WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 3, 1191-1205. Research Article ISSN 2277– 7105

COMPARATIVE NEPHROPROTECTIVE EFFECT OF *CINNAMOMUM CASSIA* AND *ZINGIBER OFFICINALE* ON DIABETIC *MICE*

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Article Received on
07 Jan. 2020,

Revised on 28 Jan. 2020,
Accepted on 17 Feb. 2020,

DOI: 10.20959/wjpr20203-16896

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ABSTRACT

Diabetes is emerging disease in developed and developing country and increased exponentially in last few decades. Diabetes has global health problem. Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Alloxan were introduced intra-peritoneal @ 120 mg/kg/b. w to prepare diabetic model. Diabetic control group mice were treated with distilled water while diabetic mice were treated with *Cinnamomum cassia* @ 100 mg/kg/b. w and *Zingiber officinale* @ 80 mg/kg/b. w separately for 16 weeks. Glucose level was increased many folds in diabetic mice. SGPT, urea and uric acid was increased in diabetic group of mice. Cinnamon and ginger restores PCT, DCT and glomerulus effectively after 16 weeks of administration. It is concluded from entire study that cinnamon and ginger both acts very effectively against diabetes on biochemical and histological parameters of mice. Both restore glucose level to normal level. Cinnamon acts effectively on SGPT, Uric acid; Urea while ginger does not effectively restore uric acid and SGPT in diabetic mice. Cinnamon effectively restores glomerulus and bowmen's capsule very well in comparison to ginger administered group. It was evident from study that cinnamon causes effective restoration in both biochemical and histological parameters of mice.

KEYWORD: SGPT, Uric Acid, glomerulus, hyperglycaemia, alloxan.

1. INTRODUCTION

Diabetes is emerging disease in developed and developing country and increased exponentially in last few decades. Diabetes has global health problem. is a metabolic disorder characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (WHO, 1999). Patients with diabetes mellitus affect also the other forms of the disease. Important clinical problems are microvascular lesions in retinal, neuronal and kidney vessels leading to retinopathy, neuropathy and nephropathy (Parvanova et al., 2002). Macroangiopathy is more characteristic of diabetes mellitus. Diabetes has deserting results on male conceptive framework including testicular capacity, sperm development and sexual hormone modification (Arikawe et al., 2012, Trindade et al. 2013). Medicinal plants have high potency to treat many diseases. Number of disease has been treated by *Cinnamomum cassia* such as heart disease, arthritis, bladder infection, cholesterol, cold, stomach upsets, weight loss, hearing loss and bad breath (Ayyangar, 2016). Cinnamon has contained pharmacological properties such as antioxidant and antibacterial effects and cinnamon enhance the production of insulin (Lopez P et al., 2005). Cinnamon has potent neuroprotective, hepatoprotective, cardioprotective and gastroprotective effects due to its potent antioxidant and anti-inflammatory properties (Alqasoumi, et al 2011and Khasnavis et al 2012). Cinnamon may be effective in the treatment of cancer (Hyeon et al., 2003).

Ginger enhances resistance to infectious disease by increasing non-specific and specific immune mechanisms (Harikrishnan *et al*., 2011). Ginger is utilized as a characteristic torment reliever and a mitigating specialist. It is likewise helpful in relieving ulcer and forestalling respiratory failure and stroke. (Shubha, 2015). Zingerone provides direct adaptogenic effect by preventing oxidative stress on smooth muscles of intestine (Banji, 2014).

2. MATERIAL AND METHOD

2.1: Animal; - The mice (*Mus musculus*) were reared in animal house. The mice selected for the study were 12 weeks old with 30±2 gm body weight. The mice were housed at controlled environmental conditions i.e. at 22±2ºC temperature, 50±10% relative humidity and 12h dark-light cycle. All experiments were conducted as per the guidelines of CPCSEA (Committee for the Purpose of Control and Supervision of Experiments on Animals).

2.2: Chemical*;* - Alloxan, purchased by Loba chem Pvt. Ltd., Mumbai was utilized for the experimental design and preparation of diabetic model.

2.3: Medicinal plant used; - Aqueous bark extract of *Cinnamomum cassia* @ 100 mg/kg b.w. and aqueous rhizome extract of *Zingiber officinale* @ 80 mg/kg b.w. Was orally administered to diabetic group of mice for 16 weeks. Fresh barks of *Cinnamomum cassia* and rhizome of *Zingiber officinale* were purchased from herbal store in Patna, India and identified by botanist.

Diabetic control group mice were treated with distilled water while diabetic mice were treated with *Cinnamomum cassia* and *Zingiber officinale* separately for 16 weeks. Animals were sacrificed on 4^{th}, 8^{th}, 12^{th} and 16^{th} week of *Cinnamomum cassia* and *Zingiber officinale* administration. Blood were collected from the sacrificed mice for biochemical analysis while tissues of kidney were fixed for light microscopic study.

3. RESULTS

3.1: Biochemical Analysis

In control group glucose level was 90.67 ± 1.45 while in diabetic group it was 213.3 ± 6.36. In *Cinnamomum Cassia* 4 weeks, 8 weeks, 12 weeks and 16 weeks administrated groups it was 165.9±8.72, 139.1±5.46, 110.9±8.14 and 89.67 ± 0.88 respectively (Text figure -1). and in *Zingiber officinale* 4 weeks, 8 weeks, 12 weeks and 16 weeks administrated group it was 157.8± 11.53, 144.3± 7.63, 129.7±14.58 and 106.0 ± 2.64 respectively (Text figure -2).

In control group urea level was 106.0 ± 2.64 while in diabetic groups it was 73.00 ± 2.51. In *Cinnamomum cassia* 4 weeks, 8 weeks, 12 weeks and 16 weeks administrated groups it was 41.33 ± 1.45, 35.33 ±1.76, 3.33 ± 1.76, and 31.67 ± 0.88 respectively (Text figure -3). In *Zingiber officinale* 4 weeks, 8 weeks, 12 weeks, and 16 weeks administrated groups it was 42.00 ± 1.15, 41.33 ± 1.20, 40.67 ± 2.02 and 40.67 ± 2.02 respectively (Text figure -4).

