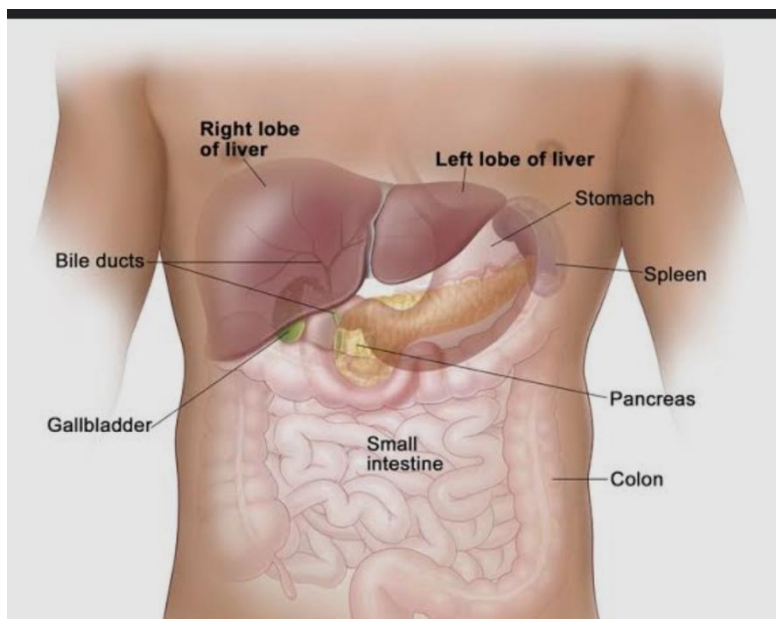


Plate 1: A picture showing the liver and its location (Google source)

1.2.4.2 Liver disease

Definition of liver disease

Liver disease also known as hepatic disease can be defined as any occurrence, disturbance or condition that hinders the liver from performing any of its functions. The liver is a center for many important functions in the body but could also lead to a cascade of other disruptions and problems in both the liver and other parts of the body. It is called chronic liver disease when the progress or degree of the damage has gone far.

1.2.4.3 Drug induced liver injury

“Drug induced liver injury (DILI) is defined as liver damage due to drugs, herbal medications or supplements.”(Lowet *al.*, 2019). Drug induced liver injury can be life- threatening and may present with different levels of liver damage, starting from mild changes to fibrosis and even acute liver failure. Although serious cases do not occur often, they can be very dangerous, especially when jaundice develops. (Lowet *al.*, 2019).

1.2.4.4 Liver function Assessment

Liver function assessment or tests,also known as liver chemistries, help determine the health of the liver by measuring the levels of proteins, liver enzymes, and bilirubin in the blood. A liver function test is often recommended in the following situations. To check for damage from liver infections such as hepatitis B and hepatitis C, to monitor the side effects of certain medications known to affect the liver, if there is existing liver disease to monitor the disease and how well a particular treatment is working, if there are symptoms of a liver disorder, if there are certain medical conditions such as high triglycerides, diabetes, high blood pressure or anemia, if one takes alcohol heavily and if here is gallbladder disease.

Many tests can be performed on the liver. Certain tests can reflect different aspects of liver function.

HEPATOXICITY INDICATORS

Commonly used test to check liver abnormalities are: Alanine Transaminase (ALT)Aspartate Aminotransferase (AST), Alkaline Phosphatase (ALP), Albumin, Bilirubin, Total Protein.

The ALT and AST tests measure enzymes that the liver secretes in response to damage or disease. The albumin test measure how well the liver secretes albumin, while the bilirubin test measure how well it disposes of bilirubin. ALP can be used to evaluate the bile duct system of the liver.

Having abnormal results on any of these liver tests typically requires follow up to determine the cause of the abnormalities. Even mildly elevated results can be associated with liverdisease. However, these enzymes can also be found in other places besides the liver. The liver function tests are used to measure specific enzymes and proteins in the blood, depending on the test; either higher or lower than normal levels of these enzymes or proteins can indicate a problem with the liver.

ALANINE TRANSAMINASE (ALT)

Alanine Transaminase (ALT) is used by the body to metabolize protein. If the liver is damaged or not functioning properly, ALT can be released into the blood. This causes ALT levels to increase in the blood. A higher than normal result on this test can be a sign of liver damage.

According to the American College of Gastroenterology an ALT above 25 IU/L' (international units per liter) in females and 33 IU/L in males typically requires further testing and evaluation.

ASPARTATE AMINOTRANSFERASE (AST) TEST

Aspartate Aminotransferase (AST) is an enzyme found in several parts of the body, including the heart, liver, and muscles. Since AST levels aren't as specific for liver damage as ALT, it's usually measured

together with ALT to check for liver problems. When the liver is damaged, AST can be released into the bloodstream. A high result on an AST test might indicate a problem with the liver or muscles.

The normal range for AST is typically up to 40 IU/L in adults and may be higher in infants and young children.

ALKALINE PHOSPHATASE (ALP) TEST

Alkaline Phosphatase (ALP) is an enzyme found in the bones, bile ducts, and liver. An ALP test is typically ordered in combination with several other tests. High levels of ALP may indicate liver inflammation, blockage of the bile ducts, or a bone disease.

Children and adolescents may have elevated levels of ALP because their bones are growing. Pregnancy can also raise ALP levels. The normal range for ALP is typically up to 20 IU/L in adults.

ALBUMIN TEST

Albumin is the main protein made by the liver. It performs many important bodily functions: For example, albumin: stops fluid from leaking out of the blood vessels, nourishes the tissues transportshormones, vitamins, and other substances throughout the body. An albumin test measures how well the liver is making this particular protein. A low result on this test can indicate that the liver isn't functioning properly.

The normal range for albumin is 3.5-5.0 grams per deciliter (g/dL). However, low albumin can also be as a result of poor nutrition, kidney disease, infection and inflammation.

BILIRUBIN TEST

Bilirubin is a byproduct formed when red blood cells are broken down. Under normal conditions, the liver processes this substances and removes it from the body through the stool. When the liver is

damaged or not functioning effectively it may fail to process bilirubin properly, resulting in an increased amount in the blood. A high bilirubin level can therefore indicate liver dysfunction. The normal bilirubin concentration in the blood usually ranges from about 0.1 to 1.2 milligrams per deciliter (mg/dL). Some inherited disorders can also cause elevated bilirubin levels even when liver function remains normal. Abnormal outcomes in liver tests often require further medical investigation to identify the underlying cause. Even slightly raised bilirubin levels may suggest liver-related problems, although these enzymes can sometimes be found in other tissues apart from the liver.

TOTAL PROTEIN TEST

The total protein test helps determine the overall concentration of proteins present in the blood, particularly focusing on albumin and globulin levels. These two proteins play important roles in the body. The test evaluates the combined levels of albumin and globulin and can aid in detecting signs of liver-related conditions. It also measures the proportion of albumin to globulin, which is referred to as A/G ratio.

