Evaluation of Hypoglycaemic Effect of *Withania somnifera, Curcuma longa, Zingiber officinale* and *Cinamomum cassia* on Diabetic mice



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Introduction

- Diabetes is a global epidemic and, according to the International Diabetes Federation, “one of the most challenging health problems in the 21st century.”

- In 2011, diabetes accounted for about 4.6 million deaths worldwide.

- Globally, it is estimated that more than 350 million people suffer from diabetes; this number is expected to jump to over 550 million by 2030, if nothing is done.

- An estimated 280 million people worldwide have an impaired glucose tolerance—a precursor to diabetes.

Introduction

- Diabetes mellitus is a disease associated with hyperglycaemia.

- Diabetes mellitus is a chronic disease, it generates overproduction of free radicals & reactive oxygen species (ROS), which trigger on oxidative stress, enhanced lipid per oxidation, damage to DNA & protein degradation.

- High blood glucose in adults with diabetes increases the risk for heart attack, stroke, angina, and coronary artery disease

Introduction

- The plants used in India has about 45,000 species and several thousands have been claimed to possess medicinal properties.

- The active principles of many plant species are isolated for direct use as drugs, lead compounds or pharmacological agents.

- Traditional plant medicines or herbal formulations might offer a natural key to unlock diabetic complications

Introduction

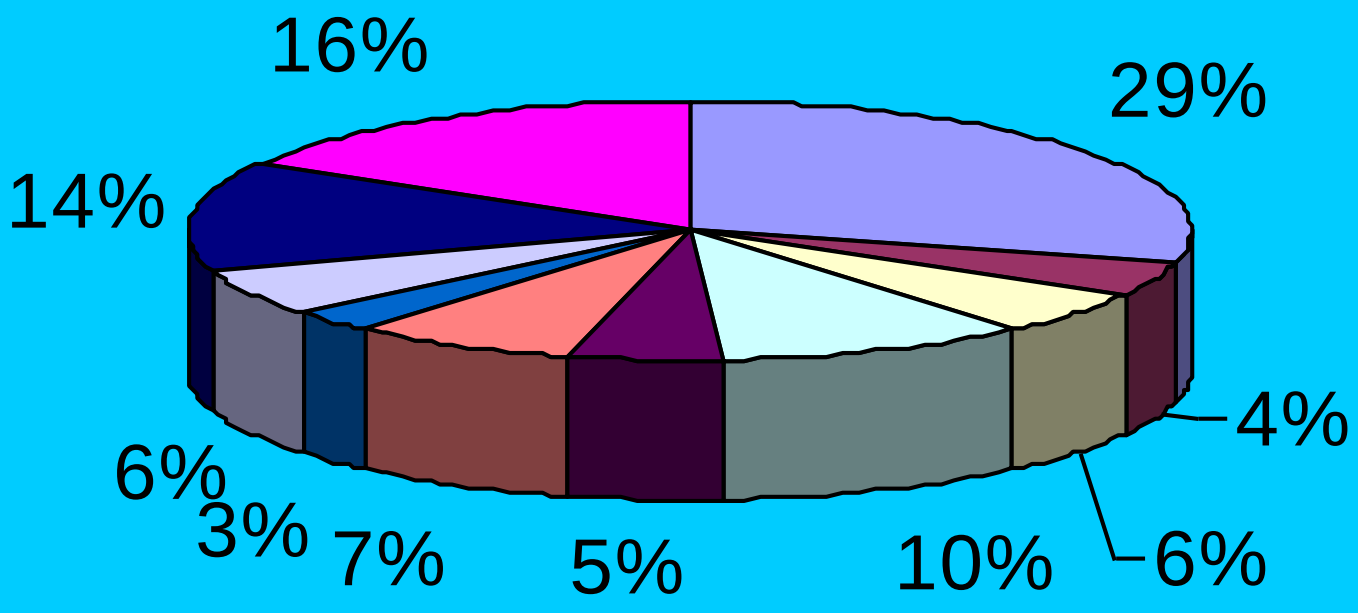
Medicinal Plants :

- World Health Organisation (WHO) estimated that 80% of the population of developing countries rely on traditional medicine mostly plant drugs, for their primary health care needs.

- Medicinal plants being natural, non-narcotic, having no side effect, cost effective, preventive and curative therapies which could be useful in achieving the goal of "Health for all" in a cost effective manner.

- Medicinal plants occupy an important position in the socio-cultural, spiritual and medicinal arena of rural people of India.

Medicinal Plant by their part utilised



Introduction

Ashwagandha (*Withania somnifera*) :





- ***Withania somnifera*** **belongs to the family *Solanaceae*, and is an evergreen shrub, grown wild and also cultivated for medicinal use in many parts of India.**
- **To cure a variety of diseases.**
- **Major Components : Withaferine – A,Withaferine- B & Withanolides.**



Introduction



Health Effect of *Withania somnifera*

- Rejuvenative Effect
- Antioxidant effect
- Immunity boosting herb
- Adaptogenic and anti-stress herb
- Cardiovascular and diabetic protection
- Hypolipidemic effect

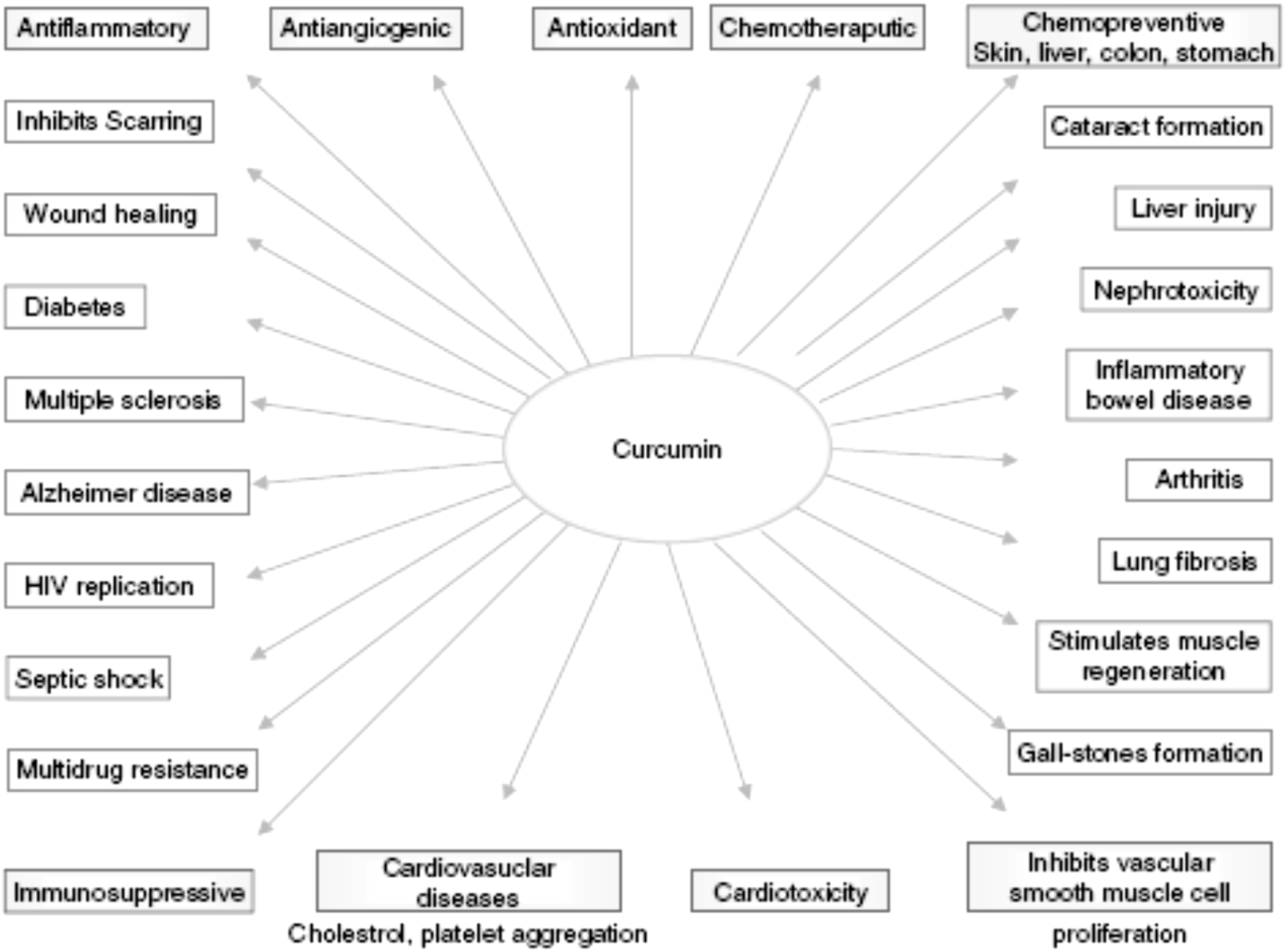
Introduction

Turmeric (*Curcuma longa*) :





- **Turmeric is a plant of the *Gingeberacea* family, native to India and Southeast Asia.**
- **Turmeric is an ancient spice and a traditional remedy that has been used as a medicine, condiment and flavoring.**
- **Curcumin is the main constituent.**


Antiflammatory
Antiangiogenic
Antioxidant
Chemotheraputic
Chemopreventive
Skin, liver, colon, stomach
Inhibits Scarring
Cataract formation
Wound healing
Liver injury
Diabetes
Nephrotoxicity
Multiple sclerosis
Inflammatory bowel disease
Curcumin
Alzheimer disease
Arthritis
HIV replication
Lung fibrosis
Septic shock
Stimulates muscle regeneration
Multidrug resistance
Gall-stones formation
Immunosuppressive
Cardiovasuclar diseases
Cardiotoxicity
Inhibits vascular smooth muscle cell
Cholestrol, platelet aggregation
proliferation

Health Effect of *Zingiber officinale*

- **Digestive issues**: The phenolic compounds in ginger are known to help relieve gastrointestinal irritation, stimulate saliva and bile production and suppress gastric contractions and movement of food and fluids through the GI tract.
- **Nausea**: Chewing raw ginger or drinking ginger tea is a common home remedy for nausea.
- **Pain reduction**:
- Ginger has also been found to reduce the symptoms of dysmenorrhea (severe pain during a menstrual cycle).
- **Inflammation**: Ginger has been used to reduce inflammation and treat inflammatory conditions.

Introduction

- Cinnamon is a traditional herbal medicine to treat various diseases.
- Cinnamon contains polyphenols which are potent antioxidant compounds that can help to reduce the oxidative damage caused by free radicals.
- These polyphenolic components are also reactive oxygen & nitrogen species scavengers, redox- active transitional chelators & enzyme modulators.

Introduction

- The volatile components of cinnamon are broadly classified into monoterpenes, sesquiterpenes and phenylpropenes.

- Cinnamaldehyde (more precisely trans -cinnamaldehyde or 3-phenyl-2- propenal) is the main constituent in cinnamon bark oil.

Introduction

Evidence suggests that cinnamon may be effective in

- Treatment of cancer (Hyeon et al., 2003; Nishida et al., 2003)
- Infectious diseases (Hayashi et al., 2007; Premanathan et al., 2000),
- Anti-inflammatory (Hong et al., 2002; Tung et al., 2008),
- Antioxidant (Su et al., 2007; Murcia et al., 2004; Okawa et al., 2001),
- Hypotensive (Preuss et al., 2006), and
- Cholesterol-lowering effects

Materials and Methods

- Animals: The mice (*Mus musculus*) were reared in our laboratory. The age group of mice selected for the study was 8 weeks old with 30±2 gm. body weight (b.w)
- Chemicals: Alloxan, manufactured by Loba Chem Pvt. Ltd., Mumbai was utilized for the experiment.
- Medicinal plant: Aqueous bark extract of Medicinal Plants is administered orally to diabetic group of mice. It is identified by Dr Ramakant Pandey, Department of Botaney, Patna University, Patna.