In control group uric acid level was 16.33 ± 0.88 while in diabetic group it was 73.00 ± 2.51. in *Cinnamomum cassia* 4 weeks, 8 weeks, 12 weeks and 16 weeks administrated groups it was 7.580 ± 0.049, 6.44 ± 0.052, 6.097 ± 0.008, and 5.92 ± 0.041 respectively (Text figure -5). In *Zingiber officinale* 4 weeks, 8 weeks, 12 weeks, and 16 weeks administrated groups it was 10.12 ± 0.151, 9.70 ± 0.057, 9.66 ± 0.08 and 9.70 ± 0.057 respectively (Text figure -6).

In **c**ontrol group SGPT level was 19.67 ± 1.202 while in diabetic group it was 191.3 ± 2.84.00. in Cinnamomum *cassia* 4 weeks, 8 weeks, 12 weeks and 16 weeks administrated groups it was 85.00 ± 1.15, 60.33 ± 1.45, 54.00 ± 1.52 and 45.67 ± 1.20. Respectively (Text figure -7). In *Zingiber officinale* 4 weeks, 8 weeks, 12 weeks, and 16 weeks administrated

groups it was 121.3 ± 2.028, 108.0 ± 1.73, 100.3 ± 2.028 and 99.00 ± 1.155 respectively (Text figure -8).

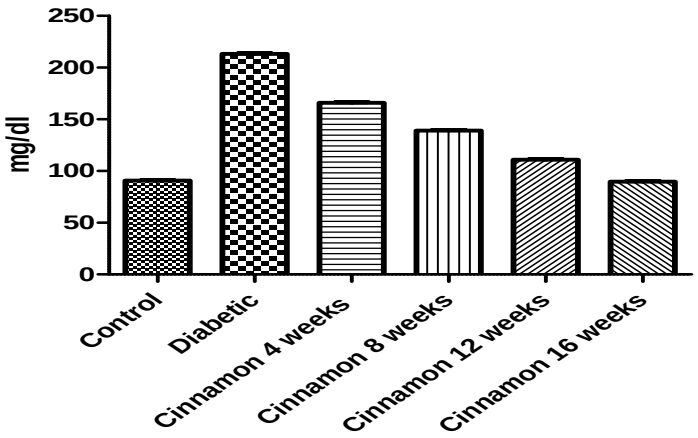
3.2: Histological Analysis

Kidney of control mice showing, cortex with normal glomerulus with women capsule proximal convoluted tubules and distal convoluted tubules (PCT&DCT) well organised with even distribution of cytoplasmic and nuclear material in (Figure-1). Kidney of diabetic mice shows cluster nuclei in glomerulus with in capsule were degenerated to greater extend cluster nuclei were observed in renal capsule in (Figure-2).

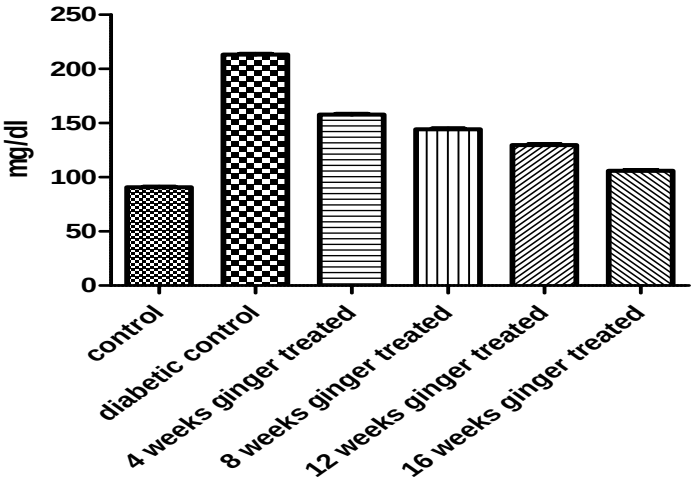
Kidney of diabetic mice administrated with *Cinnamomum cassia* for 4 weeks shows effective restoration in renal cortex few vacuolated space was observed PCT & DCT were distinct in (Figure-3). Kidney of diabetic mice administrated with *Cinnamomum cassia* for 8 weeks shows effective restoration in renal cortex PCT & DCT were observed effectively. Glomerulus were also restored in (Figure-4). Kidney of diabetic mice administrated with *Cinnamomum cassia* for 12 weeks shows restoration in renal cortex with little vacuolated space. Glomerular & women capsule was observed in restored condition in (Figure-5). Kidney of diabetic mice administrated with *Cinnamomum cassia* for 16 weeks shows effective restoration in renal cortex with little vacuolated space renal capsule is also normal like in (Figure-6).

Kidney of diabetic mice administrated with *Zingiber Officinale* for 4 weeks shows little restoration in glomerulus women capsule are continuous many vacuolated space was observed in renal cortex in (Figure-7). Kidney of diabetic mice administrated with *Zingiber Officinale* for 8 weeks shows restoration in renal cortex with continuous renal capsule, dilated PCT & DCT were observed women capsule were also dilated in (Figure-8). Kidney of diabetic mice administrated with *Zingiber Officinale* for 12 weeks shows cirrated renal capsule many vacuolated space was observed in renal cortex clustered nuclei were observed in PCT & DCT in (Figure-9). Kidney of diabetic mice administrated with *Zingiber Officinale* for 16 weeks shows many vacuolated space was observed in renal cortex & renal capsule become thicker many haemorrhagic spaces were observed in (Figure-10).

