**EFFECT OF MOMORDICA CHARANTIA ON VISCERAL ORGANS WEIGHT, SERUM BIOCHEMISTRY AND LIVER HISTO-MOPHOMETRICS OF MONOSODIUM GLUTAMATE DIABETES INDUCED GUINEA PIGS**

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**Abstract**

This study was designed to evaluate the effect of *Momordica charantia* on visceral organ weight, serum biochemistry and liver tissue histo-morphometric of monosodium glutamate induced guinea pigs. A total of twenty four (24) apparently healthy guinea pigs were randomly allotted into four treatment consist of 0g. 0.50g, 1g and 1.5g/ kg diet of *M.* charantia guinea after 5 days monosodium glutamate administration. The result were analyzed using analysis of variance (ANOVA) and separated using Duncan multiple range test of Genstat statistical software. The result showed that *M charantia* supplementation had significantly (P<0.05) influenced liver and spleen weight while no significant (P>0.05) changes were noticed in kidney, heart and bile weight. The result revealed that there significant (P<0.05) differences in alkaline phosphatase with the highest value in T4. Histologically, *M. charantia* had a profound effect on hepatocytes, hepatocytes height, cholangiocytes, Kupffer`s cells, stellate cells, endocthelial cells and bile canaliculi. It was concluded that supplementation of *M. charantia* on monosodium glutamate diabetic induced guinea pigs had influence in reducing the damaging effect visceral, modulate the serum biochemical profile and play integral role in increasing liver cells and other hepatic tissue cells. It is therefore, recommended that inclusion of 1g/kg diet of *M. charantia* is safe and can be used to improve visceral organs weight, serum biochemistry and hepatic histological morphology.

**Introduction**

Diabetes is a chronic health with devastating, yet preventable consequences. It is characterized by high blood glucose levels resulting from defects in insulin production, insulin action or both (Langford et al., 2007). Sodium glutamate, also known as monosodium glutamate, is a flavor enhancer that is widely used in the food industry to improve the taste of various dishes. However, its excessive consumption has been associated with adverse health effects, including metabolic disturbances. Experimental studies in animal models, such as rabbits, have revealed a link between sodium glutamate intake and the development of hyperglycemia, insulin resistance, and disturbance in glucose metabolism (Xiong *et al.,* 2009). Beside its flavor enhancing effects monosodium glutamate has been linked with obesity, metabolic disorders, Chinese restaurant syndrome, neurotoxic effects and detrimental effects on the reproductive organs (Kamal *et al.,* 2018). Results from both animal and human studies have demonstrated that administration of even the lowest dose of monosodium glutamate has toxic effects (Kamal *et al.,* 2018).

There is need to explore alternative methods of treatment of diabetic that are effective, cheaper and readily available for the populace considering the high rate of diabetics in the world today.

For the present study, *M. charantia (Ccurbitaceae)* was chosen since it is the most greatly inspected and most widely acclaimed remedy for the management of diabetes since ancient times. *M. charantia* also referred to as bitter melon, bitter gourd or karela (Behera *et al.,* 2008). Scientific research have proved the potential of *M. charantia* has anti-diabetic effect due to the its insulin-like principle which is often being designated as plant insulin, which has positive effects in lowering the blood and urine glucose content (Janagal *et al.,* 2018).

Due to the insulin-like metabolites contained in *M. charantia*, it was believed to have counteractive effect against the damaging effect of diabetics. Therefore, the objectives of this paper was to determine the effect of *M. charantia* on monosodium glutamate induced diabetic guinea pigs on serum biochemistry, visceral organ weight and physical pathologies and liver histo-morphometric.

**Materials and methods**

This study was carried out at Micro-livestock Unit of Prof. Lawal Abdu Saulawa Livestock Teaching and Research Farm, Department of Animal of Animal Science Federal University Dutsin-Ma Katsina State, Nigeria. The farm is situated in Latitude 11o22`N and Longitude 7o33`E in the Sudan Savannah ecological zone of Nigeria. A total number of twenty four (24) guinea pigs were randomly allotted into four treatment groups consist of three replicate with two guinea pigs per replicate. The guinea pigs were induced with monosodium gluatamate orally via drinking water for a period of two weeks and suspended when their sugar level was high. Treatment 1 is the control without monosodium glutamate inducement while T2, T3 and T4 consist of 0.50g, 1 and 1.5g/kg diet of *M. charantia* powder mixed thoroughly in the feed and fed to the guinea pigs for six weeks. At the end of six weeks three guinea pigs one from each replicate were randomly selected for blood samples collection, visceral organ and hepatic tissue histo-morphometeric determination. The data obtained were subjected to analysis of variances (ANOVA) where treatment means were separated using Duncan Multiple Range Test of Genstat Statistical Software.