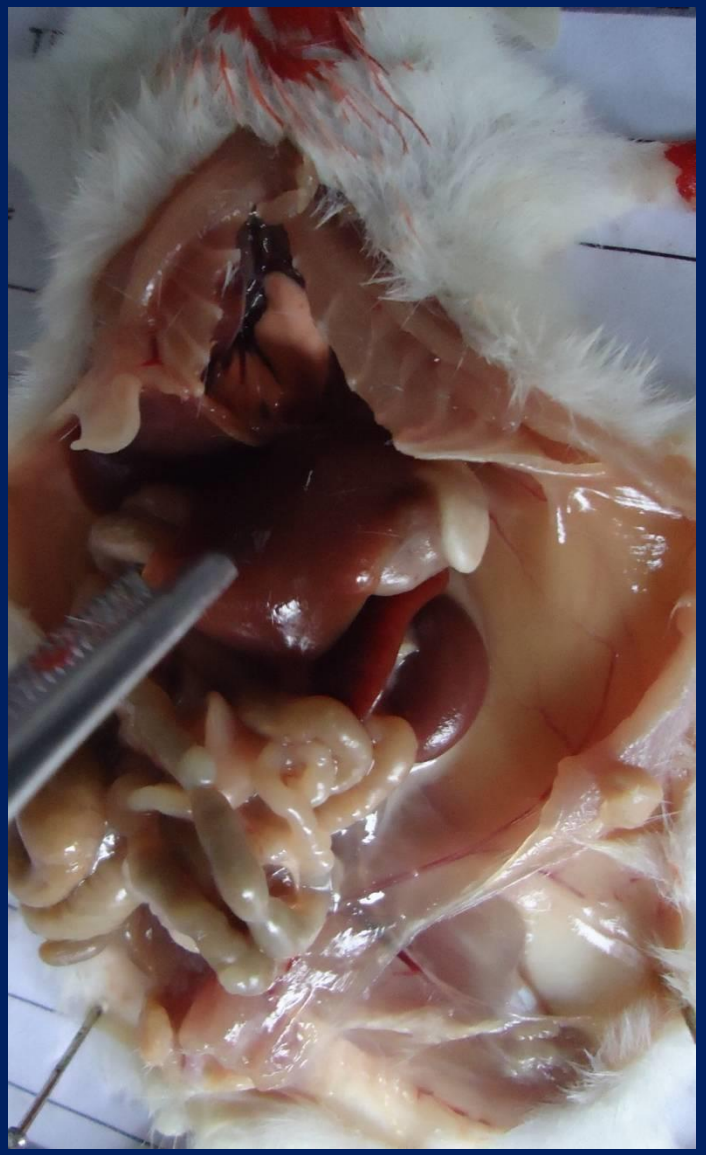
Materials and Methods

- Study groups & sampling: The control group of 6 mice received distilled water orally.
- The 'treatment' groups (n=6) received alloxan 125 mg/kg b.w by intra-peritoneal method once followed by eight weeks administration of aqueous extract of *Withwnia somnifera* (250 mg/kg/b.w/day), *Curcuma longa* (200 mg/kg/b.w/day), *Zingiber officinale* (100 mg/kg/b.w/day), *Cinamomum cassia* (70 mg/kg/b.w/day) orally through Gavage method.
- Serum was collected for urea, uric acid, amylase, lipase, SGPT, lipid per oxidation and glucose estimation.
- The tissue were removed for LM study.

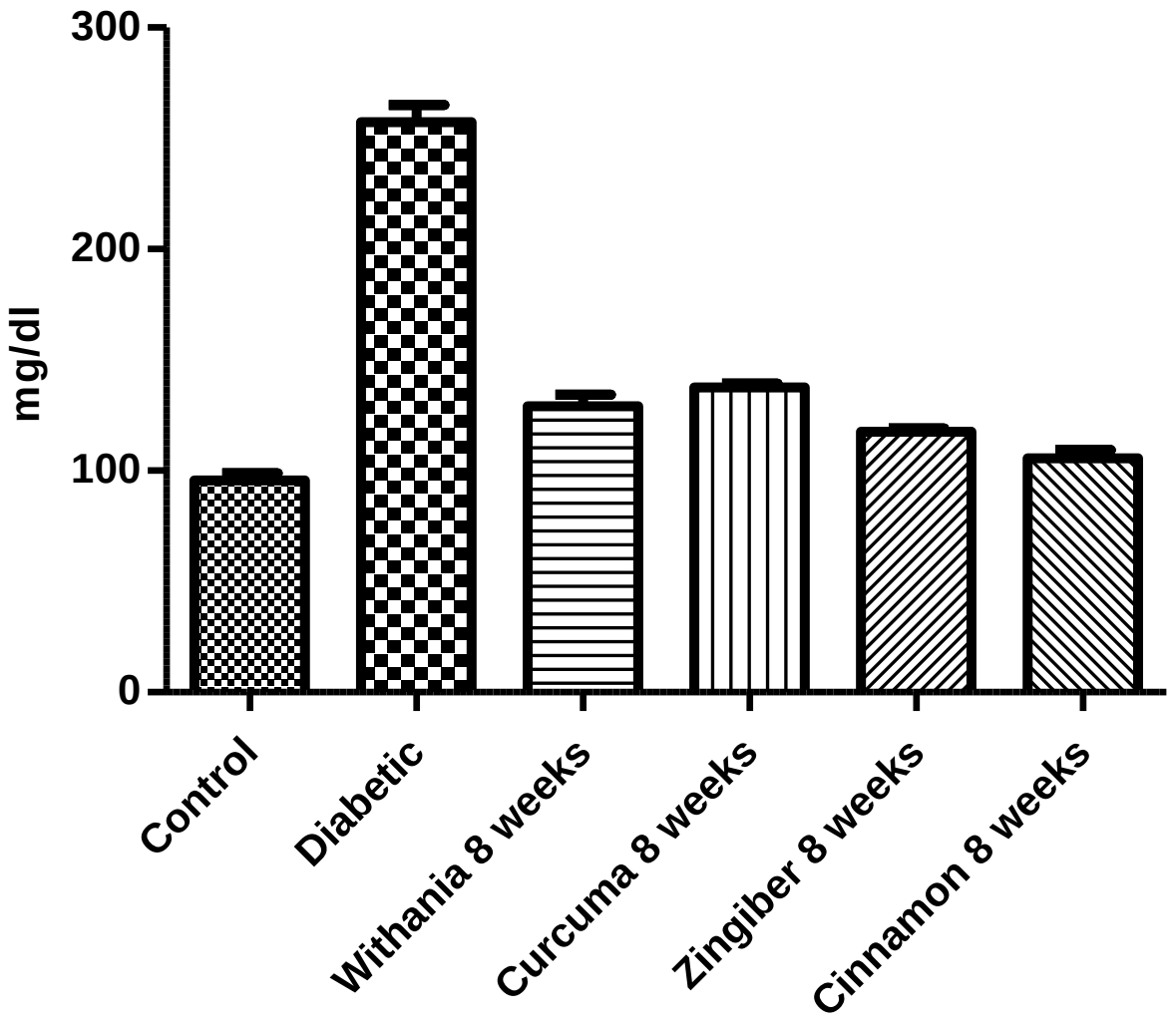
Results

SWISS ALBINO MICE (*Mus musculus*)