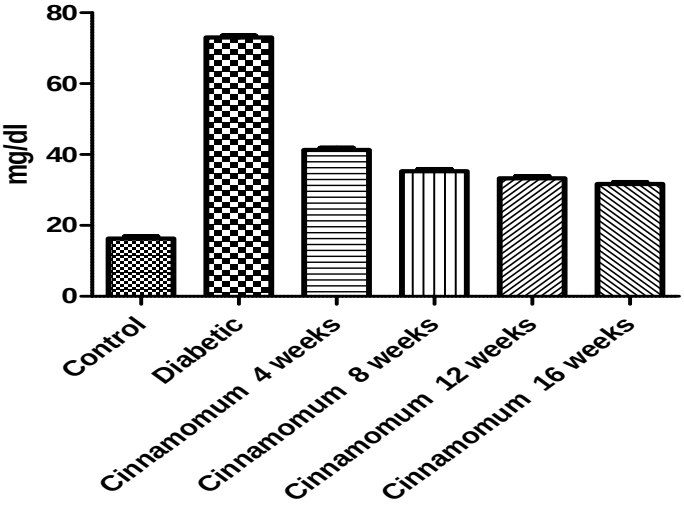
Text Figure ;- 1 Glucose level in cinnamon group of mice



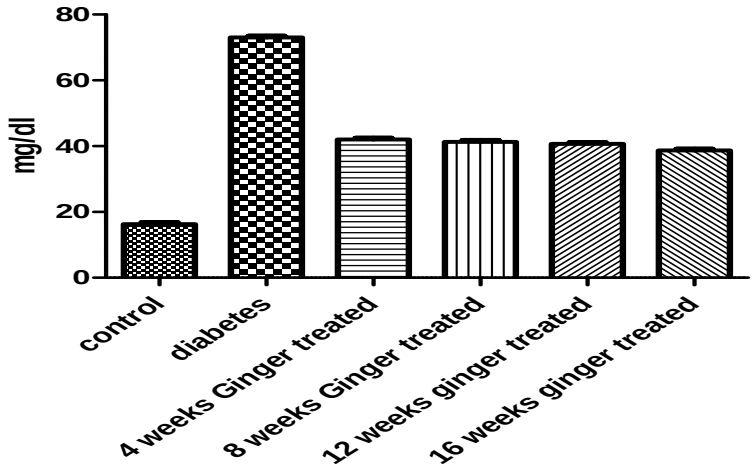
Text Figure -2: Glucose level in ginger group of mice



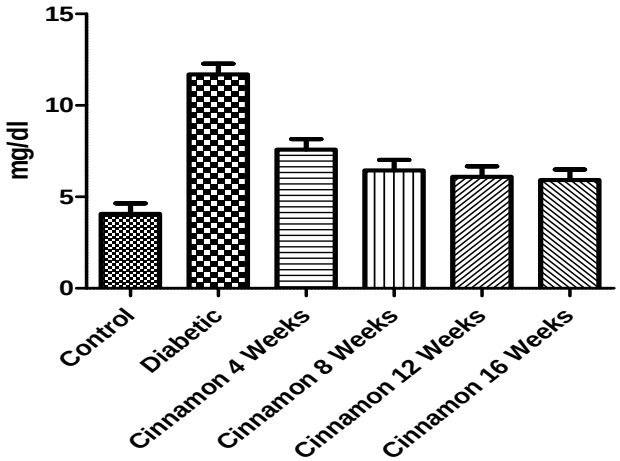
Text Figure ;- 3 urea level in cinnamon group of mice



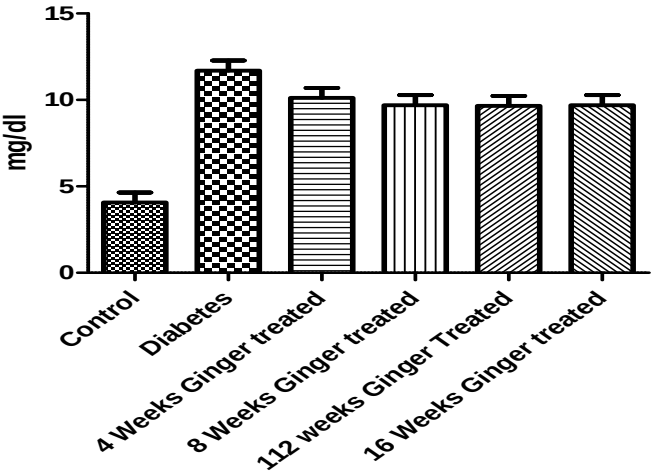
Text Figure:4- Urea level in ginger group of mice



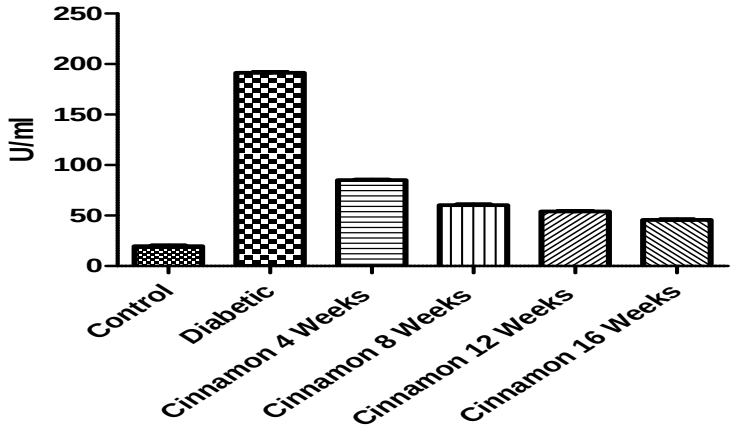
Text Figure ;- 5 uric acid level in cinnamon group of mice



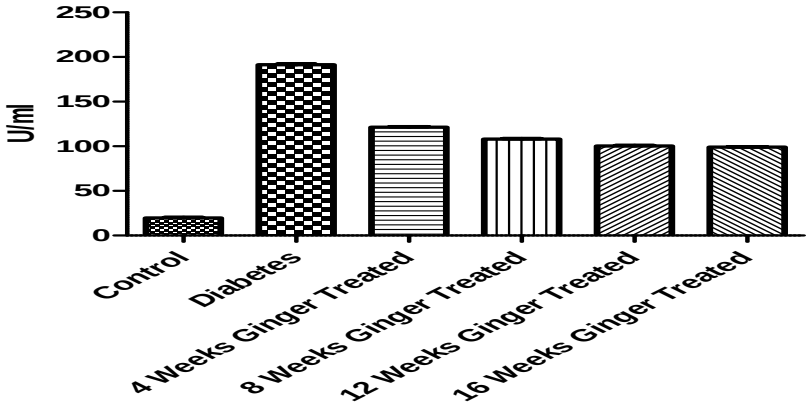
Text Figure -6: Uric acid level in ginger group of mice