CHAPTER TWO

MATERIALS AND METHOD

2.1 MATERIALS

2.1.1 Equipment used for this study

Measuring cylinder, Weighing balance, Mortar and pestle, Refrigerator, Cages, Gauvage, Sample bottles, Cheese cloth, Spectrophotometer, Needle and syringe, Collection tubes, Elastic bands, Alcohol pad, Gauze, Centrifuge, Pipettes, Coagulometer.

2.1.2 CHEMICALS AND REAGENT

All chemicals and reagent were of analytical grade and were obtained from standard commercial suppliers, Aspartate Transaminase, Alanine Transaminase, alkaline Phosphatase, total protein, total bilirubin and albumin kits, and 98% methanol, distilled water, chloroform from fortress diagnostic test kits.

2.2 SAMPLE COLLECTION

The banana and plantain petals were collected from precinct of University of Benin Edo state on the 23rd of July, 2025.

2.2.1 PREPARATION OF THE SAMPLE

The banana and plantain petals (Plates 2.1 and 2.2, respectively) were rinsed, cut into small pieces and ground with mortar and pestle.



PLATE 2.1: Banana petals.



PLATE 2.2: Plantain petals

2.2.2 PREPARATION OF THE AQUEOUS EXTRACT

The petals were divided into 3 different dose groups for Banana and Plantain respectively; for 0.5ml, 8.4g of the sample was extracted by using 42ml of water, while for 1ml, 16.8g of the sample was extracted by 84ml of water and lastly for 2ml, 33.6g of the samples was extracted by 168ml of water. The mixture was then filtered with a cheese cloth respectively. The filtrate was then stored in the refrigerator. The sample was been made weekly throughout the 28 days of the administration.

2.3 EXPERIMENTAL ANIMALS

Allfemale Wistar albino rats used in this experiment were procured from a local breeder in the University of Benin city, Edo State and housed in the Animals house of the Department of Anatomy, Faculty of Basic Medical Sciences, University of Benin.

2.3.1 EXPERIMENTAL DESIGN

A total of forty two (42) female Wistar albino rats were used for this study. The experimental animals weighed between 90-114g, and they were divided into seven (7) groups with group 1 as the control and the remaining (6) dose group of 0.5ml, 1ml, and 2ml (with 6 animals per group). The animals were housed in clean cages, acclimatized for more than two weeks and exposed to twelve hours light and darkness cycle. They were fed with pelleted diet; the feed and water were given ad libitum.

Group 1: Assigned as control. The six (6) experimental rats in this group were not administered the extract but were given only food and water

Group 2: The six (6) experimental animals in this group were administered the plantain petals extract with a dosage of 2.0ml of the sample solution

Group 3: The six(6) experimental animals in this group were administered the plantain petals extract with a dosage of 1.0ml.

Group 4: The six (6) experimental animals in this group were administered the plantain petals extract with a dosage of 0.5ml

Group 5: The six (6) experimental animals in this group were administered the banana petals extract with a dosage of 2.0ml of the sample solution

Group 6: The six (6) experimental animals in this group were administered the banana petals extract with a dosage of 1.0ml.

Group 7: The six (6) experimental animals in this group were administered the banana petals extract with a dosage of 0.5ml

Prior to the administration of the extracts the animals were fasted over night but water was made available for them. The animals were weighed and doses of 0.5ml, 1.0ml and 2ml of the extracts were given orally with a gavage to the treatment groups in a single dose with the control receiving just the vehicle (water). After administration of the extracts, the rats were observed closely consecutively for 3hours for changes in the skin, fur, eyes, somatic motor activity, behavioral patterns, tremors, salivation, diarrhea, sleep, coma and mortality before feeding and thereafter daily for 28days. Food consumption and weight changes were also recorded daily during the observation period. At the end of the study, the animals were fasted overnight prior to sacrifice. They were anesthetized with chloroform, blood sample was collected from the abdominal aorta and the heart; the rats were then sacrificed and liver function test was been carried out.

2.4 LIVER FUNCTION TEST

2.4.1 DETERMINATION OF ALANINE AMINOTRANSFERASE (ALT)

This was determined by the method of (Sanni *et al.*,2014)

Principle

α -oxoglutarate + L-alanine ^{ALT}L-glutamate + Pyruvate

Alanine Aminotransferase is measured by observing the amount of pyruvate hydrazone produced with 2, 4-dinitrophenylhydrazine.

Procedure

Exactly 0.1ml of the sample (Serum) was mixed with 0.5ml of ALT R1 solution in the sample test tube while for the blank 0.1ml of distilled water was mixed with 0.5ml of ALT R1 solution. The mixtures were incubated for 30 minutes at 37°C. After incubation, 0.5ml of ALT solution R2 was added across all test tubes. The mixture was allowed to stand for 20 minutes at 20°C. Finally, 5.0ml of sodium hydroxide was added across all test tubes. The absorbance was read at 505 nm after 5 minutes using a spectrophotometer.

2.4.1.2 DETERMINATION OF ASPARTATE AMINOTRANSFERASE (AST)

(Sanni *et al.*, 2014). Method is used to determine the presence of AST.

Principle



Aspartate Aminotransferase is measured by observing the amount of Oxaloacetate hydrazone produced with 2,4-dinitrophenylhydrazine.

Procedure

Exactly 0.1 ml of the sample was mixed with 0.5ml of AST R1 solution in the sample test tube while for the blank 0.1ml of distilled water mixed with 0.5ml of AST R1 solution. The mixtures were incubated for 30 minutes at 37 °C. After incubation, 0.5ml of AST solution R2. was added .across all test tubes

The mixture was allowed to stand for 20 minutes at 20°C. Finally, 5.0ml of 0.4N sodium hydroxide (NaOH) was added across all test tubes. After 5 minutes the absorbance was read at 505 nm, using a spectrophotometer.

2.4.1.3 DETERMINATION OF ALKALINE PHOSPHATASE (ALP)

The method developed by was used in the evaluation of serum alkaline phosphate. (Schumann *et al.*,2011).

Principle

p-nitrophenylphosphate + H₂O ^{ALP}phosphate + p-nitrophenol

Procedure

Exactly 0.5ml of alkaline phosphatase substrate was dispensed into blank, standard and sample test tubes and it was left to equilibrate to 37°C for three minutes).05ml of distilled water, standard reagent and sample was introduced into their respective test tubes, and then mixed thoroughly. The mixture was incubated for 10minutes at 37°C 2.5ml of alkaline phosphatase color developed was added to all test tubes and mixed. Absorbance of samples was read against blank at 590nm.

2.4.1.4 DETERMINATION OF ALBUMIN

This was determined by the method of (Moreira *et al.*,2018).

Principle

The estimation of albumin in the serum is on the basis of its quantitative binding to 3,3',5,5'-tetrabromo-m cresol sulphonephthalein (bromocresol green, BCG) (indicator). At 578 nm, the albumin-BCG-complex is known to absorb at a maximum capacity and the concentration of albumin is directly proportional to the absorbance read.

Procedure

Exactly 0.01ml of distilled water was mixed with 3.00ml of BCG reagent (blank). 0.01ml of the standard solution was also 3ml mixed with BCG reagent (standard). 0.01ml of the serum was mixed with 3.00ml of BCG reagent (R1). The separate mixtures were incubated for 5 minutes at 20-25°C. The absorbance of the sample (A_{sample}) and of the standard (A_{standard}) was estimated against the reagent blank at 630nm.