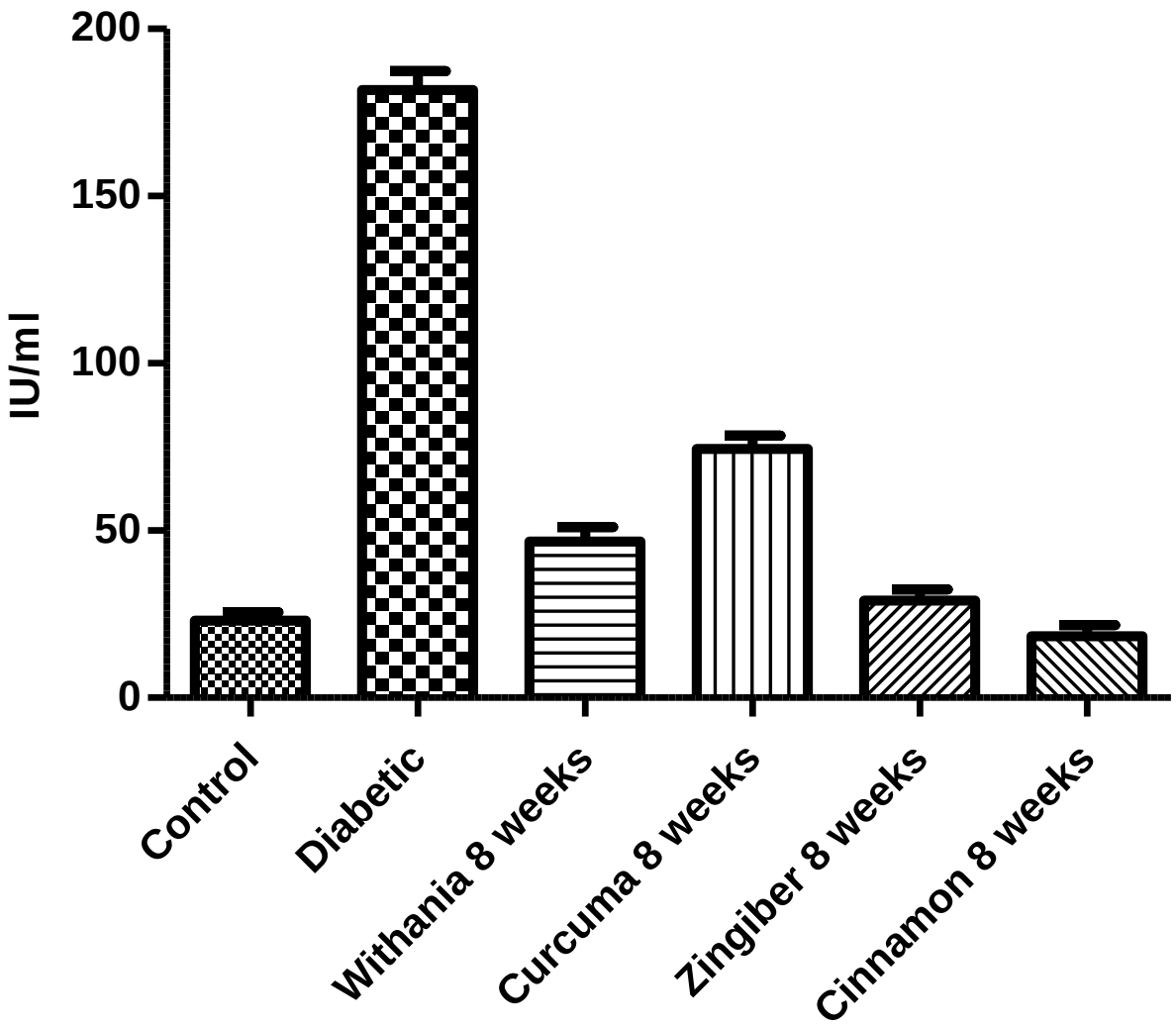




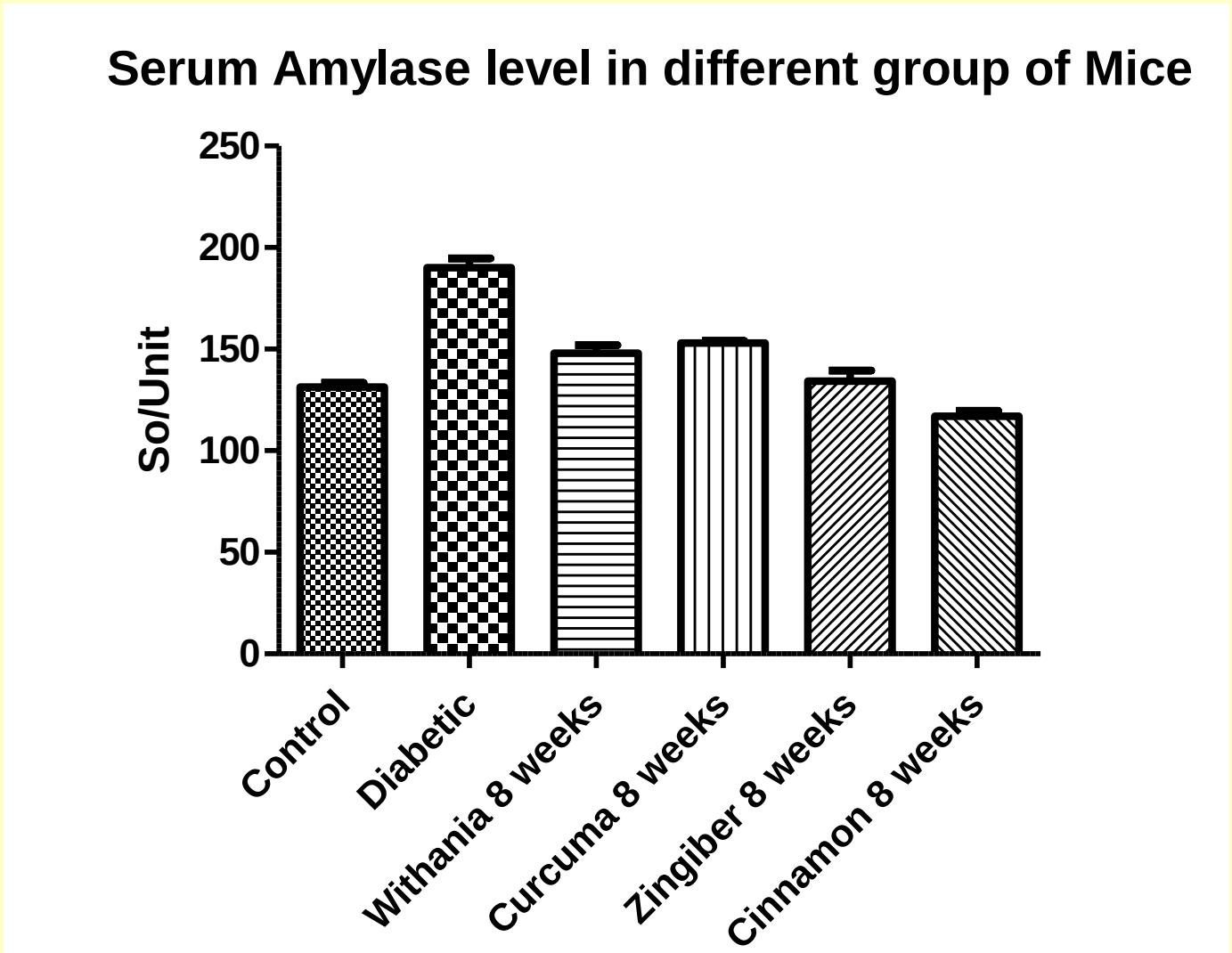
Results


Glucose Level in Different Groups of Mice
mg/dl
300
200
100
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

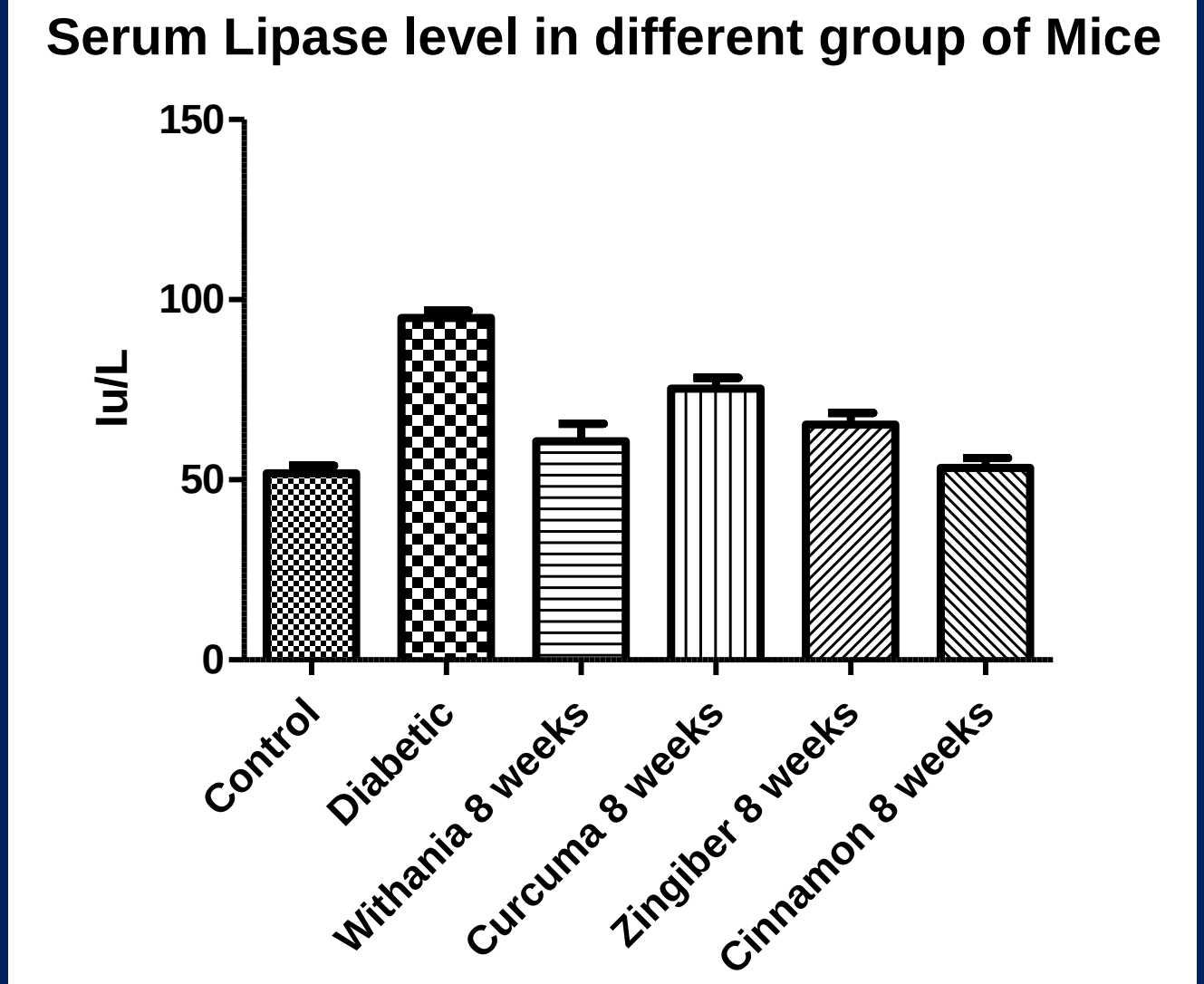
Results


SGPT Level in Different Groups of Mice
IU/ml
200
150
100
50
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

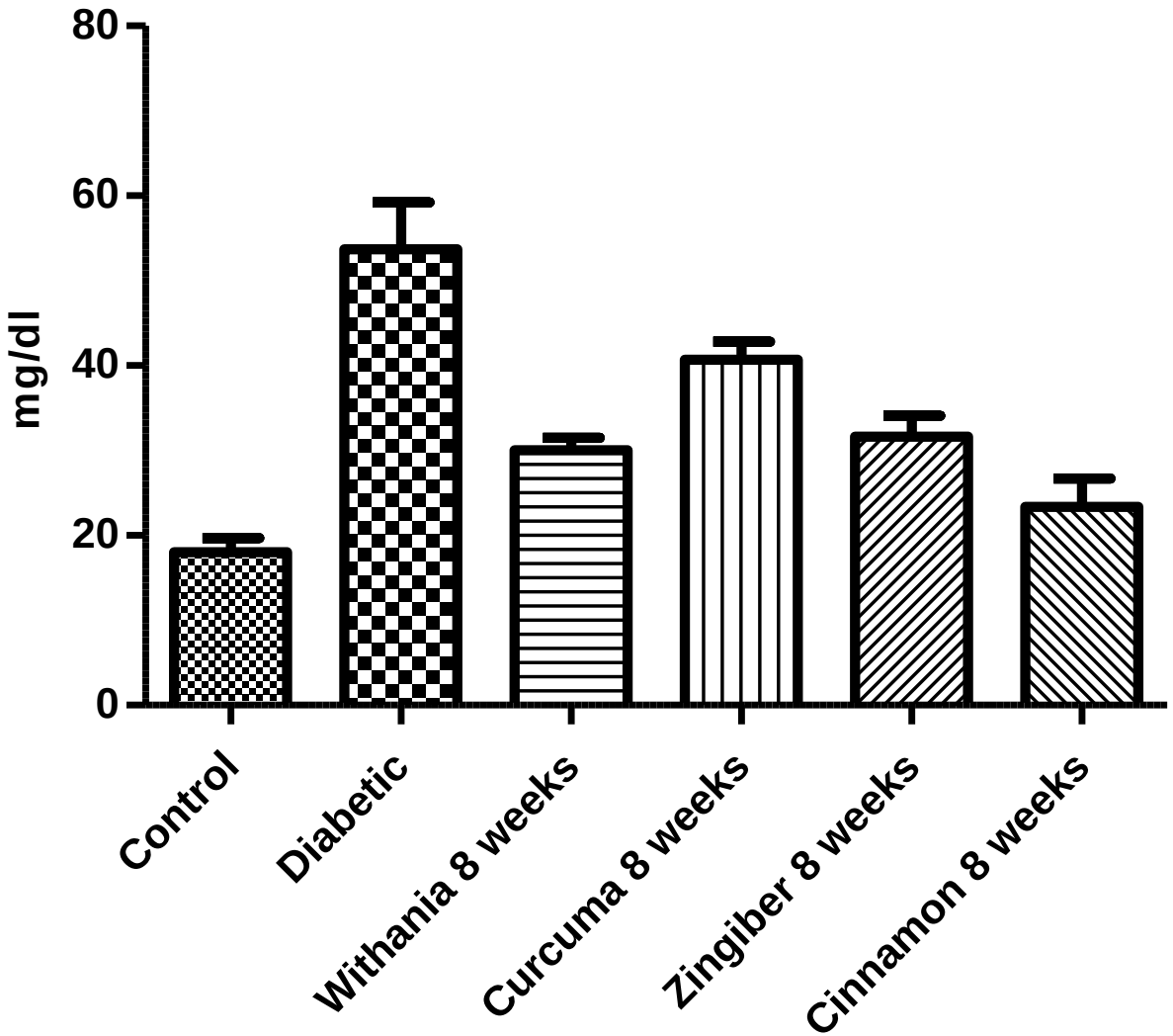
Results


Serum Amylase level in different group of Mice
So/Unit
250
200
150
100
50
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