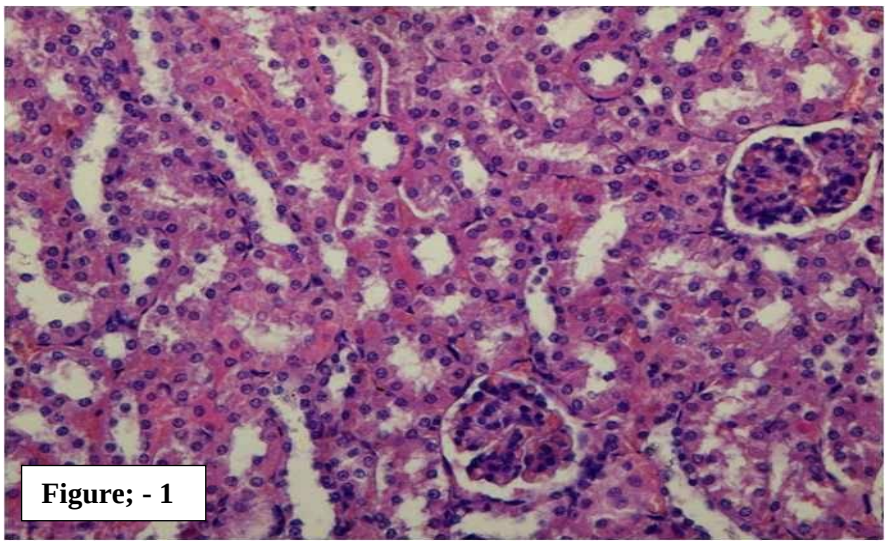


Text Figure -7: SGPT level in cinnamon group of mice



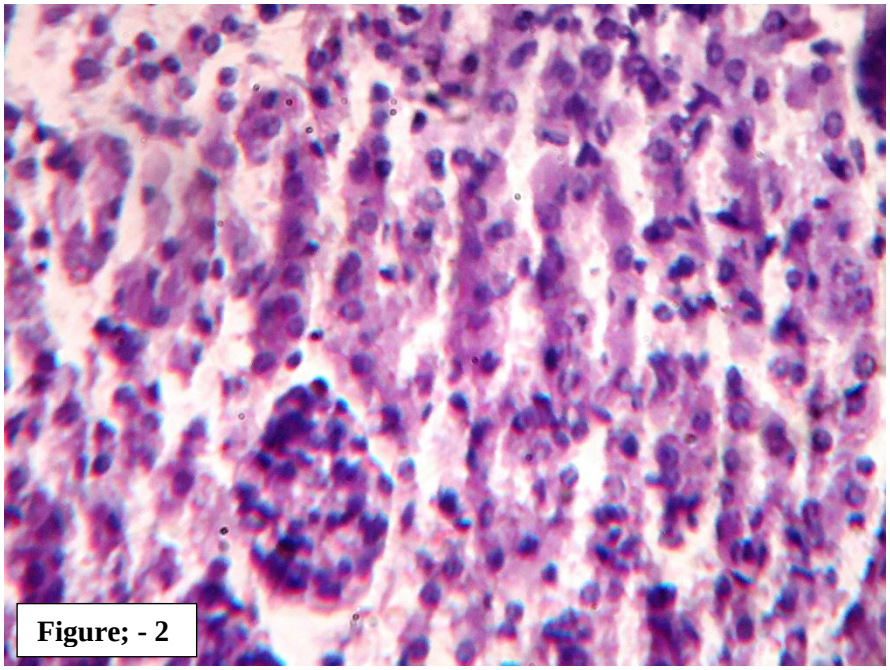
Text Figure -8: SGPT level in ginger group of mice





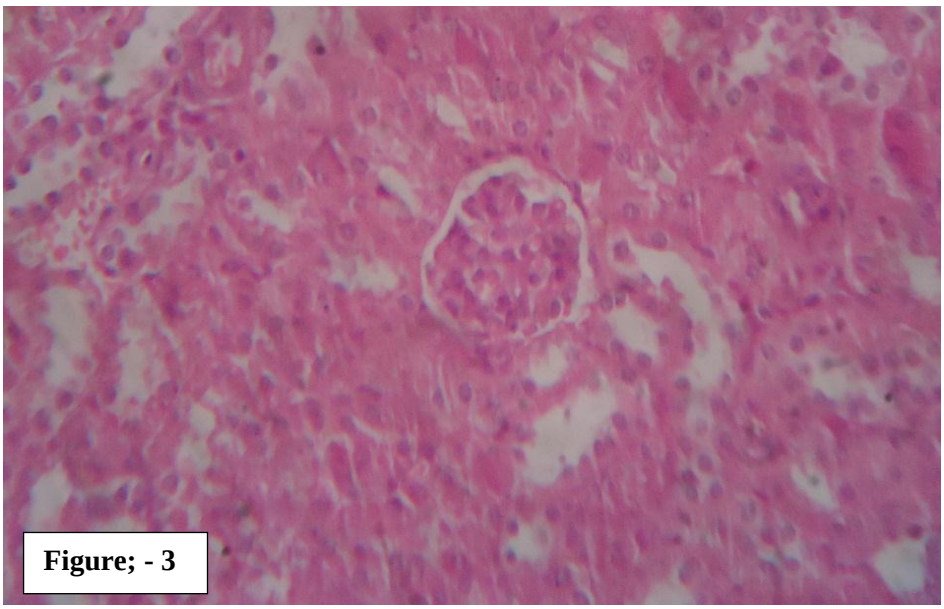
Figure; - 1

kidney of control mice showing, cortex with normal glomerulus with women capsule proximal convoluted tubules and distal convoluted tubules (PCT&DCT) well organised with even distribution of cytoplasmic and nuclear material.