2.4.1.5 DETERMINATION OF BILIRUBIN

This was estimated by the method of (Saktawat *et al.*,2024).

Principle

Direct (conjugated) bilirubin interacts with diazotized sulphanilic acid, in an alkaline medium to yield a blue colored complex (azobilirubin compound). Caffeine reacts with diazotized sulphanilic acid to release the bilirubin bounded to albumin. Thus the amount of released albumin bound bilirubin determines the total bilirubin concentration.

Procedure

Total Bilirubin

Exactly 200 μ L of reagent 1, 1000 μ L of reagent 3 and 200 μ L of the samples were mixed (sample blank) while 200 μ L of reagent 1, 1 drop of reagent 3 and 200 μ L of the sample were mixed. The solutions were incubated for 10 minutes at 20-25°C. 1000 μ L of reagent 4 were added to the solutions, mixed thoroughly and left to stand for 5-30 min at 20-25°C, then the absorbance of the sample was read against the sample blank (ATB) at 578nm.

2.4.1.6 DETERMINATION OF TOTAL PROTEIN

This was estimated by the method of (Saktawat *et al.*, 2024).

Principle

In an alkaline medium, cupric ion interacts with protein peptide bonds leading to the production of a blue-violet complex known as the biuret reaction. In order to stop the alkaline copper complex from autoreducing, an iodide is been utilized and tartate (Potassium sodium tartate) which can act as a stabilizer is added to each copper ion complex containing five or six peptide links. The color that forms is been measured using a spectrophotometer at 546nm (520-560) and is proportionate to the protein content.

Procedure

Exactly 0.02mL of distilled water was mixed with 1.0ml R1 (blank), 0.02ml of standard (CAL) was mixed with 1,0mL R1 (standard) while 0.02mL of the sample was mixed with 1.0mL of R1. The solutions were incubated for 30minutes at 20-25°C. The absorbance of the sample (A_{sample}) and of the standard (A_{standard}) was estimated against the reagent blank at 546nm.

STATISTICAL ANALYSIS

All measurements were carried out in triplicate and results were presented as mean \pm standard error of mean (SEM). Statistical analysis were carried out using one-way analysis of variance (ANOVA) and difference between means was determined using the least significant difference on statistical package for social sciences (SPSS); version 27. The level of significance was set at ($p \leq 0.05$).

The data on the tables are reported as mean \pm standard error of mean, n=5. Values with superscript 'a' shows a non-significant difference compared to the control, while values with superscript 'b' shows significant difference compared to control.

CHAPTER THREE

RESULTS

3.1 Effect of Aqueous Banana and Plantain petals extract on the body weight of Female Wistar albino rats

The administration of banana and plantain petal extracts produced a non-significant ($p>0.05$) increase in the mean initial, final and overall body weight of female Wistar albino rats, as shown in Tables 1 and 2, respectively. This suggests that treatment with the extracts did not exert a statistically significant effect on body weight when compared with the control group.

3.2 Effect of Aqueous Banana petals extract on Liver Function parameters of Female Wistar albino rats

The effect of Banana petal extracts on the liver enzymes (AST, ALT, ALP) and total protein levels in female Wistar albino rats, as presented in table 5, revealed no significant changes ($p>0.05$) in these parameters across the treatment groups when compared with the control. However a significant change was observed ($p<0.05$) was observed in the ALT activity of rats administered with 0.5ml and 0.1ml of the extract relative to the control group.

Similarly, the effect of the aqueous extract of banana petals on total bilirubin, direct bilirubin, conjugated bilirubin and albumin levels in female Wistar rats, as shown in Table 6, indicated no significant alterations ($p>0.05$) in these biochemical parameter.

3.3 Effect of Aqueous Plantain petals extract on Liver Function parameters of Female Wistar albino rats.

The effect of Plantain petal extracts on the liver enzymes (AST, ALT, ALP) and total protein levels in female Wistar albino rats, as presented in table 3, revealed no significant changes ($p>0.05$) in these parameters across the treatment groups when compared with the control. However a significant change was observed ($p<0.05$) was observed in the AST activity of rats administered with 0.5ml of the extract relative to the control group.

Similarly, the effect of the aqueous extract of plantain petals on total bilirubin, direct bilirubin, conjugated bilirubin and albumin levels in female Wistar rats, as shown in Table 4, indicated no significant alterations ($p>0.05$) in these biochemical parameters, except for the direct bilirubin levels in rats administered with 2.0ml of the extract, which showed a significant difference ($p<0,05$) compared with the control.

Table 1: Effect of Aqueous Banana petals extract on the body weight of Female Wistar albino rats.

Test groups	Mean Initial Body Weight (g)	Mean Final Body Weight (g)	Change in Body weight(g)
Control	99.4±2.25	136.2±10.54	36.8±11.19
0.5ml	107.2±4.92 ^a	146±2.92 ^a	38.8±6.48 ^a
1.0ml	107.8±2.73 ^a	134±9.81 ^a	29±6.66 ^a
2.0ml	110.2±3.44 ^a	157.4±8.86 ^a	47.2±9.11 ^a

Table 1 presents the effect of aqueous banana petal extract on the body weight of female Wistar albino rats. The results show that administration of the extract led to an increase in body weight across all treatment groups when compared with their initial body weights.

Although there was an increase in mean body weight in all groups, the changes observed were not statistically significant ($p>0.05$) when compared with the control group. The control group had a mean initial body weight of 99.4 ± 2.25 g and a mean final body weight of 136.2 ± 10.54 g, corresponding to a change of 36.8 ± 11.19 g

Rats administered 0.5ml, 1.0ml and 2.0ml of the extract recorded mean changes in body weight of 38.8 ± 6.48 g, 29.6 ± 6.63 g, and 47.2 ± 9.11 g, respectively. Among the treated groups, rats given 2.0ml of the extract showed the highest increase in body weight, though the difference was not significant compared to the control.

This indicates that the aqueous extract of banana petals did not exert any adverse effect on body weight and may possess mild nutritive properties that support normal growth and weight gain in female Wistar albino rats.

Table 2: Effect of Aqueous Plantain petals extract on the body weight of Female Wistar Albino Rats.

Test groups	Mean Initial Body Weight (g)	Mean Final Body Weight (g)	Change in Body weight(g)
Control	99.4 ± 2.25	136.2 ± 10.54	36.8 ± 11.19
0.5ml	104 ± 5.99^a	152.8 ± 9.44^a	48.8 ± 8.35^a
1.0ml	107.2 ± 4.33^a	133.6 ± 13.51^a	32.4 ± 11.77^a

2.0ml	95.6±5.12 ^a	153.2±10.87 ^a	57.6±15.58 ^a
-------	------------------------	--------------------------	-------------------------

Table 2 presents the effect of aqueous Plantain petal extract on the body weight of female Wistar albino rats. The results show that administration of the extract led to an increase in body weight across all treatment groups when compared with their initial body weights, with an exception of the mean initial body weight of the rats that was administered 2.0ml of the extract, which shows a reduction in mean initial body weight relative to the control group.