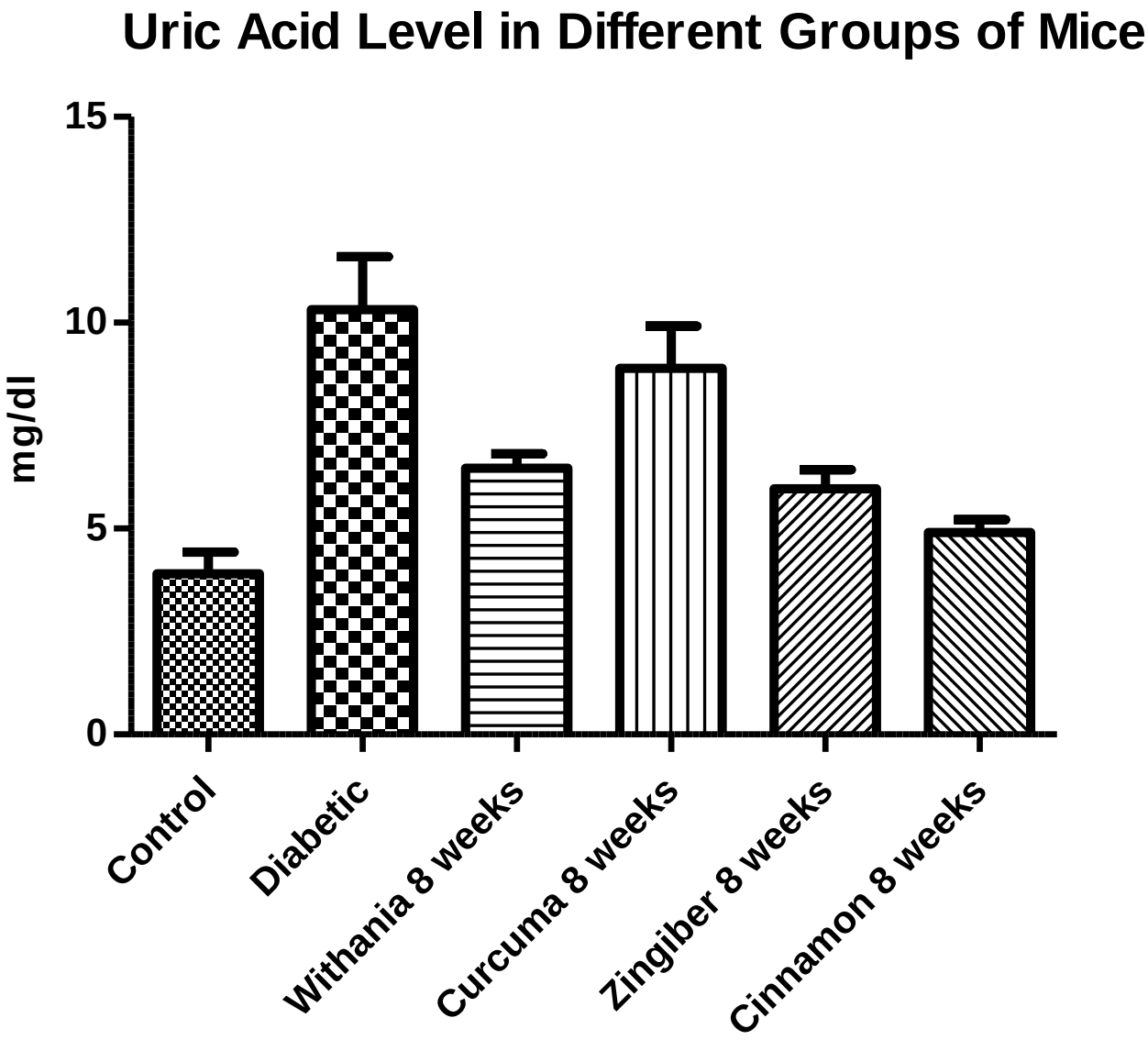
Results


Serum Lipase level in different group of Mice
150
100
50
0
Iu/L
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

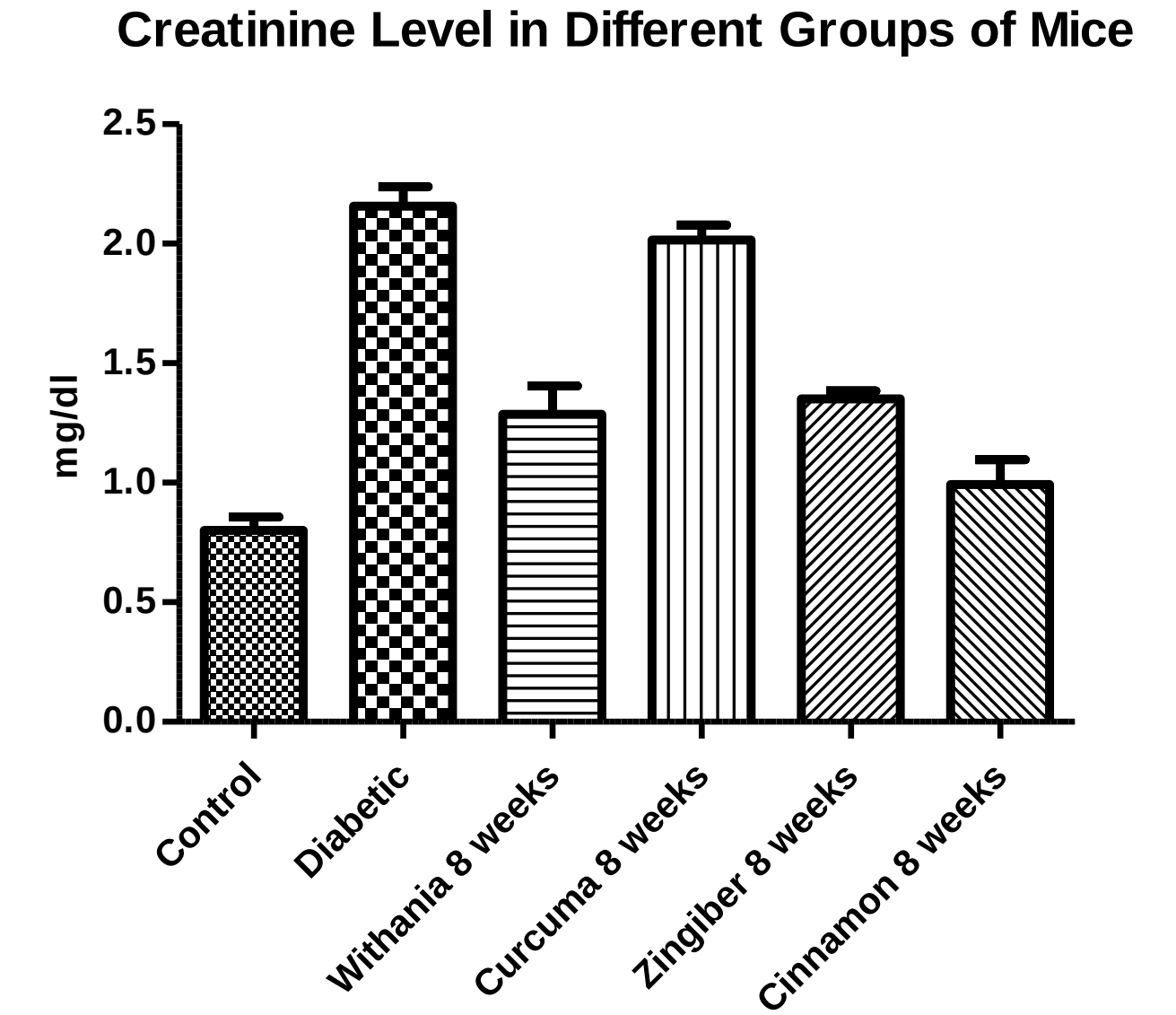
Results


Urea Level in Different Groups of Mice
mg/dl
80
60
40
20
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

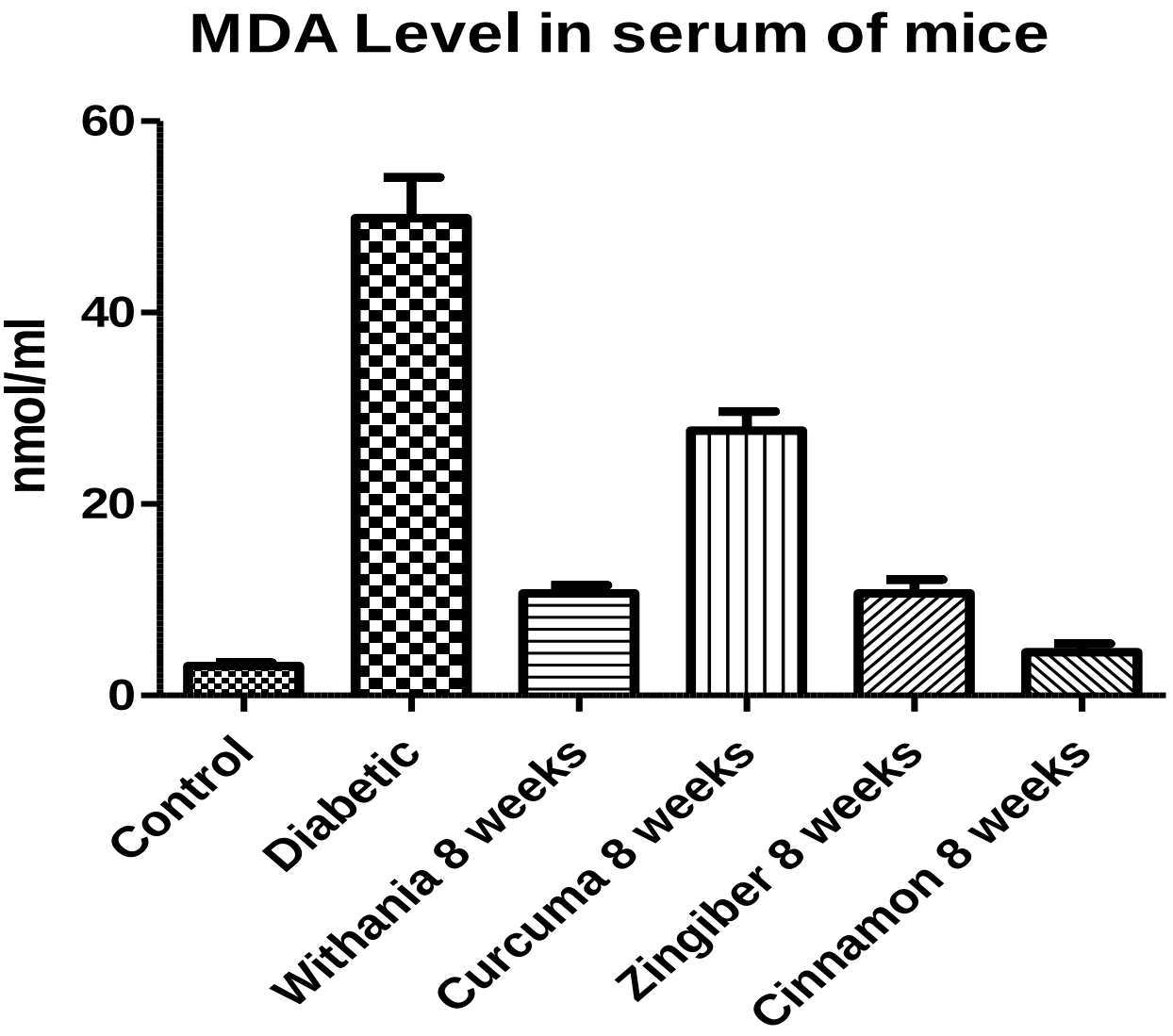
Results


Uric Acid Level in Different Groups of Mice
mg/dl
15
10
5
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

Results


Creatinine Level in Different Groups of Mice
mg/dl
2.5
2.0
1.5
1.0
0.5
0.0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

Results


MDA Level in serum of mice
nmol/ml
60
40
20
0
Control
Diabetic
Withania 8 weeks
Curcuma 8 weeks
Zingiber 8 weeks
Cinnamon 8 weeks

Results

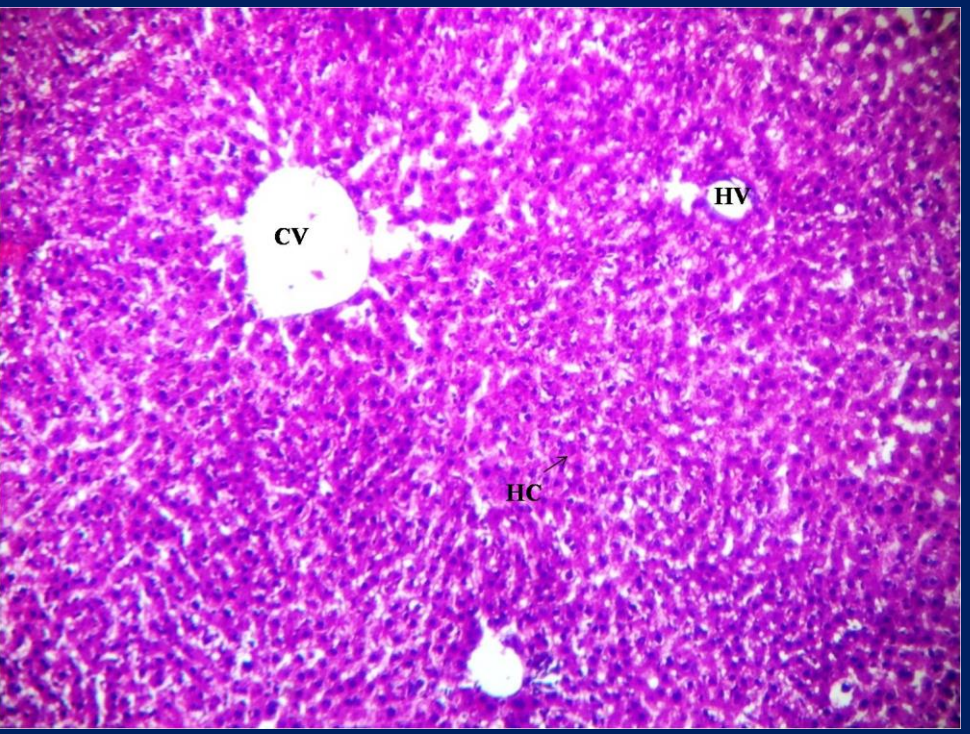


Figure – 1: shows liver of control mice with distinct hepatic cells, central vein is also normal in shape, hepatic veins are normal in structure.