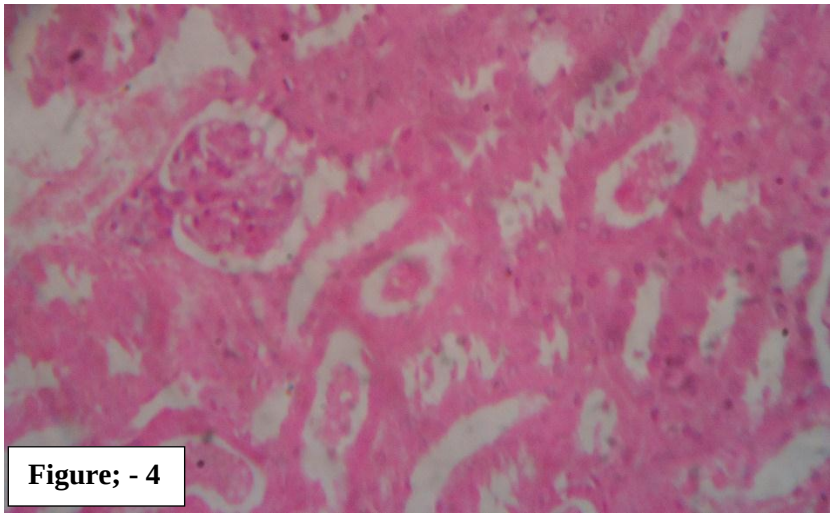
Figure; - 2

Kidney of diabetic mice shows cluster nuclei in glomerulus discontinuous women capsule were observed many vacuolated space were observed in renal cortex.



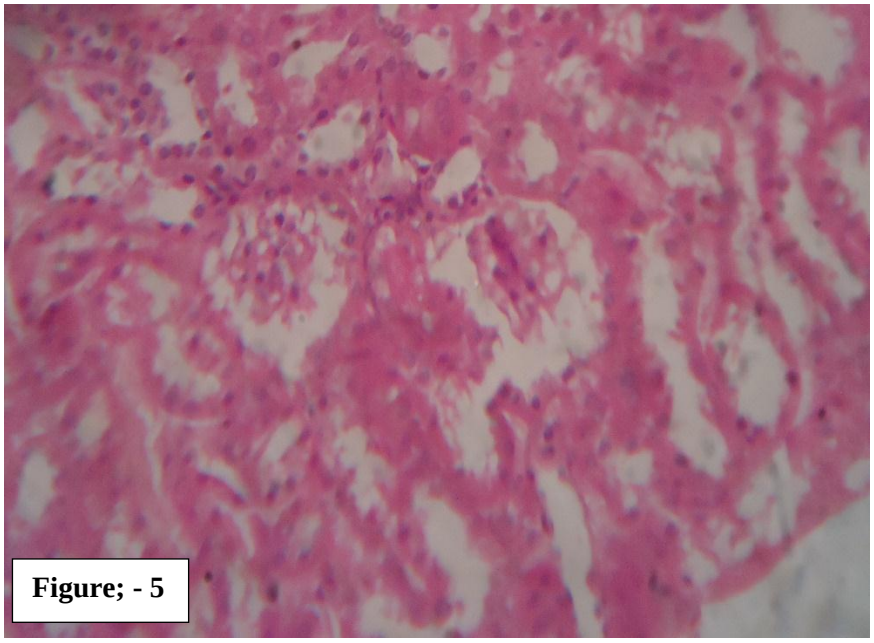
Figure; - 3

Kidney of diabetic mice administrated with *Cinnamomum cassia* for 4 weeks shows effectively restoration in women capsule PCT & DCT were also restore to greater extend.



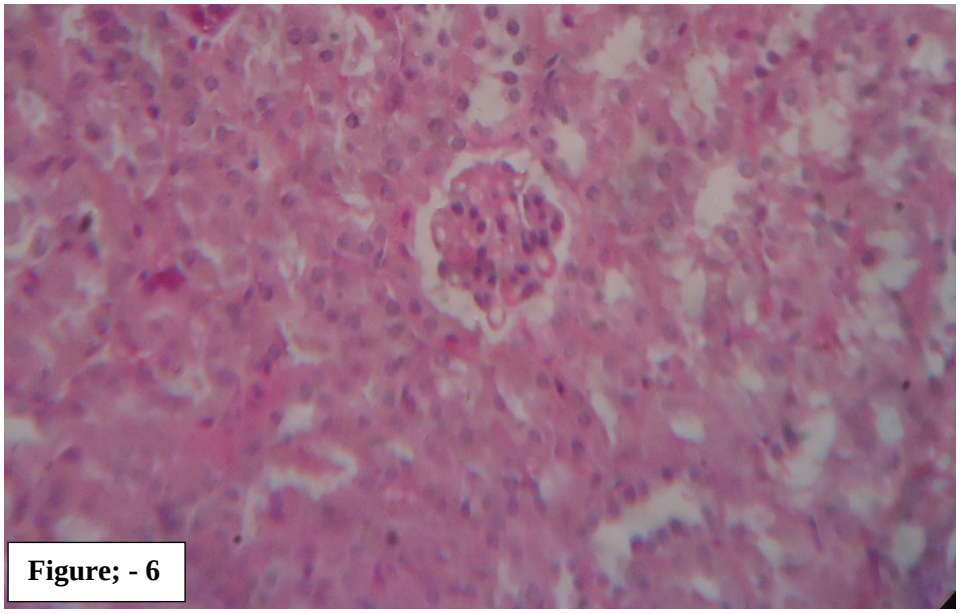
Figure; - 4

Kidney of diabetic mice administrated with *Cinnamomum cassia* for 8 weeks shows effective in renal medulla collecting duct restored to greater extend.