Although there was an increase in mean body weight in all groups, the changes observed were not statistically significant ($p>0.05$) when compared with the control group. The control group had a mean initial body weight of 99.4 ± 2.25 g and a mean final body weight of 136.2 ± 10.54 g, corresponding to a change of 36.8 ± 11.19 g

Rats administered 0.5ml, 1.0ml and 2.0ml of the extract recorded mean changes in body weight of 38.8 ± 6.48 g, 29.6 ± 6.63 g, and 47.2 ± 9.11 g, respectively. Among the treated groups, rats given 2.0ml of the extract showed the highest increase in body weight, though the difference was not significant compared to the control

This indicates that the aqueous extract of banana petals did not exert any adverse effect on body weight and may possess mild nutritive properties that support normal growth and weight gain in female Wistar albino rats.

Table 3: Effect of Aqueous Banana petals extract on ALT, AST, ALP and Total Protein activities in Female Wistar albino rats

Test groups	Alanine Transaminase (ALT) (U/L)	Aspartate Aminotransferase (AST) (U/L)	Alkaline Phosphatase (ALP) (U/L)	Total protein (g/l)
Control	116.45±14.12	120.41 ± 10.48	67.46 ± 1.27	3.79 ± 0.13
0.5ml	74.52 ± 9.62 ^b	121.68 ± 8.66 ^a	69.34 ± 1.36 ^a	3.97±0.26 ^a
1.0ml	68.29 ± 6.23 ^b	100.74 ± 9.08 ^a	68.62 ± 0.39 ^a	3.85±0.22 ^a
2.0ml	93.42 ± 11.06 ^a	92.6 ± 9.39 ^a	68.17 ± 0.48 ^a	3.67±0.19 ^a

Table 3: The effect of Banana petal extracts on the liver enzymes (AST,ALT,ALP) and total protein levels in female Wistar albino rats revealed no significant changes ($p>0.05$) in these parameters across the treatment groups when compared with the control. However, a significant change ($p<0.05$) was observed in the ALT activity of rats administered with 0.5ml and 1.0ml of the extract relative to the control groups.

Table 4: Effect of Aqueous Banana petals extract on total protein, total bilirubin, direct bilirubin and albumin activities in Female Wistar albino rats.

Test groups	Total Bilirubin (mg/dl)	Direct Bilirubin (mg/dl)	Conjugated Bilirubin (mg/dl)	Albumin (g/l)
Control	0.79 ± 0.1	0.24 ± 0.01	0.55±0.09	0.75 ± 0.07
0.5ml	1.3 ± 0.11 ^b	0.23 ± 0.03 ^a	1±0.13 ^b	2 ± 0.17 ^b
1.0ml	1.13 ± 0.03 ^b	0.31 ± 0.02 ^a	0.81±0.04 ^a	1.98 ± 0.15 ^b

2.0ml	1.08 ± 0.03 ^a	0.32 ± 0.05 ^a	0.75±0.07 ^a	1.52 ± 0.07 ^b
-------	--------------------------	--------------------------	------------------------	--------------------------

Table 4: The aqueous banana petals extract caused a mild increase in bilirubin levels but significantly ($p<0.05$) elevated albumin concentration in a dose-dependent manner, indicating a possible hepatoprotective and protein enhancing effect on female Wistar albino rats.

Table 5: Effect of Aqueous Plantain petals extract on ALT, AST, ALP and Total Protein activities in Female Wistar albino rats.

Test groups	Alanine Transaminase (ALT) (U/L)	Aspartate Aminotransferase (AST) (U/L)	Alkaline Phosphatase (ALP) (U/L)	Total protein (g/l)
Control	116.45±14.12	120.41 ± 10.48	67.46 ± 1.27	3.79 ± 0.13
0.5ml	80.04 ± 10.54 ^a	90.27 ± 3.37 ^b	68.17 ± 0.53 ^a	3.42 ± 0.27 ^a
1.0ml	98.53 ± 12.44 ^a	113.08 ± 6.77 ^a	68.83 ± 0.5 ^a	3.76 ± 0.24 ^a
2.0ml	112.49 ± 17.64 ^a	112.84 ± 4.78 ^a	68.98 ± 1.05 ^a	3.56±0.32 ^a

Table 5: The effect of Plantain petal extracts on the liver enzymes (AST,ALT,ALP) and total protein levels in female Wistar albino rats revealed no significant changes ($p>0.05$) in these parameters across the treatment groups when compared with the control. However, a significant decrease ($p<0.05$) was observed in the AST activity of rats administered with 0.5ml of the extract relative to the control groups.

Table 6: Effect of Aqueous Plantain petals extract on total protein, total bilirubin, direct bilirubin and albumin activities in Female Wistar albino rats.

Test groups	Total Bilirubin (mg/dl)	Direct Bilirubin (mg/dl)	Conjugated Bilirubin (mg/dl)	Albumin (g/l)
Control	0.79 ± 0.1	0.24 ± 0.01	0.55±0.09	0.75 ± 0.07
0.5ml	1.1 ± 0.06 ^a	0.3 ± 0.02 ^a	0.8±0.07 ^a	1.88 ± 0.18 ^b
1.0ml	1.04 ± 0.05 ^a	0.36 ± 0.03 ^a	0.68±0.05 ^a	1.15 ± 0.06 ^a
2.0ml	1.03 ± 0.17 ^a	0.42 ± 0.05 ^b	0.61±0.14 ^a	1.2 ± 0.11 ^a

Table 6: The effect of Plantain petal extracts on the total bilirubin, direct bilirubin, conjugated bilirubin and albumin levels in female Wistar albino rats revealed no significant changes ($p>0.05$) in these parameters across the treatment groups when compared with the control. However, a significant change ($p<0.05$) was observed in the direct bilirubin and albumin activity of rats administered with 2.0ml and 0.5ml respectively of the extract relative to the control groups.

CHAPTER FOUR

DISCUSSION

This study examined the effect of aqueous banana and plantain extract on the liver function in female Wistar albino rats. The study lasted for 28 days and liver function parameters; Alanine Aminotransferase (ALT), alkaline Phosphatase (ALP), Aspartate Aminotransferase (AST), bilirubin, total protein and albumin were analysed.

An alteration in the membrane integrity of the liver will cause an increase in the release of liver cell enzymes such as ALT, ALP, AST into the blood stream thereby raising the enzymes levels, these and others are used in the diagnosis of liver injury (Singh *et al.*, 2011). Consequently, an increase in the activities of serum enzymes is considered a vital indicator of liver damage where as elevation in total bilirubin concentrations measures the general function of the liver as this indicates the inability of the liver to excrete bilirubin as bile.

The result obtained from this study largely showed no significant change ($p>0.05$) in Alanine Aminotransferase (ALT), alkaline Phosphatase (ALP), Aspartate Aminotransferase (AST) activities in rats administered 0.5,1.0 and 2.0 ml of the aqueous extract of banana and plantain petals, with the exception of the AST levels of the rat administered with 0.5ml of the aqueous plantain extract and ALT levels of the rats administered with 0.5ml and 1.0ml of the aqueous banana extract, which had a significant decrease ($p<0.05$) of which we can infer from it that there was an improvement of liver function, such decrease often points to hepatoprotective or antioxidant properties of the substance in this case the plantain and banana petals.