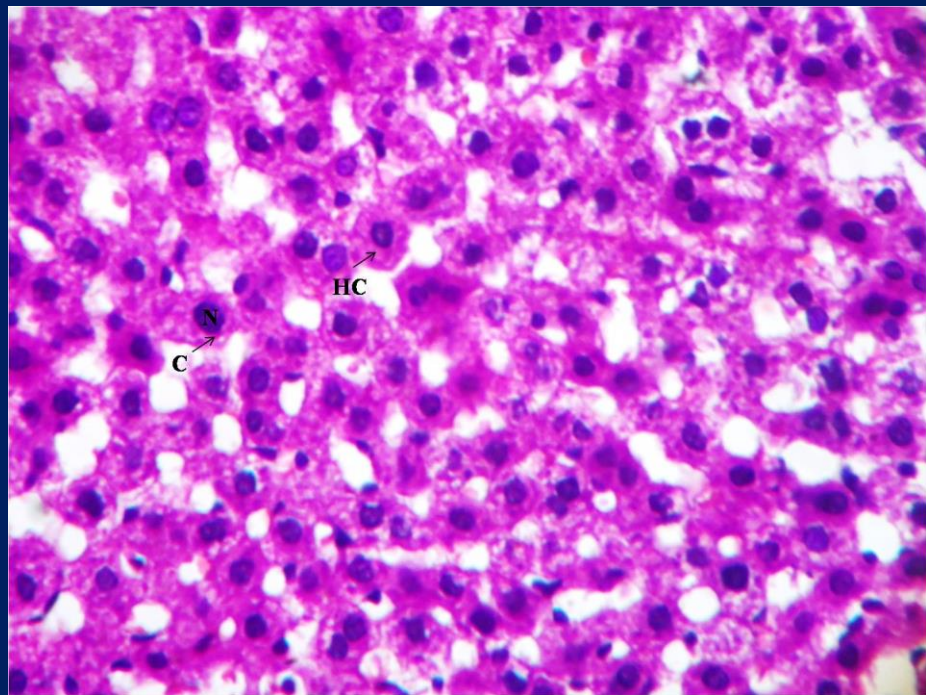


Figure – 2: shows liver of control mice with distinct hepatic cells, nucleus and cytoplasm of hepatic cells are well distributed.

Results

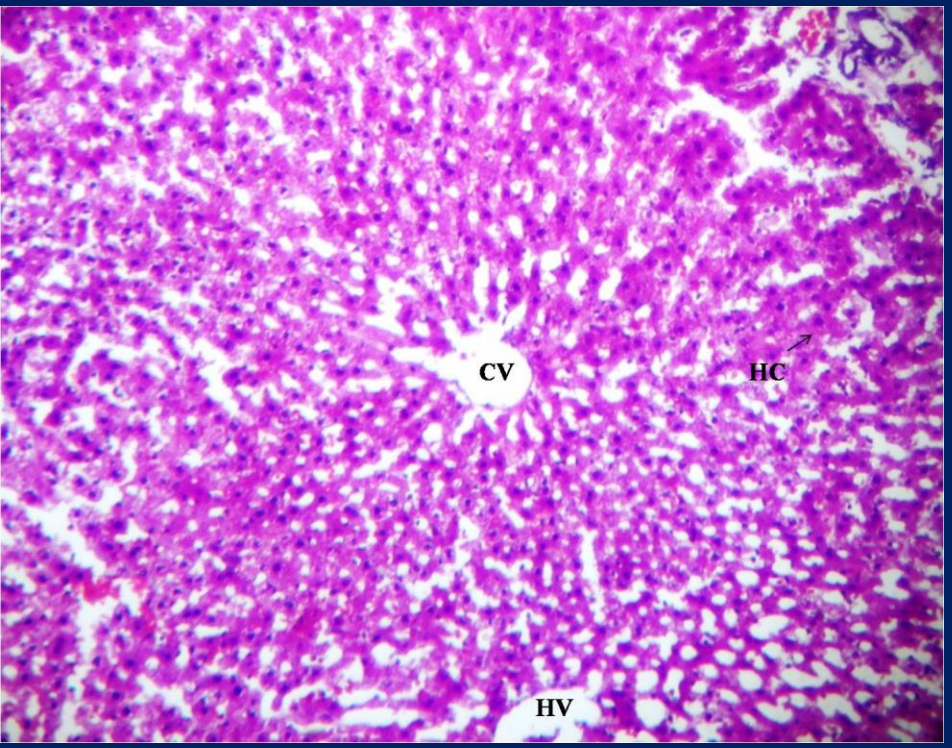


Figure – 3: shows liver of diabetic mice with degeneration in hepatic cells. Many vacuolated spaces were observed. Degenerated cytoplasm was also visible. Central vein is degenerated with rudiments of cytoplasm. Fragmented nucleus was also observed.

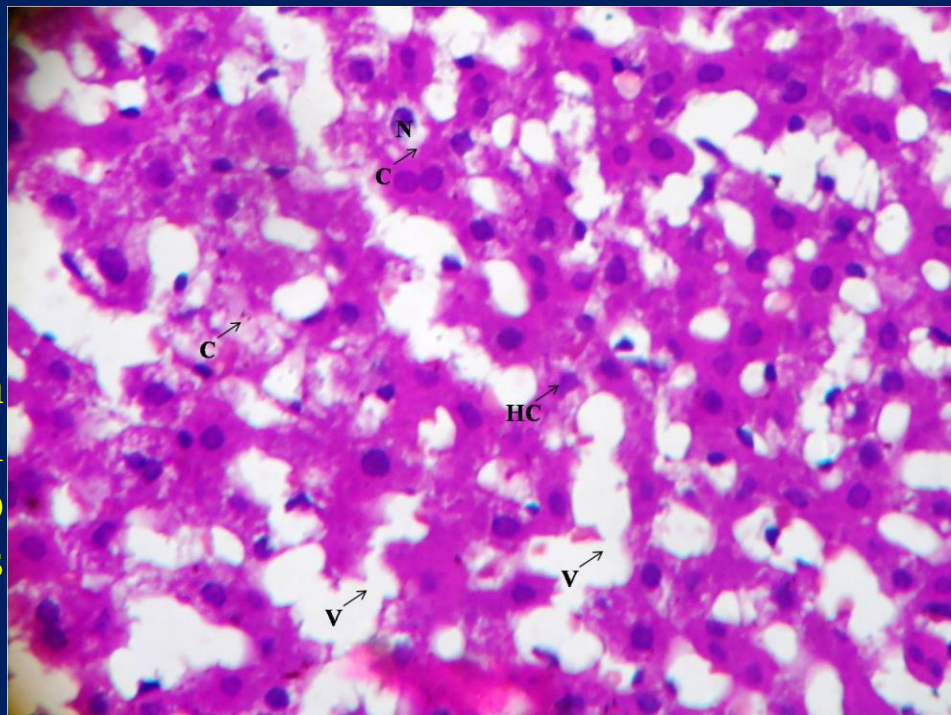


Figure – 4: shows liver of diabetic mice with degeneration in hepatic cells. Fragmented nuclei were observed. Vacuolated chromatin is also visible. Vacuolization is frequent in hepatic cells with degenerated cytoplasm.

Results

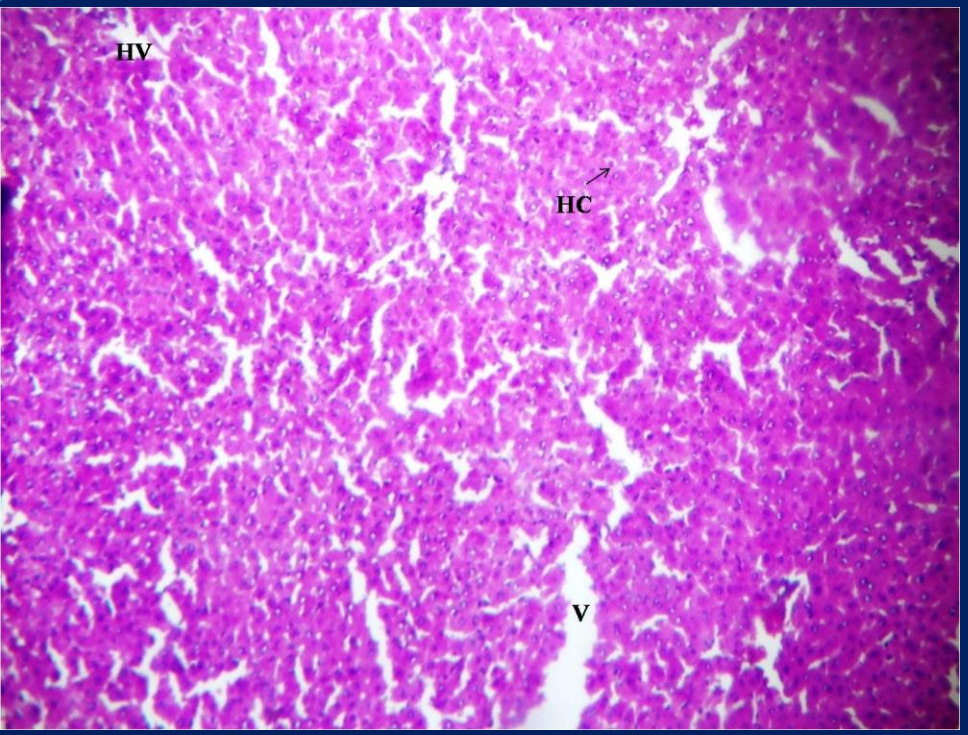


Figure – 5: shows liver of diabetic mice followed by eight weeks administration of *Withania somnifera* with degeneration in hepatic cells. Many vacuolated spaces were observed. Restoration were observed in cytoplasm with nuclei.

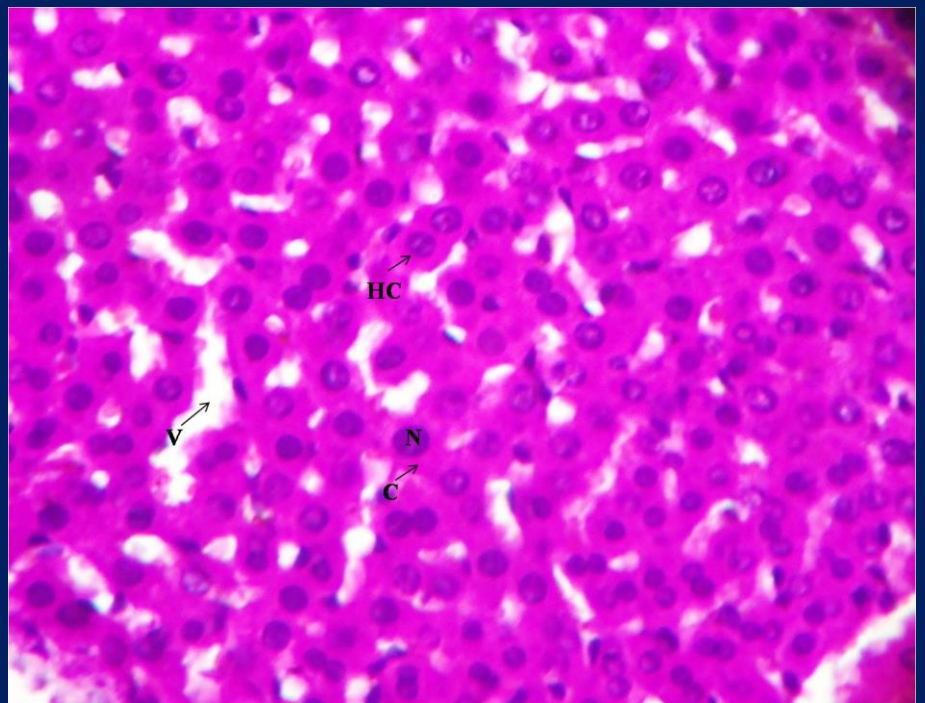


Figure – 6: shows liver of diabetic mice followed by eight weeks administration of *Withania somnifera* with vacuolated chromatin in hepatic cells. Clustered nuclei were observed in cytoplasm. Least vacuolated spaces were observed.