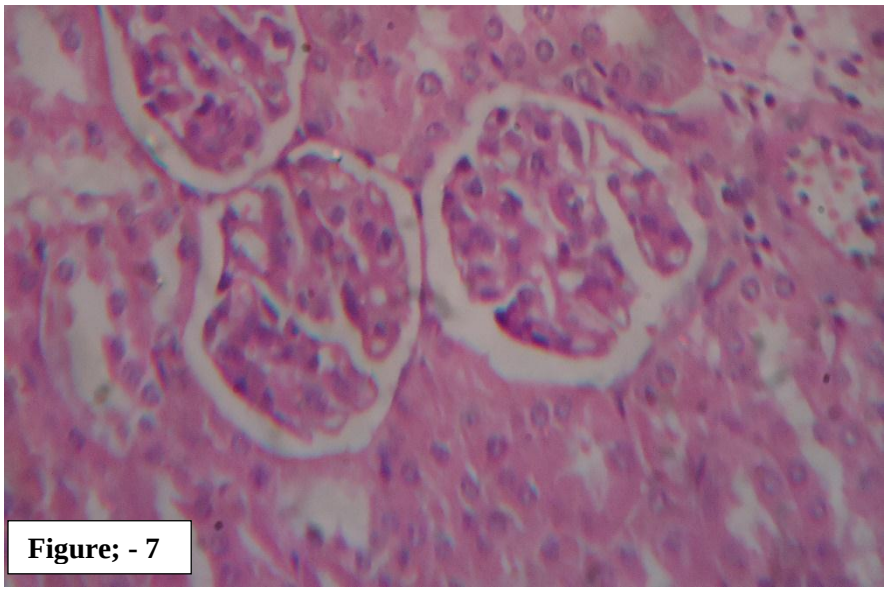
Figure; - 5

Kidney of diabetic mice administrated with *Cinnamomum cassia* for 12 weeks shows restorative effect in capsule with restored glomerulus cytoplasmic material were more restored than nuclear material in PCT & DCT.



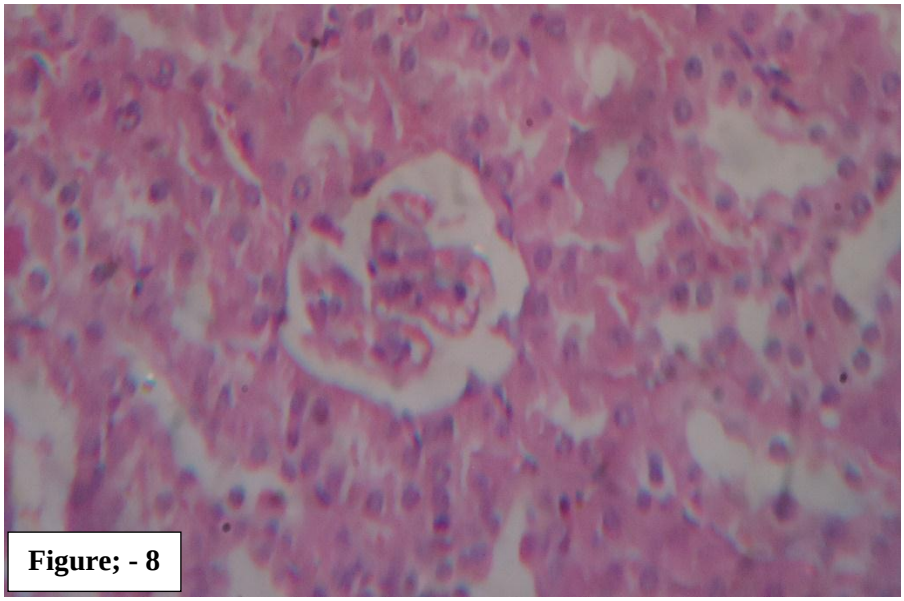
Figure; - 6

Kidney of diabetic mice administrated with *Cinnamomum cassia* for 16 weeks shows well organised glomerulus & women capsule both nuclei & cytoplasmic material in PCT & DCT were well organised in renal cortex.



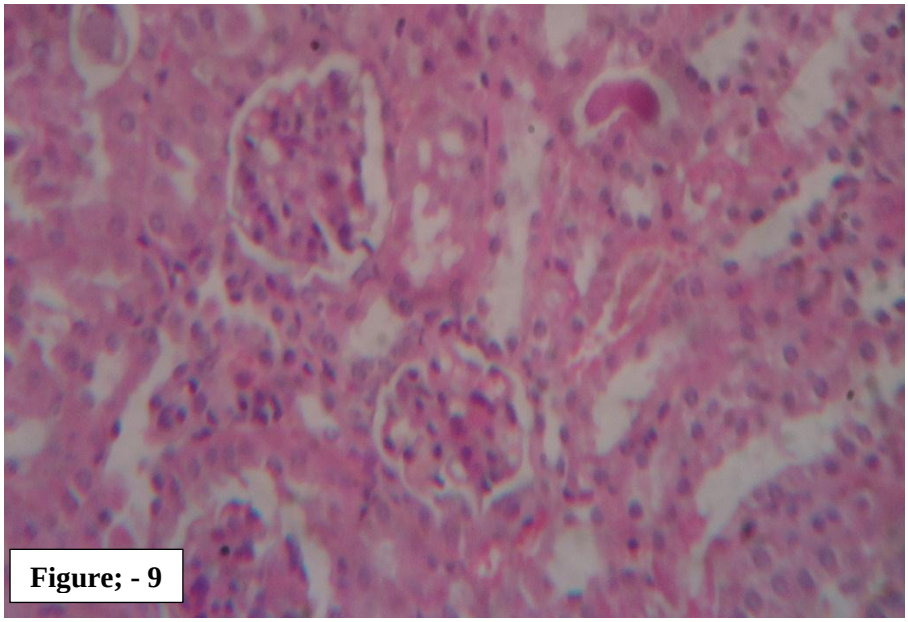
Figure; - 7

Kidney of diabetic mice administrated with *Zingiber Officinale* for 4 weeks shows clustered nuclei were observed in glomerulus with little restoration women capsule were observed in grater extend.