The non-significant increase ($p>0.05$) in AST,ALT,ALP activities at the doses mentioned above indicates that the extract did not compromise the integrity of the liver membrane. In other words, the

extracts did not harm neither did it significantly improve the liver function within the duration and dosage of the experiment. This result is in agreement with that reported by Falowoet *al.*, (2021), who showed that the bracts of *Musa spp.* (*Musa acuminata* and *Musa paradisiacalbracts*) were found to contain appreciable amounts of tannins, flavonoids, saponins and phenolics compound commonly associated with antioxidant and hepatoprotective effects.

Bilirubin is a compound that is derived from the breakdown of heme in the body. This breakdown is a necessary process for the removal of waste product that arises from the breakdown of aged red blood cells. The liver is responsible for removal of bilirubin from the blood and excretes it via the bile as the bile pigment. The results of this study showed a significant increase ($p < 0.05$) in total bilirubin levels among rats administered 0.5ml and 1.0ml of the banana petal extracts. Similarly, a significant elevation was observed in conjugated bilirubin at 0.5ml and in serum albumin levels at doses of 0.5ml, 1.0ml, and 2.0ml when compared with the control group. The observed rise in bilirubin concentration could be associated with a reduced ability of the liver to excrete bilirubin or with mild obstruction of bile ducts. This finding may suggest a minor, non-significant alteration in hepatic function or structural integrity.

Also, the total protein concentration showed a non-significant change ($p > 0.05$) in the groups that was administered with 0.5ml, 1.0ml and 2.0ml of both the banana and plantain petals. The non-significant change in protein concentration and enzyme activities of AST, ALT and ALP as seen in this study is indicative that the extract did not compromise the liver.

Albumin is synthesized in the liver and therefore serves as a reliable biomarker for detecting hepatic dysfunction. A reduction in albumin concentration typically indicates hepatotoxicity. In this study, the rats treated with 0.5ml, 1.0ml, and 2.0ml of the banana petal extract, as well as those given 0.5ml of the plantain extract, exhibited a significant change ($p < 0.05$) in serum albumin levels.

The findings of this study revealed a significant change ($p < 0.05$) in serum albumin levels compared to the control group, suggesting that the extract did not impair hepatic function and that liver integrity was maintained.

4.1 CONCLUSION

In conclusion the extract of banana and plantain petals that was administered on the experimental animals shows no negative effect on the liver.

REFERENCES

- Adeleke, T., Akinwle, A., Adeleye, O., and Ogunbanjo, R. (2021). 'Extractive value, Phytochemical screening and antioxidant properties of plantain (*Musa paradisiacal*) flower extracts'. *Bulletin of National Research Centre*, **45**(86):1-7. <https://www.researchgate.net/publication/363195261>
- Amacher, D.E., and Schomaker, S.J., (2020). ' Drug-induced liver injury: A review of established and new biomarkers'. *Toxicology Letters*. 148-156.
- Debnath, B. and Manna, K., (2022). 'Phytochemicals and nutrient profiles, antioxidant activity study of three edible parts (flower, fruit and stem) of *Musa paradisiacal*.' *Current Biotechnology*, **8**(1): 9-18. <https://www.benthamscience.com/article/97370>
- Divya, R.S., Venkatalakshmi P., Vadivel V., and Brindha P., (2016). In vitro studies of the biological activities of flowers of banana (*Musa Paradisiaca L*). *J Scholar Res Lib*, **8**(10):238-46.
- Divya, R.S., Venkatalakshmi, P., Vadivel, V., and Brindha, P., (2016). In vitro studies on the biological activities of flowers of banana (*Musa Paradisiaca L*). *Der Pharmacia Lettre*, **8**(10): 238-246.
- Eddie-Amadi, B.F., Ezejiolor, A.N., Orish, C.N., Rovira, J., Allison, T.A., and Orisakwe, O.E., (2022). Banana peel ameliorated hepato-renal damage and exerted anti-inflammatory and anti-apoptotic effects in metal mixture mediated hepatic nephropathy in female albino rats. *Food and Chemical Toxicology*, **170**:113471. <https://doi.org/10.1016/j.fct.2022.113471>

- Edenta, C., James, D.B., Owolabi, O.A., and Okoduwa, S.I.R., (2014). Hypolipidemic effects of aqueous extract of three cultivars of *Musa sapientum* of fruit peel on poloxamer-407 induced hyperlipidemic Wistar rats. *International Journal of Pharmaceutical Sciences and Research*, **5**(3):1046-1051.
- Elaveniya, E., and Jayamuthunagai, J. Functional physicochemical and antioxidant properties of dehydrated banana blossom powder and its incorporation in biscuits. *Int J Chem Tech Res* **6**:4446-54.
- Falowo, T.T., Ejidike, I. P., Lajide, L., and Clayton, H.S. (2021). Polyphenolic Content of *Musa Acuminata* and *Musa Paradisiaca* bracts: Chemical Composition, Antioxidant and Antimicrobial Potentials. *Biomed Pharmacol J*, **14**(4):1767-1780.
<https://doi.org/10.13005/bpj/2276>
- Festing, M.F.W., (2010). Inbred strains of rats and their characteristics. *Journal of Experimental Animal Science*, **43**(4):235-249.
- Garcia Moreira, V., Garcia Gil, D., Fernandez Fernandez, M., and Bermejo Barrera, A. (2018). Overestimation of albumin measured by bromocresol green vs bromocresol purple method: Influence of acute-phase globulins, *Laboratory Medicine*, **49**(4): 355-361.
<https://doi.org/10.1093/labmed/lmy015>
- Golani, P., Sharma, V., and Shukla, K.V. (2019). Traditional and medicinal effect of banana blossom. *Int J Sci Dev Res* **4**:377-81.

- Govindaraj, J., Govindaraj, K., Vidyarekha, U., and Bhuminathan, S.,(2022). A review on the therapeutic potential of Banana flower.*Bioinformation***18**:349-53.
- Imam, M.Z., and Akter, S.,(2011). *Musa pradiasiaca L. and Musa sapientum L*: A phytochemical and pharmacological review, *Journal of Applied Pharmaceutical Science*, **1**(5):14-20.
- Kavya, M.H., Manasa, R., Deepika, M., Mahesh,Shivananjappa, Shekhara Naik, R., (2023). A review on banana flower: Nutritional composition, processed products and health benefits. *IPJournal of Nutrition, Metabolism and Health Science*,**6**(3):110-115.
- Komal, D., and Kaur, P., (2019). Development of value added product and evaluation of banana blossom incorporated nut chocolate.International. *Journal of Trend in Scientific Research andDevelopment*,**3**(5): 1930-1931.<https://doi.org/10.31142/ijtsrd26383>
- Kumar, S., Kumar, V., Rana, M., Kumar, D.,(2012). Enzyme inhibitors from plants: An alternate approach to treat diabetes. *Pharmacognosy Communications*,**2**(1):18-33.<https://doi.org/10.5530/pc.2012.1.5>.
- Latha Rani, M., Indumathy, V., Vinodhini, M., Krishnaaveni, D., Reena, J., Sudarvizhi, M, and Rajarajeswari, S.,(2022).Therapeutic value of selected traditional flowers – a review, *Journal of Pharmaceutical Negative Results*, **13**(7):6496-6511.
<https://doi.org/10.47750/pnr.2022.13.S07.790>
- Lisi, D.M. (2016).Understanding liver function tests.*US Pharmacist*; **41**(12):30-34.
- Low, E.X.S., Zheng, Q., Chan, E., and Lim, S.G., (2019). Drug induced liver injury: East versus West- a systematic review and meta-analysis. *Clinical and Molecular Hepatology*,**26**(2):142-154.
<https://doi.org/10.3350/cmh.2019.1003>