Results

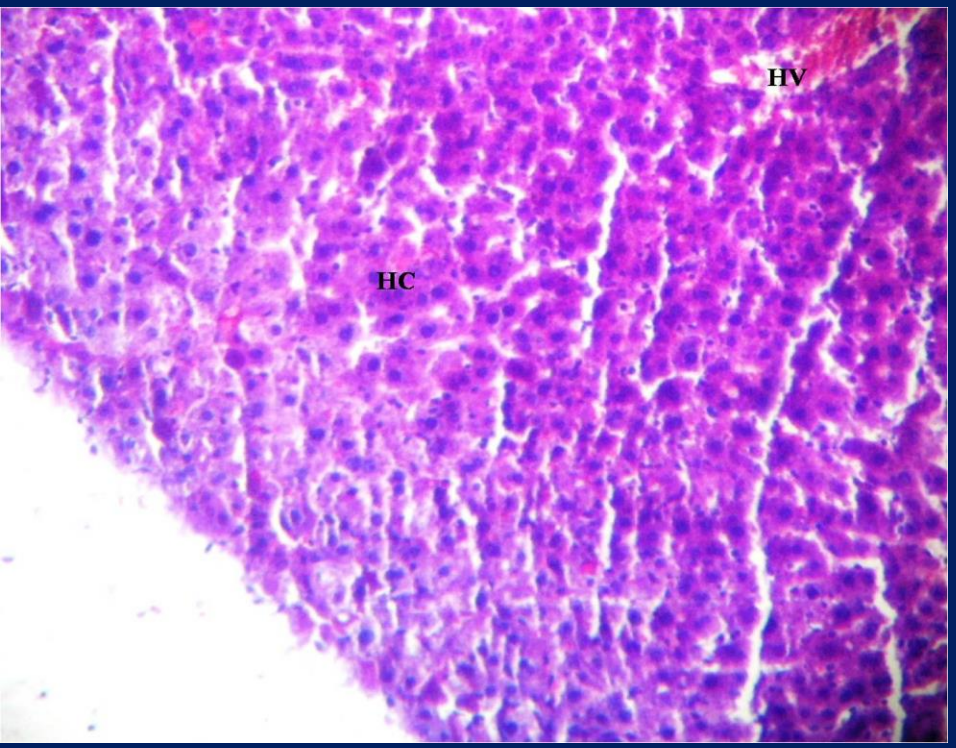


Figure – 7: shows liver of diabetic mice followed by eight weeks administration of *Curcuma longa* with frequent vacuolization. Clustered nuclei were observed in hepatic cells. Degenerated central vein and hepatic veins were observed.

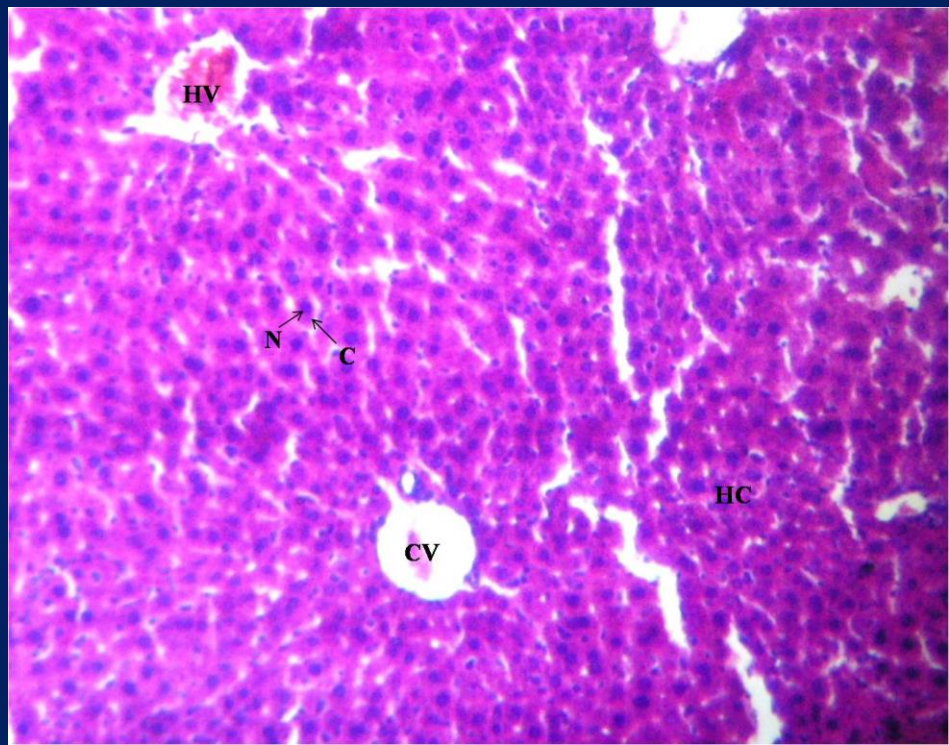


Figure – 8: shows liver of diabetic mice followed by eight weeks administration of *Curcuma longa* with many vacuolated spaces in hepatic cells. Clustered and fragmented nuclei were observed in hepatic cells. Degenerated hepatic vein was observed.

Results

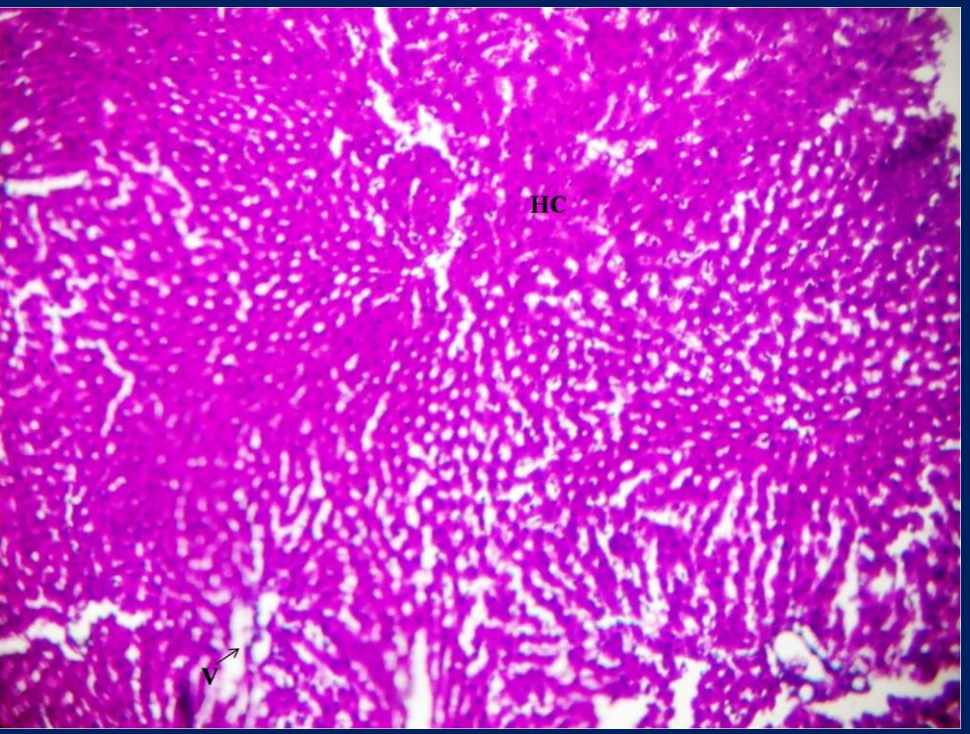


Figure – 9: shows liver of diabetic mice followed by eight weeks administration of *Zingiber officinale* with restoration in hepatic cells. Least vacuolization were observed. Restoration in cytoplasm was more effective.

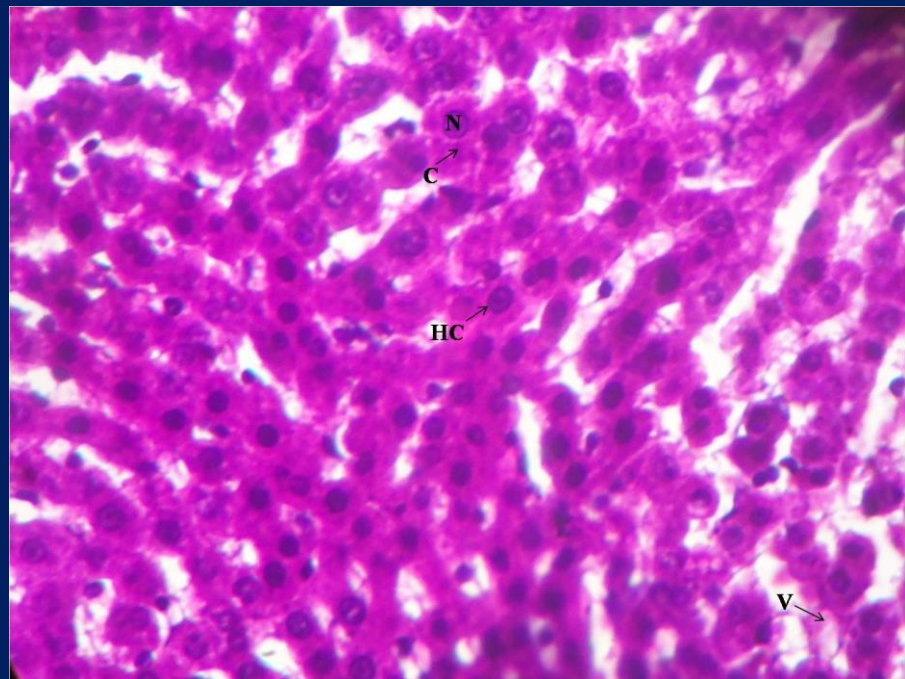


Figure – 10: shows liver of diabetic mice followed by eight weeks administration of *Zingiber officinale* with restoration in chromatin material of hepatic cells. Restoration in cytoplasm was observed

Results

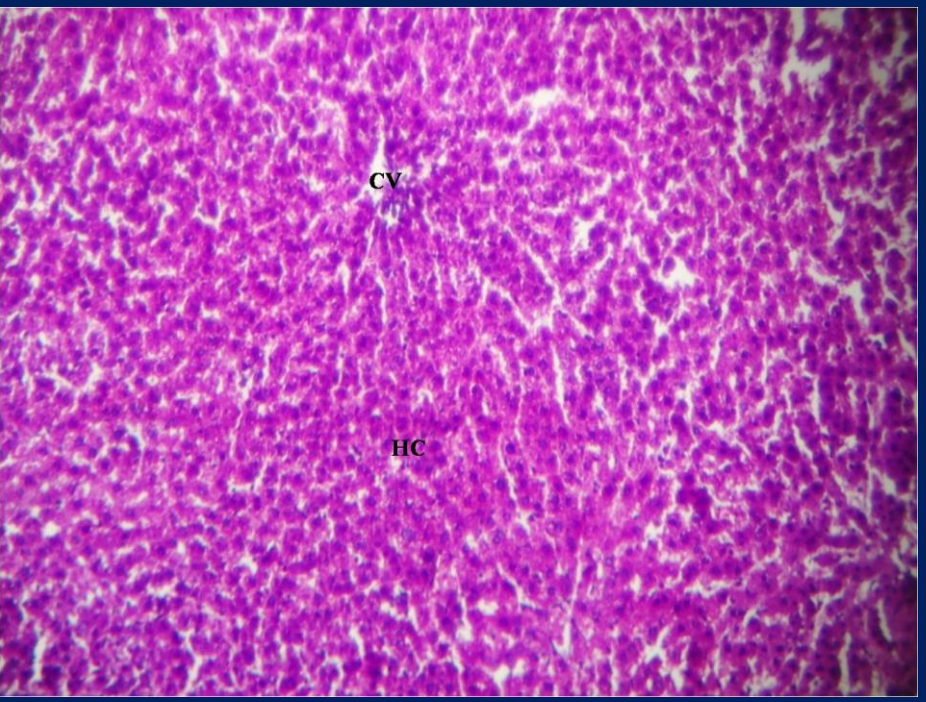


Figure – 11: shows liver of diabetic mice followed by eight weeks administration of *Cinamomum cassia* with restoration in hepatic cells. Restoration in cytoplasm and nuclear material was observed.