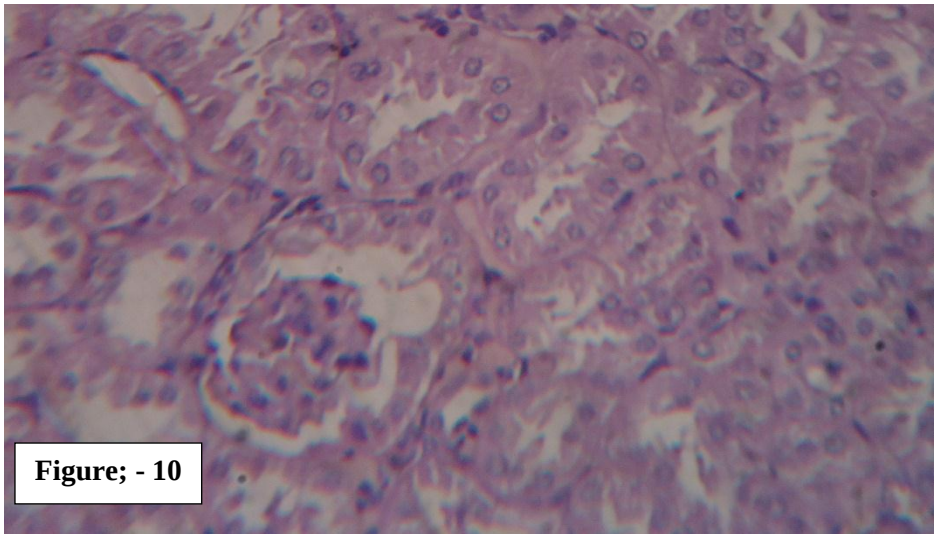
Figure; - 8

Kidney of diabetic mice administrated with *Zingiber Officinale* for 8 weeks shows degenerated glomerulus and dilated women capsule PCT & DCT were observed in degenerated vacuolated space.



Figure; - 9

Kidney of diabetic mice administrated with *Zingiber Officinale* for 12 weeks shows vacuolization in glomerulus with scattered nuclear material lumen of PCT is filled with cytoplasmic devrise clustered nuclei were observed in DCT.



Figure; - 10

Kidney of diabetic mice administrated with *Zingiber Officinale* for 16 weeks shows clustered nuclei in glomerulus women capsule were dilated to greater extend. Degenerated cytoplasmic material were observed in PCT & DCT.

4. DISCUSSION

Treatments of cinnamon extract resulted in the decrease of degenerated parts in the liver with reduction in levels of AST, ALT, and total bilirubin (Moselhy, and Junbi, 2011). Cinnamon methanol extract, respectively, showed a significant decrease in serum urea, creatinine, uric acid, and urine albumin and increase in urine creatinine (Kumar et al 2014). In our study SGPT, Urea and uric acid were increased many folds in diabetic group of mice.

Cinnamon extract was found to improve the histopathological alterations and ALT and AST (Elkomy et al 2016). It also shows a slight, insignificant rise in SGPT, SGOT and ALP, following administration (Anand et al 2010). The renal function showed that an increase in serum urea, creatinine, uric acid, and urine albumin was disrupted by diabetes, cinnamon methanol extract, respectively, showed a significant decrease in serum urea, creatinine, uric acid, and urine albumin and increase in urine creatinine (Mogensen and Christensen 1985, and Kumar et al 2014). In our present study cinnamon causes effective restoration in biochemical parameters of liver and kidney of mice. Pathological changes in the tissues of kidney and pancreas as a result of diabetes whereas treating the cinnamon methanol extract restored the altered tissues nearly to the normal conditions. (Ullah et al. 2012). Cinnamon, have, protecting the renal tubular cells injurious substances glomeruli and tubulointerstitial and blood glucose regulating property. While, nephropathy complications (Tolouian et al 2013 and Gheissari 2012). Kidney tissues showed effective restoration in glomerulus and

bowmen's capsule. PCT and DCT were also restored after cinnamon administration. Ginger significant lowering of serum AST, ALT, ALP and tissue lipid peroxide levels. (Ajith et al. 2007). In our present study SGPT, urea and uric acid were restored effectively in ginger administered group. Extract of ginger showed almost normal morphology and normal architecture of the kidney (Ozturk et al 2003). Ginger reducing proteinuria in diabetic kidney disease *(*Thomson et al. 2013). Ginger administration reduction of blood glucose level, reduction of serum urea and creatinine level *(*Hanna et al., 2014). Ginger was proved more potent Reno protective agent in both acute and chronic renal failure (Mahmoud et al., 2012; Swaroopa, 2013). In our present study renal tubules were effectively restored with little vacuolization in ginger administered group. The decrease in GPX (Glutathione peroxidase) activity was due to lead toxicity. Ginger extract treated groups showed a significant increase of kidney GPX activity (Kikuzaki and Nakatani 1993). In the gingerol treated cells, insulin-touchy glucose take-up was expanded. It is expected that ginger enhances the insulin-sensitivity, and improves chronic disease, such as diabetes (Sekiya et al., 2004).

5. CONCLUSIONS

It is concluded from entire study that cinnamon and ginger both acts very effectively against diabetes on biochemical and histological parameters of mice. Both restore glucose level to normal level. Cinnamon acts effectively on SGPT, Uric acid; Urea while ginger does not effectively restore uric acid and SGPT in diabetic mice. Cinnamon effectively restores glomerulus and bowmen's capsule very well in comparison to ginger administered group. It was evident from study that cinnamon causes effective restoration in both biochemical and histological parameters of mice.

6 REFERENCES

1. World Health Organization. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Report of a WHO Consultation. Geneva: World Health Organization, 1999.
2. Parvanova A., Dimitrov B., Ruggenenti P., Iliev I., Tolecova A., Trevisan R., Remuzzi G. Insulin resistance as a marker of type 2 diabetic nephropathy. Scient conf '20 years Med Fac – St Zagora', 2002 Oct; 18-20, Vol 2: Clin Med.
3. Arikawe AP, Oyerinde A, Olatunji-Bello II, Obika LO. Streptozotocin diabetes and insulin resistance impairment of spermatogenesis in adult rat testis: central Vs local mechanism. Niger J Physiol Sci, 2012; 18(2): 171–179.