Madrigal-Santillan, E., Madrigal-Bujaidar, E., Alvarez-Gonzalez, I., sumaya-Martinez, M.T.,

Gutierrez-Salinas. J., Bautista, M., and Morales-Gonzalez, J.A., (2014). Review of natural products with hepatoprotective effects. *World Journal of Gastroenterology*, **20**(40):14787-14804.

Mao, W., Cairns, B., Vander Hyden, B., and Harrigan, S, (2022). Sexual dimorphism in the expression of cytochrome P450 enzymes in rat heart, liver, kidney, lung, brain, and small intestine. *Pharmacology and Experimental Therapeutics*, **381**(1):101.

<https://doi.org/10.1124/pet.122.101123>

Marikkar, J.M.N., Tan, S.J., Salleh, A., Azrina, A., and Shukri, M.A.M. (2016). Evaluation of banana (*Musa sp.*) flowers of selected varieties for their antioxidative and antihyperglycemic potentials. *International Food Research Journal*, **23**(5): 1987-1993

Mousa, K.A., Samsudin, N.I.P., Abas, F. and Rakayadi, Y., (2023). Phytochemical constituents

analysis of ethanolic extract of *Musa paradisiacal L.* flower using GC-MS and LC-MS. *Chelonian Conservation & Biology*, **18**(2):376-395.

<https://www.acgpublishing.com/index.php/CCB/article/view/35>

Narzary, P. and Sharma, D. (2022). Therapeutic potential of *Musa Balbisiana Colla* as a super food: A review. *Indian J Natural Sciences*, **13**(73):45572-45580.

Onyema, O. O., Ojo. O.A. and Akintunde, J.K., (2019). Ethanolic extract of whole unripe plantain (*Musa paradisiacal L.*) ameliorates carbon tetrachloride-induced hepatotoxicity and nephrotoxicity in Wistar rats. *Journal of Food Biochemistry*, **43**(8), e12947.

<https://doi.org/10.1111/jfbc.12947>

Pan, Y., Cao, M., You, D., Qin, G. and Liu, Z., (2019). Research progress on the animal models of drug-induced liver injury: current status and further perspectives. *BioMed Research International*. Article ID 1283824. <https://doi.org/10.1155/2019/1283824>

Pereira, A. and Maraschin, M., (2015). Banana (*Musa spp.*) from peel to pulp:

Ethnopharmacology, source of bioactive compounds and its relevance for human health. *Journal of Ethnopharmacology*,**160**:149-163.

Ramu, R., Prithvi, S., Shirahatti, P.S., Anilakumar, K.R., ShivasharanappaNayakavadi,B.L., Zameer, F., Dhananjaya, M.N., and Negendra, P.,(2017). Assessment of nutritional quality and global antioxidant response of banana (*cv. Nanjangud Rasa Bale*) pseudostem and flower. *Pharmacognosy Research*,**9(1)**:S74-S83.

https://doi.org/10.4103/pr.pr_20_17

Ramu, R., Shirahatti, P.S., Zameer, F., Lakkapa, D.B.,and Nagendra,M.N.,(2015). Evaluation of banana (*Musa sp. Var. Nanjangud rasa bale*) flower and pseudostem extracts on antimicrobial, cytotoxicity and thrombolytic activities. *International Journal of Pharmacy and pharmaceutical Sciences*,**7(1)**:136-140.

Saktawat, R., Rawat, P., Sharma, S. and Singh, S. (2024). Direct and total bilirubin estimation by modified Jendrassik and Grof's method, *The Pharmaceutical and Chemical Journal*, **11(2)**: 96-109.

<https://tpcj.org/download/vol-11-iss-2-2024/TPCJ2024-11-02-96-109>.

Salvador, I.F.(2018). Consumer acceptability of banana blossom sisig. *UNEJ e-Proceeding* :336-350.

Sanni, O.L., Ajiboye, T.O. and Adetutu, A., (2014). Protective effect of aqueous extract of *Carica papaya* leaves against carbon tetrachloride induced hepatotoxicity in rats. *World Journal of Pharmaceutical Research*,**3**(7):1546-1555.

https://wjpr.s3.ap-south-1.amazonaws.com/article_issue/1409891857

Schumann, G., Klauke, R., Canalias, F., Bossert-Reuther, S., Franck, P.F.H., Gella, F.J., Jorgensen, P.J., Kang, D., Lessinger, J.M., Panteghini, M., and Ceriotti, F., (2011). IFCC primary reference procedures for the measurement of catalytic activity concentrations of enzymes at 37°C. Part 9: Reference procedure for the measurement of catalytic concentration of alkaline phosphatase. *Clinical Chemistry and Laboratory Medicine*,**49**(9):1439-1446. <https://doi.org/10.1515/CCLM.2011.621>

Sheng ZW, Ma WH, Jin ZQ Bi Y, Sun ZQ Dou HT Han LN, (2010). Investigation of dietary fiber, protein, vitamin E, and other nutritional compounds of banana flower of two cultivars grown in China. *Afr. J. Biotechnology*.**9**(25): 3888-3895.

Singal, A. K., Bataller, R., Ahn, J., Kamath, P.S., and Shah, V.H., (2018). ACG clinical guideline: Alcoholic liver disease. *American Journal of Gastroenterology*,**113**(2):175-194.

Singh S. (2017). Banana blossom: An understated food with high functional benefits. *International Journal of Current Research*.**9**:44516-9.

Tasnim, T., Das, P.C., Begum, A.A., Nupur, A.H. and Mazumder, M.A.R., (2020). Nutritional,

textural and sensory quality of plain cake enriched with rice rinsed water treated banana blossom flour. *Journal of Agriculture and Food Research*. **2**:100071.

Thaweesang, S. (2019). Antioxidant activity and total phenolic compounds of fresh and blanched banana blossom (Musa ABB cv. Kluai Namwa) in Thailand. *IOP Conference Series: Material Science and Engineering*. **639**(1): 012047. IOP publishing.

Vijay, N., Shashikant, D. and Mohini, P., (2022). Assessment of antidiabetic potential of *Musa acuminata* peel extract and its fractions in experimental animals and characterization of its bioactive compounds by HPTLC. *Archives of Physiology and Biochemistry*, **128**(2):360-372.