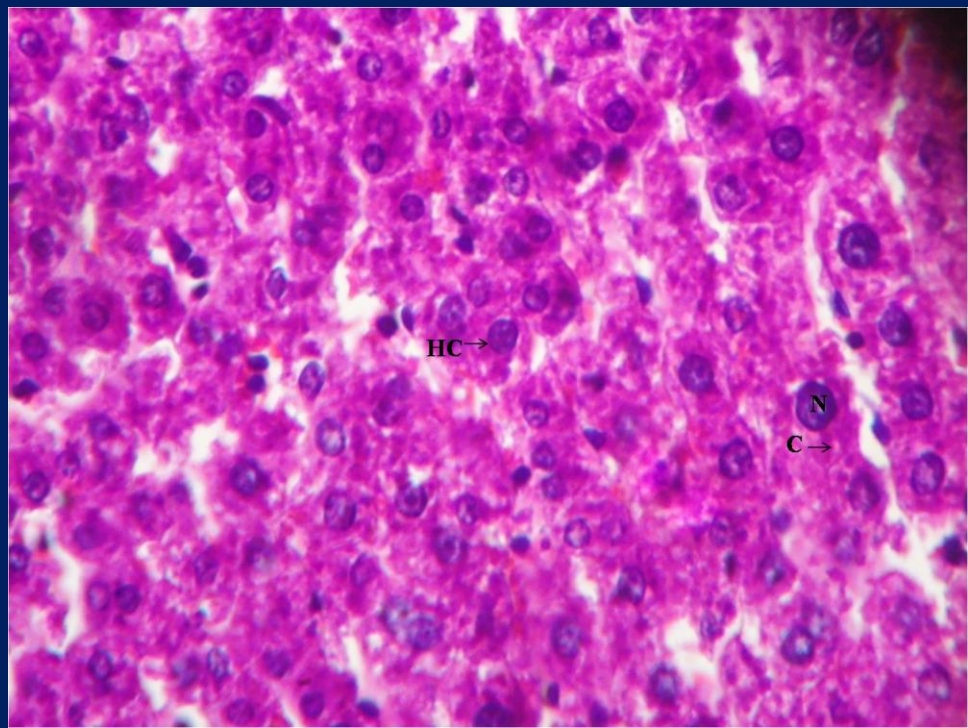
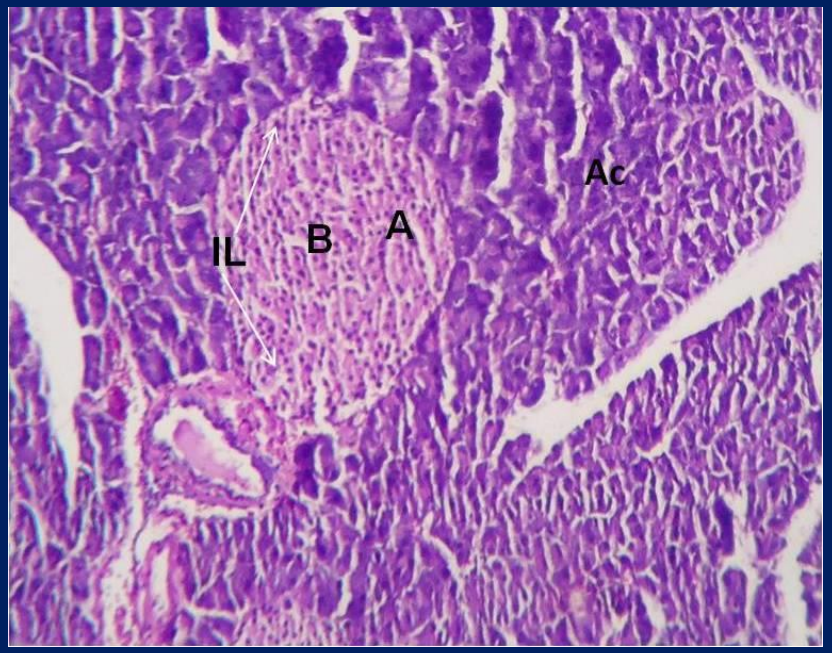
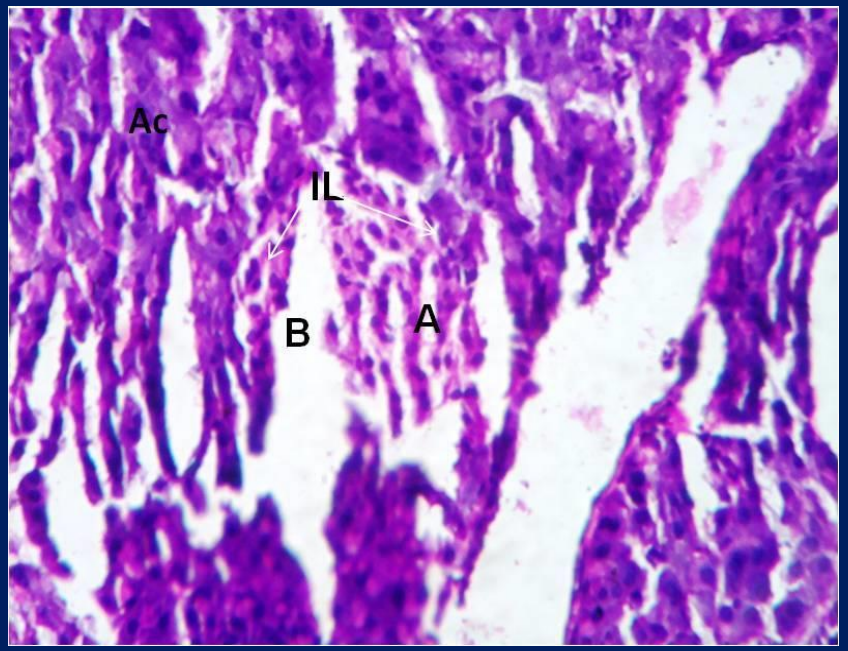


Figure – 12: shows liver of diabetic mice followed by eight weeks administration of *Cinamomum cassia* with restored chromatin in hepatic cells. Well organized hepatic cells were observed. Cytoplasm was restored to greater extent.