**Result and Discussion**

**Effect of *M. charantia* on Diabetic Induced Guinea pigs visceral organs weight**

The result on the effect of *M. charantia* on Diabetic induced guinea pigs visceral organs weight were presented in table 1 below. The result revealed that there were significant (P<0.05) differences in liver and spleen weight. Higher liver and spleen weight were recorded in T3 with 30.150g and 0.400g for liver and spleen respectively. The significant (P<0.05) of these internal organs could be due to the variation of physiological activities of the organs caused by the varied level of inclusion of *M. charantia* in the diet across treatment groups. The weight of spleen and liver reported in this study were similar to the findings of Okpanachi (2008).

The result further showed that there were no significant (P>0.05) differences in the heart, kidney and bile parameters although there were numerical differences between the treatments. The result were in agreement with Haruna and Muhammad (2018) where the visceral organs values fall within the values reported in this study.

**Table 1: Effect of *M. charantia* on Diabetic Induced Guinea pigs visceral organs weight**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters | T1 | T2 | T3 | T4 | SEM | LOS |
| Liver (g) | 23.500b | 21.450b | 30.150a | 19.800b | 1.648 | \* |
| Heart (g) | 2.350a | 2.350a | 3.150a | 2.400a | 0.243 | NS |
| Kidney (g) | 6.500a | 6.900a | 8.000a | 5.550a | 0.841 | NS |
| Spleen (g) | 0.300ab | 0.150b | 0.400a | 0.300ab | 0.056 | \* |
| Bile (g) | 0.400a | 0.450a | 0.350a | 0.200a | 0.079 | NS |

Table 2 showed the patho-anatomical changes observed in the visceral organs of diabetic induced guinea pigs treated with *M. charantia*. Liver congestion and change in liver colour were recorded in monosodium glutamate diabetic induced guinea pigs fed *M. charantia* in T3 and T4. Slightly kidney hyperthrophy, excessive changes in the bile colour, congested lungs with heamatoma were found in guinea pigs of T4.

**Table 2: Physical Anatomical Changes observed in Visceral of Diabetic induced guinea pigs treated with *M. charantia***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tissue | T1 | T2 | T3 | T4 |
| Liver | No visible lesion, no necrosis but liver color turned dark brown | The hepatic tissue is alright without swollen, odour or fluid accumulation only liver excessively dark brown | No visible lesion only liver discolorations was observed | Hepatic congestion and dark brown coloured |
| Kidney | Swollen and hypertrophy kidney was observed | Kidney was swollen with renal congestion | No visible lesion | Kidney was slightly found to have hypertrophy  |
| Heart | No pathological changes in cardiac tissue | No pathological changes in cardiac tissue | Cardiac tissue was apparently normal | No pathological changes in cardiac tissue |
| Spleen | No changes | Swollen and distension of spleen was noticed | No visible lesion | No visible lesion |
| Bile | No clear pathological changes | No visible lesion | Changes in colouration of bile fluids | Excessive changes in bile content |
| Lungs | There were necrosis, distension and heamatoma in the lungs | Visible necrosis, changes in lungs colour and lesion were noticed | Excessive discolouration and heamatoma | The lungs are congested, presence of heamatoma and undefined colour |

**Effect Momordica charantia on serum biochemistry profile of Monosodium glutamate diabetic induced guinea pigs**

Evaluation of serum biochemical profile are usually related to health status and are of diagnostic importance in clinical evaluation of the state of health. It serves as indicator of physiological, welfare assessment, pathological and nutritional status of an animal (Okoruw and Ihimioya, 2014). The result on the effect of *M. charantia* in serum biochemical profile of diabetic induced guinea pigs were presented in table 3 below. The result clearly indicated that there were significant (P<0.05) differences in alkaline phosphatase were T4 had the highest level of alkaline phosphatase (78.81 iu/l) while lowest were recorded in T1 (57.50 iu/l). The result revealed that alanine aminotransferase were significantly (P<0.05) increased with increases level of *M. charantia* in which highest value were obtained in T4 followed by T3, T2 while lowest recorded in T1. Being aspartate aminotransferase as an enzymes that are released into the blood when certain organs or tissues, particularly the liver and heart are injured were found not significantly (P>0.05) affected in this study. The result revealed that albumin was significantly (P<0.05) increases with increasing levels of *M. charantia* in the current study and this may be attributed to the *M. charantia* effect since albumin is one of the the plasma protein that are synthesized in the liver and is responsible for nearly 80% of the colloid osmotic pressure of the intravascular fluid, which maintains the appropriate fluid balance in the tissue. Albumin has the capacity to bind and transport various substances in the blood such as thyroid hormones, unconjugated bilirubin, fat-soluble hormones and others. The plasma total protein values falls within the normal ranges reported by Williamson and Festing (1971) and Hill et al. (2003) 4.6 - 6.2g/dl and 5.66 – 5.94g/dl respectively. The high level of ALT and AST observed in this study supported the findings Bashandy and Alwasel (2011). The total protein and globulin were found not have significant (P>0.05) differences in this study.