Vilhena, H., Kurebayashi, A., Barros, A., de Almeida, V., and Oliveira, J, (2020). Antidiabetic and antioxidant effects of aqueous and methanolic flower/bract extracts of *Musa paradisiacal* in STZ-induced diabetic rats. *Bulletin of National Research Centre*, **44**(130):1-9.

<https://bnrc.springeropen.com/articles/10.1186/s42269-021-00549-3>

APPENDIX

**PLANTAIN
Descriptives**

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Prot	A	5	3.7907	0.2813	0.1258	3.4414	4.1400	3.5099	4.2567
	B	5	3.5577	0.7182	0.3212	2.6659	4.4494	2.5689	4.4807
	C	5	3.7608	0.5387	0.2409	3.0920	4.4297	3.0320	4.3164
	D	5	3.4203	0.5956	0.2663	2.6808	4.1598	2.4196	3.8684
	Total	20	3.6324	0.5341	0.1194	3.3824	3.8823	2.4196	4.4807
ALB	A	5	0.7545	0.1584	0.0708	0.5578	0.9512	0.5203	0.9593
	B	5	1.1951	0.2365	0.1058	0.9014	1.4888	0.8780	1.4228
	C	5	1.1480	0.1426	0.0638	0.9709	1.3250	0.9268	1.3252
	D	5	1.8780	0.4027	0.1801	1.3781	2.3780	1.3333	2.3089
	Total	20	1.2439	0.4769	0.1066	1.0207	1.4671	0.5203	2.3089
ALT	A	5	116.4497	31.5829	14.1243	77.2343	155.6651	91.3217	171.0100
	B	5	112.4943	39.4390	17.6376	63.5244	161.4643	49.4417	155.3050
	C	5	98.5343	27.8065	12.4354	64.0080	133.0606	78.5250	147.1617
	D	5	80.0373	23.5722	10.5418	50.7686	109.3061	45.9517	106.4450
	Total	20	101.8789	32.1127	7.1806	86.8497	116.9081	45.9517	171.0100
AST	A	5	120.4050	23.4369	10.4813	91.3042	149.5058	87.2500	142.5083
	B	5	112.8433	10.6938	4.7824	99.5652	126.1215	98.8833	124.4767
	C	5	113.0760	15.1490	6.7749	94.2660	131.8860	100.0467	136.6917
	D	5	90.2747	7.5437	3.3737	80.9079	99.6415	84.3417	102.3733
	Total	20	109.1	18.2961	4.0911	100.58	117.71	84.3	142.50

			498			69	26	417	83
ALP	A	5	67.45 51	2.8435	1.2717	63.924 4	70.985 8	64.3 713	71.107 8
	B	5	68.98 20	2.3537	1.0526	66.059 6	71.904 5	66.3 174	72.604 8
	C	5	68.83 23	1.1072	0.4951	67.457 6	70.207 1	66.9 162	69.610 8
	D	5	68.17 37	1.1768	0.5263	66.712 4	69.634 9	66.4 671	69.760 5
	Total	20	68.36 08	1.9502	0.4361	67.448 1	69.273 5	64.3 713	72.604 8
TBil	A	5	0.788 8	0.212513	0.0950 39	0.5249 3	1.0526 7	0.58	1.073
	B	5	1.026 6	0.379557	0.1697 43	0.5553 2	1.4978 8	0.60 9	1.45
	C	5	1.038 2	0.10928	0.0488 72	0.9025 1	1.1738 9	0.92 8	1.218
	D	5	1.102	0.137559	0.0615 18	0.9312	1.2728	0.92 8	1.247
	Total	20	0.988 9	0.24749	0.0553 4	0.8730 7	1.1047 3	0.58	1.45
DBil	A	5	0.236	0.01673	0.0074 8	0.2152	0.2568	0.22	0.26
	B	5	0.416	0.1161	0.0519 2	0.2718	0.5602	0.32	0.6
	C	5	0.356	0.07797	0.0348 7	0.2592	0.4528	0.28	0.46
	D	5	0.3	0.05099	0.0228	0.2367	0.3633	0.24	0.36
	Total	20	0.327	0.09696	0.0216 8	0.2816	0.3724	0.22	0.6
Con.BIL	A	5	0.552 8	0.2096	0.0937 4	0.2925	0.8131	0.34	0.81
	B	5	0.610 6	0.30929	0.1383 2	0.2266	0.9946	0.29	1
	C	5	0.682 2	0.11593	0.0518 5	0.5383	0.8261	0.58	0.86
	D	5	0.802	0.14769	0.0660 5	0.6186	0.9854	0.59	0.95
	Total	20	0.661 9	0.21426	0.0479 1	0.5616	0.7622	0.29	1

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) SAMP LE	(J) SAMPLE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Prot	A	B	0.2330	0.3521	0.9100	-0.7744	1.2404
		C	0.0299	0.3521	1.0000	-0.9775	1.0372
		D	0.3704	0.3521	0.7220	-0.6370	1.3778
ALB	A	B	-0.4407	0.1623	0.0660	-0.9051	0.0238
		C	-0.3935	0.1623	0.1120	-0.8579	0.0709
		D	-1.123577235800*	0.1623	0.0000	-1.5880	-0.6591
ALT	A	B	3.955333	19.70219	0.997	-52.41303	60.3237
		C	17.91533	19.70219	0.8	-38.45303	74.2837
		D	36.41233	19.70219	0.288	-19.95603	92.7807
AST	A	B	7.561667	9.74704	0.864	-20.32481	35.44814
		C	7.329	9.74704	0.875	-20.55747	35.21547
		D	30.1303333800*	9.74704	0.032	2.24386	58.01681
ALP	A	B	-1.526946	1.274215	0.637	-5.172501	2.118608

		C	- 1.377 246	1.274215	0.706	-5.0228	2.2683 09
		D	- 0.718 563	1.274215	0.941	- 4.3641 17	2.9269 92
TBil	A	B	- 0.237 8	0.148354	0.405	- 0.6622 4	0.1866 4
		C	- 0.249 4	0.148354	0.365	- 0.6738 4	0.1750 4
		D	- 0.313 2	0.148354	0.192	- 0.7376 4	0.1112 4
DBil	A	B	- .1800 0*	0.04737	0.008	-0.3155	- 0.0445
		C	-0.12	0.04737	0.092	-0.2555	0.0155
		D	-0.064	0.04737	0.546	-0.1995	0.0715
Con.BIL	A	B	- 0.057 8	0.13223	0.971	-0.4361	0.3205
		C	- 0.129 4	0.13223	0.763	-0.5077	0.2489
		D	- 0.249 2	0.13223	0.273	-0.6275	0.1291

*. The mean difference is significant at the 0.05 level.