4. Trindade AA, Simões AC, Silva RJ, Macedo CS, Spadella CT. Long term evaluation of morphometric and ultra-structural changes of testes of alloxan-induced diabetic rats. Acta Cir Bras, 2013; 28(4): 256–265.
5. MRS Ayyangar, (2016). Cinnamon and honey as cure for many disease & health problems, EBNL, 17 June.
6. Lopez P, Sanchez C, Batlle R, and Nerin C. (2005). Solid- and varpour- phase antimicrobial activities of six essential oils: susceptibility of selected foodborne bacterial and fungal strains. J. Agric Food Chem, 53: 6939-6946.
7. Alqasoumi, S.; Al-Dosary, M.; Al-Yahya, M.; Al-Mofleh, I. *(*2011). Gastroprotective effect of a popular spice cinnamon "*Cinnamomum zeylanicum"* in rats. Eur. J. Pharmacol, 668, e42.
8. Hyeon K, Hee-Juhn P, Hyun-Ju J, Jong-Won C, Kyu-Seok C, Joohun H et al. Cin-namaldehyde induces apoptosis by ROS mediated mitochondrial permeability transi-tion in human promyelocytic leukemia HL-60 cells. Cancer Lett, 2003; 196: 143-52.
9. Harikrishnan R, Balasundaram C, Heo MS. Impact of plant products on innate and adaptive immune system of cultured finfish and shellfish. Aquaculture, 2011; 317: 1-15.
10. Shubha Ratna Shakya, Medicinal uses of ginger (*Zingiber officinale* Roscoe improves growth and enhances immunity in aquaculture. International Journal of Chemical Studies; 2015; 3(2): 83-87.
11. Banji D, Banji OJF, Pavani B, Kranthi Kumar C, Annamalai AR. Zingerone regulates intestinal transit, attenuates behavioral and oxidative perturbations in irritable bowel disorder in rats, Phytomedicine, 2014; 21(4): 423-429.
12. K. Kumar, A. Issac, E. Ninan, R. Kuttan, and B. Maliakel, "Enhanced anti-diabetic activity of polyphenol-rich de-coumarinated extracts of Cinnamomum cassia," Journal of Functional Foods, 2014; 10: 54–64.
13. Moselhy, SS. and Junbi, HH. Antioxidant properties of ethanolic and aqueous Cinnamon extracts against liver injury in rats. Interna. J. of Advances in Pharma. Sci, 2011; 1(2): 151-155.
14. Elkomy A, Aboubakr M, Soliman A, Abdeen A, Abdelkader A, Hekal H. Paracetamol Induced Hepatic Toxicity and Amelioration by Cinnamon in Rats, Int. J. of Pharmacol. And Toxicol, 2016; 4(2): 187-190.
15. Anand P, Murali K, Tandon V, Murthy PS, Chandra R. Insulinotropic effect of cinnamaldehyde on transcriptional regulation of pyruvate kinase, phosphoenolpyruvate

carboxykinase, and GLUT4 translocation in experimental diabetic rats. Chemico-Biolog Interact, 2010; 186: 72–81.

16. C. E. Mogensen and C. K. Christensen, "Blood pressure changes and renal function in incipient and overt diabetic nephropathy," Hypertension, 1985; 7(6): 2. II64–II73.
17. N. Ullah, M. A. Khan, T. Khan, and W. Ahmad, "Bioactive traditional plant Cinnamomum zeylanicum successfully combat against nephrotoxic effects of aminoglycosides," Bangladesh Journal of Pharmacology, 2012; 8(1): 15–21.
18. Tolouian R, Hernandez GT. Prediction of diabetic nephropathy: The need for a sweet biomarker. J Nephropathology, 2013; 2: 4-5.
19. Gheissari A, Javanmard SH, Shirzadi R, Amini M, Khalili N. The effects of blocking Angiotensin receptors on early stages of diabetic nephropathy. Int J Prev Med, 2012; 3: 477-82.
20. Ajith TA, Nivitha V, Usha S. Zingiber officinale Roscoe alone and in combination with alpha-tocopherol protects the kidney against cisplatininduced acute renal failure. Food Chem Toxicol, 2007; 45: 921-927.
21. Thomson, M.; Al-Qattan, K.K.; Divya, J.S. and Ali, M.: Ameliorative actions of garlic (Allium sativum) and ginger (Zingiber officinale) on biomarkers of diabetes and diabetic nephropathy in rats: comparison to aspirin. Interna J of Pharma, 2013; 9: 501- 512.
22. Hanna, E.T.; Aniess, W.I.M.; Khalil, A.F.; Abdalla, E.S.; Hassanin, E.A. and Nagib, E.W. The effect of ginger and thyme on some biochemical parameters in diabetic rats. IOSR J of Pharm and Biological Sci, 2014; 9(3): 54-61.
23. Mahmoud, M. F., Diaai, A. A., & Ahmed, F. Evaluation of the efficacy of ginger, arabic gum, and boswellia in acute and chronic renal failure. Renal Failure, 2012; 3473-82. http://doi.org/10.3109/0886022X.2011.623563
24. Swaroopa, M. Effect of ginger extract consumption on renal function during ethanol withdrawal induced-stress. International Journal of Innovative Research in Science, Engineering and Technology, 2013; 2: 6412-6418. Retrieved from http://www.rroij.com/open-access/effect-of-ginger-extract-consumption-on-renal-function-during-ethanol-withdrawal-inducedstress-.php?aid=48208
25. Kikuzaki H, Nakatani N. Antioxidant effects of some ginger constituents. J Food Sci. 1993; 58: 1407–1410. doi:10.1111/j.1365-2621.1993.tb06194.
26. Sekiya K, Ohtani A, Kusano S. Enhancement of insulin sensitivity in adipocytes by ginger. Biofactors, 2004; 22(1-4): 153-156.