Information on the plasma electrolytes is very essential due to the fact that electrolytes serves as an essential components in numerous process. However, the creatinine, and potassium were not significantly (P>0.05) change while plasma urea were statistically (P<0.05) different in this study.

**Table 3: Effect Momordica charantia on serum biochemistry profile of Monosodium glutamate diabetic induced guinea pigs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters | T1 | T2 | T3 | T4 | SEM | LOS |
| Alkaline phosphatase (iu/l) | 57.50a | 69.45b | 72.68b | 74.81b | 2.823 | \* |
| Alanine aminotransferase (iu/l) | 22.80a | 24.11a | 31.52ab | 37.89b | 3.66 | \* |
| Aspartate aminotransferase (iu/l) | 40.50a | 38.00a | 22.50a | 25.00a | 94.3 | NS |
| Albumin (g/dl) | 2.660a | 2.999ab | 3.636b | 3.034ab | 0.246 | \* |
| Creatinine (µmol/l) | 1.300a | 0.800a | 0.655a | 1.025a | 0.353 | NS |
| Globulin (g/dl) | 2.855a | 2.660a | 2.935a | 2.140a | 0.389 | NS |
| Total Protein (g/dl) | 5.515a | 5.659a | 6.600a | 5.174a | 0.567 | NS |
| Potassium | 48.75a | 24.50a | 14.75a | 18.75a | 24.10 | NS |
| Urea (nmol/l) | 9.125b | 7.700ab | 6.000a | 9.110b | 0.850 | \* |

 **Effect Momordica charantia on liver tissue histo-morphometric of Monosodium glutamate diabetic induced guinea pigs**

The result of hepatic tissue histo-morphometric of diabetic induced fed *M. charantia* showed significant (P<0.05) difference in all hepatic tissue cells except for the bile canaliculi which revealed no significant (P>0.05) differences as presented in table 4 below. The hepatocytes had the highest numerical valus of 12.00 mm2 at T3 and AT4 while lowest value were obtained in T1 (6.00mm). The highest numerical hepatocytes height were obtained in T2 (123.0µm) and the lowest in T3 (103.0µm). the result further indicated that cholongiocytes, stellate cells and endothelial cells obtained the highest numerical value of 3.000, 1.000 and 3.000 respectively in T3 while the kupffer`s cell, bile canaliculi and sinusoids processed the highest numerical values in T4.

**Table 4: Effect Momordica charantia on liver tissue histo-morphometric of Monosodium glutamate diabetic induced guinea pigs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters | T1 | T2 | T3 | T4 | SEM | LOS |
| Hepatocytes (mm2) | 6.00a | 7.00b | 12.00a | 12.00a | 0.001 | \* |
| Hepatocytes height (µm) | 120.0b | 123.0a | 103.0b | 104.0c | 0.325 | \* |
| Cholongiocytes | 2.000b | 0.000d | 3.000a | 1.000c | 0.231 | \* |
| Kupffers cells | 4.00d | 27.00c | 31.00b | 47.00a | 0.005 | \* |
| Stellete cells | 0.000b | 0.000b | 1.000a | 0.000b | 0.000 | \* |
| Endothelial cells | 2.000b | 2.000b | 3.000a | 2.000b | 0.000 | \* |
| Bile Canaliculi | 0.00a | 0.000a | 0.000a | 0.000a | 0.000 | NS |
| Sinusoids | 3.000d | 7.000b | 6.000c | 17.000a | 1.432 | \* |

**Conclusion**

It could be concluded that *M. charantia* can be used to modulate and normalized some serum biochemical parameters in diabetic induced guinea pigs. Supplementation of *M. charantia* have influenced in reducing visceral organs damage and significant pathological lesion in diabetic induced guinea pigs. It also play significant role in the improvement of liver cells (hepatocytes) and other cells that play a significant immunocompetent role such as cholangiocytes and kupfffer`s cells. It is therefore recommended that *M. charantia* can be used up to 1g/kg diet in order to improve visceral, serum biochemistry and other lymphoid organs of hyperglycemic animals.

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