BANAN A

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum
--	---	------	-------------------	---------------	-------------------------------------	---------	---------

						Lower Bound	Upper Bound		
Prot	A	5	3.7907	0.2813	0.1258	3.4414	4.1400	3.5099	4.2567
	E	5	3.6712	0.4272	0.1911	3.1407	4.2017	2.9871	4.1372
	F	5	3.8504	0.5013	0.2242	3.2279	4.4729	3.1813	4.3911
	G	5	3.9669	0.5761	0.2576	3.2516	4.6823	3.0917	4.4957
	Total	20	3.8198	0.4357	0.0974	3.6159	4.0237	2.9871	4.4957
ALB	A	5	0.7545	0.1584	0.0708	0.5578	0.9512	0.5203	0.9593
	E	5	1.5171	0.1535	0.0686	1.3265	1.7076	1.3821	1.7642
	F	5	1.9772	0.3321	0.1485	1.5649	2.3895	1.4959	2.3496
	G	5	1.9951	0.3842	0.1718	1.5181	2.4721	1.4959	2.3740
	Total	20	1.5610	0.5757	0.1287	1.2916	1.8304	0.5203	2.3740
ALT	A	5	116.4497	31.5829	14.1243	77.2343	155.6651	91.3217	171.0100
	E	5	93.4157	24.7212	11.0556	62.7203	124.1111	62.2383	131.4567
	F	5	68.2877	13.9333	6.2312	50.9872	85.5882	52.3500	83.1783
	G	5	74.5231	21.5073	9.6184	47.8183	101.2280	43.9740	104.7000
	Total	20	88.1690	29.1144	6.5102	74.5431	101.7950	43.9740	171.0100
AST	A	5	120.4050	23.4369	10.4813	91.3042	149.5058	87.2500	142.5083
	E	5	92.6013	21.0021	9.3924	66.5238	118.6789	63.4017	120.9867
	F	5	100.7447	20.2934	9.0755	75.5471	125.9423	73.2900	130.2933
	G	5	121.6847	19.3591	8.6577	97.6472	145.7222	92.4850	144.8350
	Total	20	108.8589	23.2240	5.1930	97.9898	119.7281	63.4017	144.8350
ALP	A	5	67.4551	2.8435	1.2717	63.9244	70.9858	64.3713	71.1078
	E	5	68.1737	1.0722	0.4795	66.842	69.505	67.21	69.910

						3	0	56	2
	F	5	68.6228	0.8703	0.3892	67.5421	69.7034	67.2156	69.6108
	G	5	69.3413	3.0485	1.3633	65.5561	73.1266	66.3174	74.2515
	Total	20	68.3982	2.1342	0.4772	67.3994	69.3971	64.3713	74.2515
TBil	A	5	0.7888	0.2125	0.0950	0.5249	1.0527	0.5800	1.0730
	E	5	1.0788	0.0692	0.0310	0.9928	1.1648	1.0150	1.1890
	F	5	1.1252	0.0629	0.0281	1.0471	1.2033	1.0730	1.2180
	G	5	1.2992	0.2540	0.1136	0.9838	1.6146	0.9860	1.6530
	Total	20	1.0730	0.2457	0.0549	0.9580	1.1880	0.5800	1.6530
DBil	A	5	0.2360	0.0167	0.0075	0.2152	0.2568	0.2200	0.2600
	E	5	0.3240	0.1152	0.0515	0.1809	0.4671	0.2400	0.5200
	F	5	0.3120	0.0415	0.0186	0.2605	0.3635	0.2800	0.3800
	G	5	0.2320	0.0593	0.0265	0.1583	0.3057	0.1600	0.3200
Con.BIL	A	5	0.5528	0.2096	0.0937	0.2925	0.8131	0.3400	0.8100
	E	5	0.7548	0.1519	0.0679	0.5662	0.9434	0.5200	0.9500
	F	5	0.8132	0.0916	0.0410	0.6994	0.9270	0.7200	0.9400
	G	5	0.9976	0.2881	0.1288	0.6399	1.3553	0.7500	1.4500
	Total	20	0.7796	0.2446	0.0547	0.6651	0.8941	0.3400	1.4500

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) SAMP LE	(J) SAMP LE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound

Prot	A	E	0.119 486	0.290668	0.976	- 0.7121 21	0.9510 93
		F	- 0.059 743	0.290668	0.997	- 0.8913 5	0.7718 64
		G	- 0.176 242	0.290668	0.929	- 1.0078 48	0.6553 65
ALB	A	E	- .7626 01626 000*	0.175071	0.002	- 1.2634 82	- 0.2617 21
		F	- 1.222 76422 7600*	0.175071	0	- 1.7236 45	- 0.7218 84
		G	- 1.240 65040 6600*	0.175071	0	- 1.7415 31	- 0.7397 7
ALT	A	E	23.03 4	15.05098	0.444	- 20.027 15	66.095 15
		F	48.16 19999 9400*	15.05098	0.026	5.1008 48	91.223 15
		G	41.92 653	15.05098	0.058	- 1.1346 19	84.987 69
ALP	A	E	- 0.718 563	1.38875	0.954	- 4.6918 05	3.2546 8
		F	- 1.167 665	1.38875	0.834	- 5.1409 07	2.8055 78
		G	- 1.886 228	1.38875	0.542	- 5.8594 7	2.0870 15
TBil	A	E	-0.29	0.108818	0.072	- 0.6013 3	0.0213 3
		F	- .3364 00*	0.108818	0.032	- 0.6477 3	- 0.0250 7

		G	-.510400*	0.108818	0.001	-0.82173	-0.19907
DBil	A	E	-0.088	0.04336	0.218	-0.2121	0.0361
		F	-0.076	0.04336	0.331	-0.2001	0.0481
		G	0.004	0.04336	1	-0.1201	0.1281
Con.BIL	A	E	-0.202	0.12585	0.404	-0.5621	0.1581
		F	-0.2604	0.12585	0.205	-0.6205	0.0997
		G	-.44480*	0.12585	0.013	-0.8049	-0.0847

*. The mean difference is significant at the 0.05 level.

WEIGHT

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) SAMPLE	(J) SAMPLE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
INITIAL	GROUP A	GROUP B	3.8	6.08229	0.995	-15.4938	23.0938
		GROUP C	-7.8	6.08229	0.854	-27.0938	11.4938
		GROUP D	-4.6	6.08229	0.987	-23.8938	14.6938
		GROUP E	-10.8	6.08229	0.574	-30.0938	8.4938

		GR OUP F	-8.4	6.08229	0.807	- 27.693 8	10.893 8
		GR OUP G	-7.8	6.08229	0.854	- 27.093 8	11.493 8
FINAL	GROU P A	GR OUP B	-17	13.98101	0.882	- 61.349 6	27.349 6
		GR OUP C	2.6	13.98101	1	- 41.749 6	46.949 6
		GR OUP D	- 16.6	13.98101	0.893	- 60.949 6	27.749 6
		GR OUP E	- 21.2	13.98101	0.733	- 65.549 6	23.149 6
		GR OUP F	2.2	13.98101	1	- 42.149 6	46.549 6
		GR OUP G	-9.8	13.98101	0.991	- 54.149 6	34.549 6
		CHANG E	GROU P A	GR OUP B	- 20.8	14.59237	0.784
GR OUP C	4.4			14.59237	1	- 41.888 9	50.688 9
GR OUP D	-12			14.59237	0.981	- 58.288 9	34.288 9
GR OUP E	- 10.4			14.59237	0.991	- 56.688 9	35.888 9
GR OUP F	7.8			14.59237	0.998	- 38.488 9	54.088 9
GR OUP G	-2			14.59237	1	- 48.288 9	44.288 9