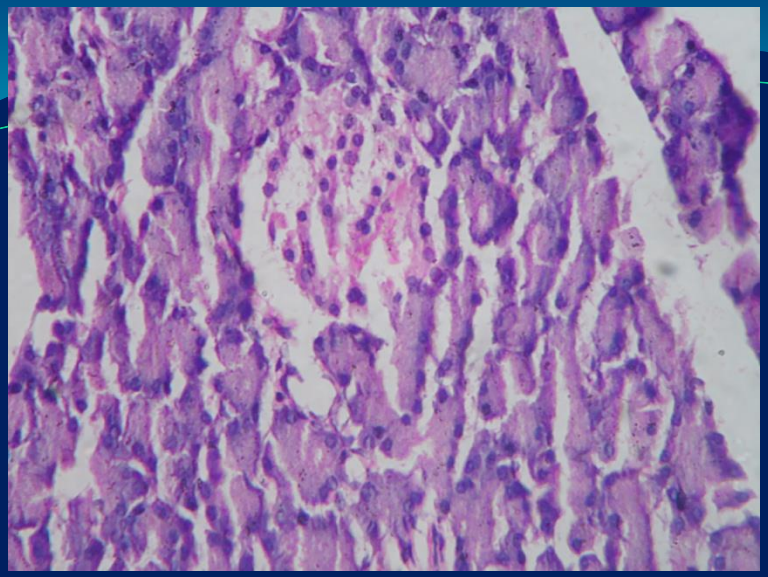
Results



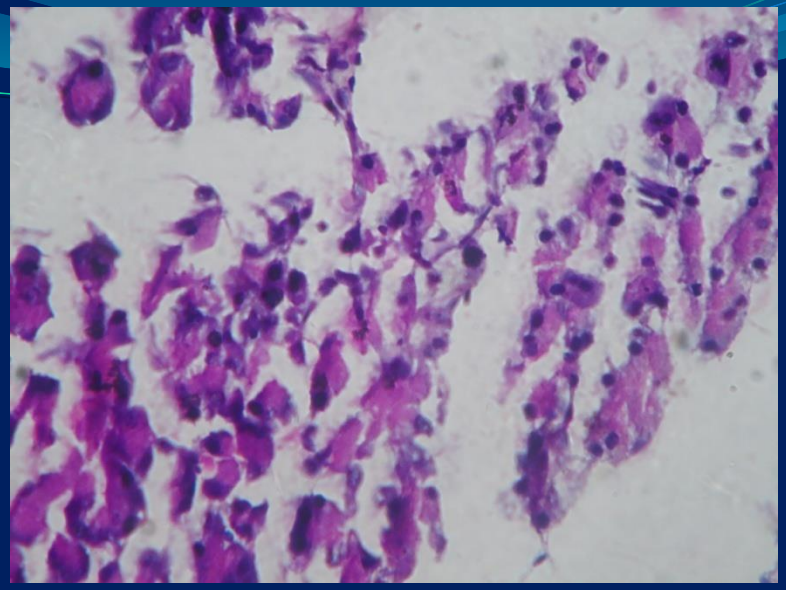
Control Pancreas



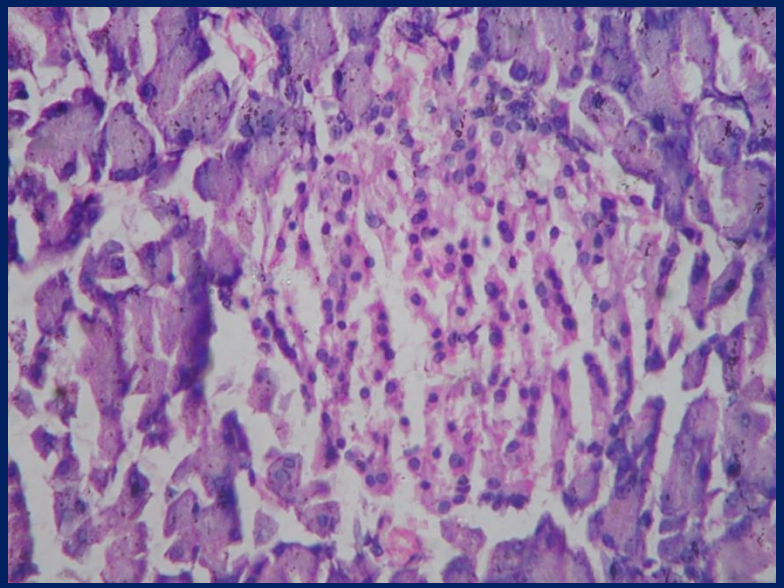
Diabetic Pancreas



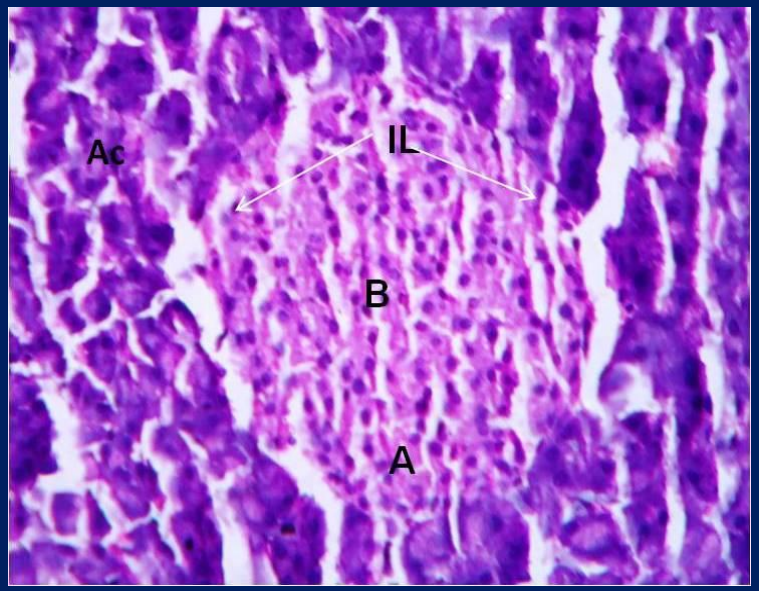
Withania treated Pancreas



Curcuma treated Pancreas

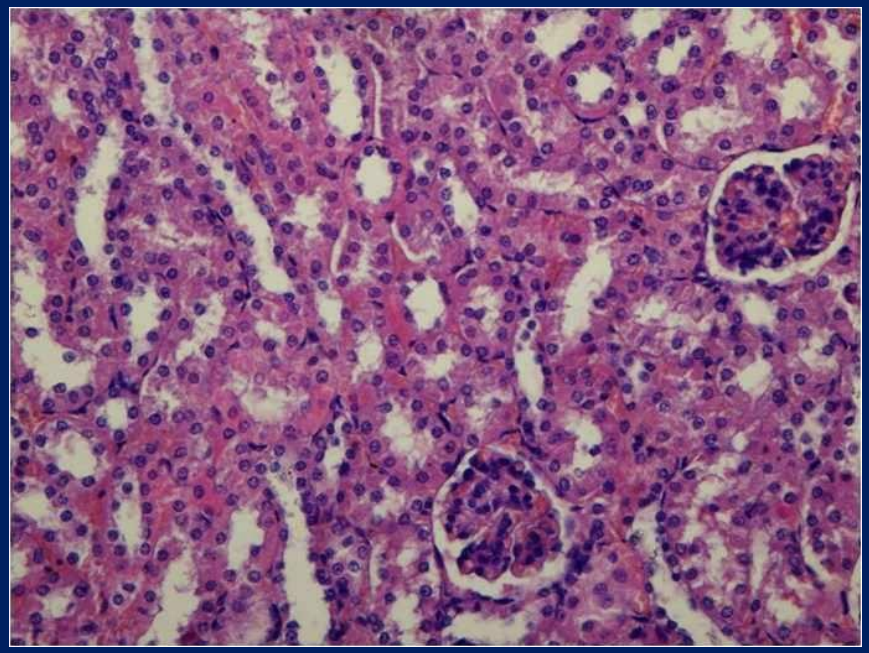


Zinger treated Pancreas

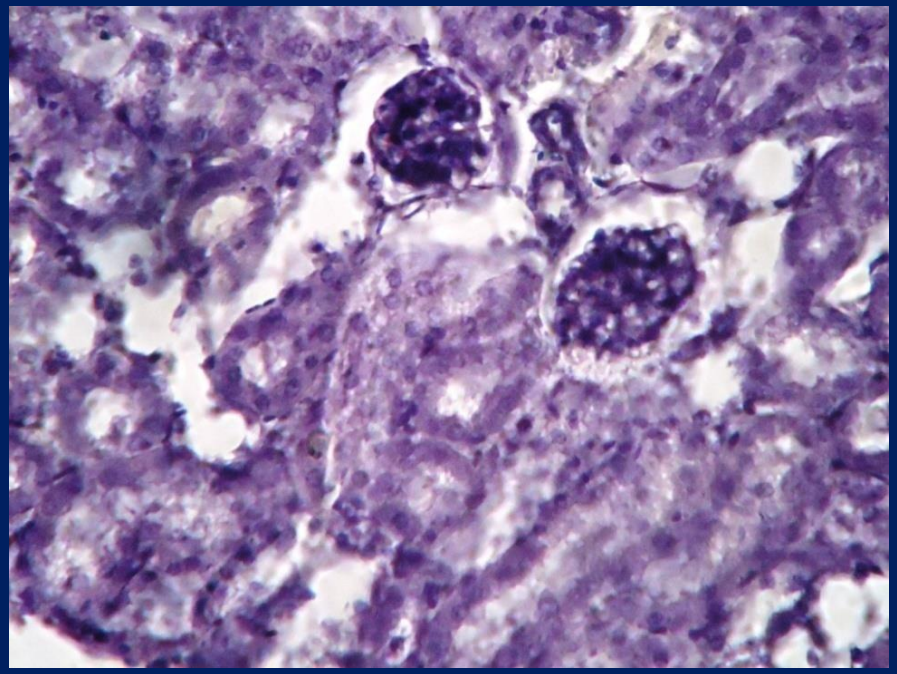


Cinnamon treated Pancreas

Results

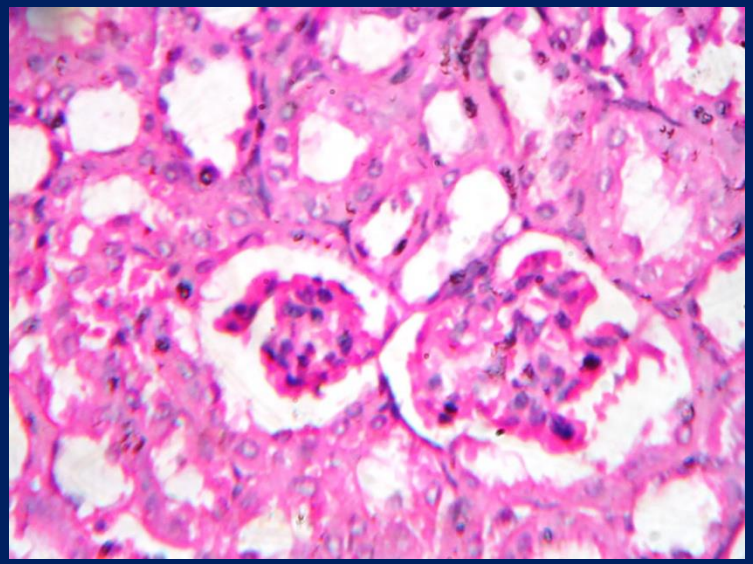


Control Kidney

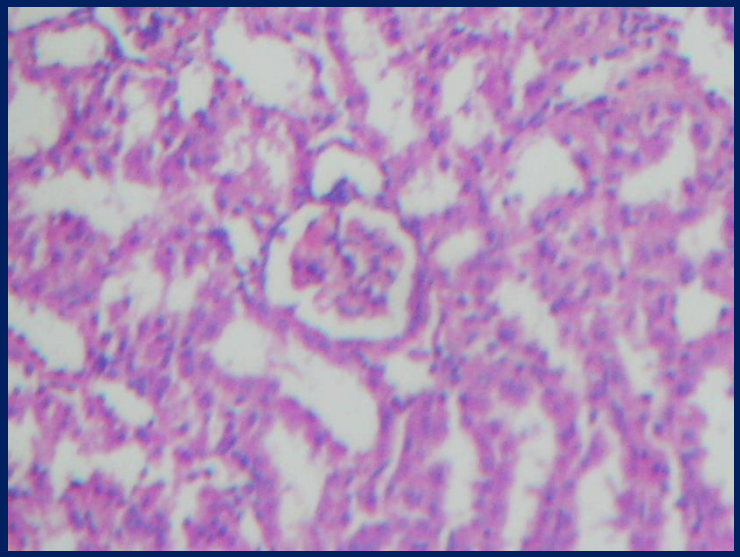


Diabetic Kidney

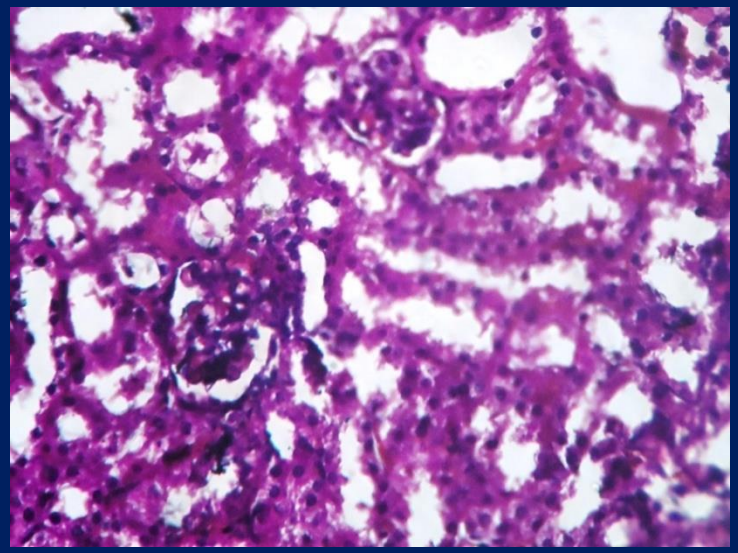
Results



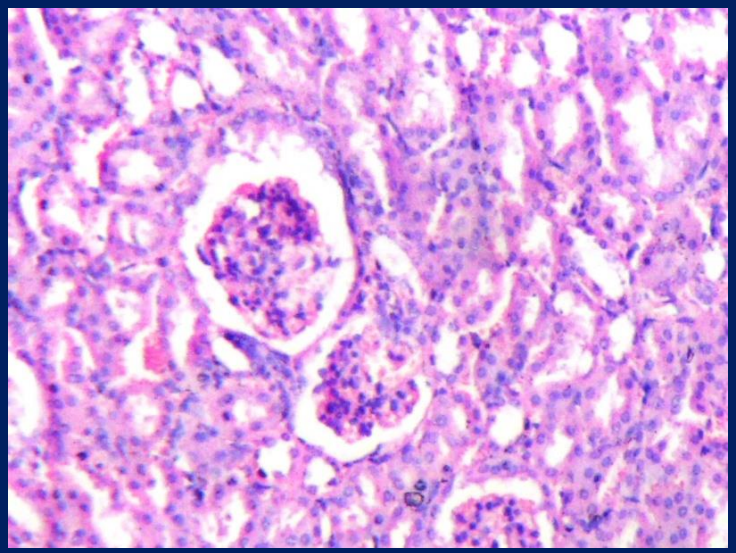
Withania treated Kidney



Curcuma treated Kidney



Zingiber treated Kidney



Cinnamon treated Kidney

Results

- Body weight of alloxan induced diabetic group of mice were decreased.
- Glucose level was increased in diabetic group.
- SGPT level were also increased in diabetic mice.
- Serum Amylase and Lipase levels were also increased.
- Urea and Uric acid levels were also increased .
- Lipid peroxidation levels were increased many folds in diabetic group of mice.
- Hepatic cells, Kupffer's cells, hepatic vein and Central vein were degenerated in diabetic group of mice.

Results

- Decreased Body weight was observed in *Withania somnifera* and *Curcuma longa* administered group.
- Body weight was increased in *Zingiber officinale* and *Cinamomum cassia* administered group.
- *Withania somnifera* and *Curcuma longa* administered group show little restoration in biochemical parameters.
- Zinger and Cinnamon administered group show effective restoration in biochemical parameters of mice.

Results

Cinnamon administered group show effective restoration in -

- Glucose level is restored to normal level.
- SGPT level were also observed in normal range.
- Serum Amylase and Lipase were effectively restored.
- Urea and Uric acid level were slightly increased .
- Lipid per oxidation level were restored to normal level.

Results

- **Amelioration in the Hepatic cells of liver is observed with effective restoration in both cytoplasm and nucleus in Cinnamon administered group.**
- **Kupffers cells and central veins were also restored in cinnamon administered group of mice.**
- **Hepatic veins was restored in *Cinamonum cassia* administered group.**
- **Vacuolated spaces were least observed.**
- **These denotes the normal functioning of liver in *Cinamonum cassia* administered group.**

Conclusions

- It is concluded from study that *Cinamomum cassia* acts effectively against diabetes and maintains normal glucose level.
- *Cinamomum cassia* also acts on biochemical parameters i.e: Urea, Uric acid, Amylase, lipase and MDA to almost normal level.
- It also restores both cytoplasmic material and nuclear material of hepatic cells of liver, kidney.
- It is evident that *Cinamomum cassia* possesses hypoglycaemic effect and acts effectively against diabetes.


Thank You