EVALUATION OF SODIUM GLUTAMATE INDUCED DIABETIC GUINEA PIG TREATED WITH *Momordica charantia* ON LYMPHOID ORGAN RESPONSES

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ABSTRACT
This study investigated the effects of sodium glutamate and Momordica charantia (bitter melon) on the lymphoid organs of induced Diabetic guinea pigs. The guinea pigs were randomly allotted to four dietary treatment T1, T2, T3, and T4 compromising of 6 guinea pigs treatment and replicated thrice with two guinea pigs per replicate. After eight weeks of treatment, the 2 guinea pigs from each treatment were euthanized and their spleen, bile, kidney, heart and lungs were collected and weighed. The results showed Effect of sodium glutamate induced Diabetic guinea pig treated with Momordica charantia on lymphoid responses. The key findings indicated that there were no significant differences in liver (insert value), spleen (insert value) kidney, bile, and heart weight. The gross anatomical and pathological lesions observed shows that T4 had the highest occurrence of pathological changes in lymphoid organs and hepatic tissues was observed to have no fluid accumulation, pus, and odor while kidney and lungs were found to have necrosis, swollen and heamatoma. It was observed that liver was looking excessively dark brown in color in most of the treatment. Momordica charantia were found to have profound effect on hepatocytes, hepatocytes height, cholangiocytes, kuffers cells, endothelial cells and sinusoids.
Keywords: Sodium glutamate, Diabetic Guinea pig, *Momordicata charantia*, Lymphoid organ

INTRODUCTION

Diabetes has been one of the metabolic diseases with typical hyperglycaemia manifestations, such as polydipsia, polyphagia, polyuria, impaired vision and body weight (Zhuo, *et al.,* 2020). As a result, this brings about an increase of high-caloric dietary intake and sedentary lifestyle, the number of diabetic patients has increased in geometrical progressive mode. A statistical from the World Health Organization in 2016, shows that, 422 million people had diabetes in 2014, this incidence has increased significantly since 1980 (WHO, 2016). Diabetes is generally divided into four categories: type 1 diabetes (T1DM) (autoimmune β-cell destruction usually accompanied by absolute insulin deficiency), type 2 diabetes (T2DM) (a gradual decrease in β-cell insulin secretion), gestational diabetes, and specific types of diabetes (ADA, 2018). The disease is so chronic that it can even damage the heart and blood vessels of any living organism (Sarwar *et al.,* 2010), ocular surface (Markoulli *et al.,* 2018), nerves (Rojas *et al.,* 2019), and musculoskeletal system (Zamfirov and Philippe, 2017) slowly and has become the important cause of kidney failure and blindness (Koye *et al.,* 2018; Bourne *et al.,* 2013). Insulin injection and oral hypoglycaemic agents are always used to reduce blood glucose levels. Also, how lifestyle is been managed is also recommended essentially (Zhuo, *et al.,* 2020). Nevertheless, poor medication compliance (Swiatoniowska *et al.,* 2019) and scarce access of huge populations to conventional antidiabetic drugs, together with the unavoidable side effects and resistance of western medicine (Thent *et al.,* 2018), a lot of effort is been made by many patients to find some effective natural plants, for instance, Indian Ayurvedic medicine, African traditional medicine, Japanese Kampo medicine, and Chinese herbs (Furman *et al.,* 2020).
Momordica charantia L., also known as bitter melon, is an annual climbing plant of the family *Cucurbitaceae* (Zhuo, *et al.,* 2020). It is native to East India and is widely grown and eaten in tropical, subtropical, and temperate regions all over the world (Zhuo, *et al.,* 2020). The vegetable is light green in colour having a long cone shape; it tastes bitter yet, popular for its various benefits (Palamthodi and Lele, 2014).

MATERIAL AND METHODS

The experiment was conducted in the Livestock Teaching and Research Farm, Federal University Dutsin-Ma, Katsina State. A total of 24 Guinea pigs were used for this experiment which lasted for 2months the Guinea pigs were randomly allotted to four (4) dietary treatments as T1, T2, T3, and T4 compromising of 6 Guinea pigs per treatment and replicated thrice with two Guinea pigs per replicate in a completely randomized design (CRD). The Guinea pigs were induced with sodium glutamate (Ajinomoto) for a period of 5days, the sodium glutamate was giving at a rate of 0g/500ml/kg, 2.5g/500ml/kg, 5g/500ml/kg, and 7.5g/500ml/kg. Then *Mormodica charantia* powder was giving at a rate of 0g/kg, 0.5g/kg, 0.10g/kg, and 0.15g/kg diet as T1, T2, T3, and T4 respectively. *Mormodica charantia* used in this study was sourced directly from Wednesday weekly market of Dutsin-Ma Local Government Area, dried and grounded into powdery form before being incorporated into the diets accordingly. All management practices were strictly adhered to throughout the period of the experiment.

Data were collected on the following growth parameters. Initial body weight(g/bird), Final body weight, gain (g/bird), Total body weight gain(g/bird), Average daily body weight gain(g/bird), Daily feed intake(g/bird), Total feed intake(g/bird) and Feed conversion ratio. All data obtain were subjected to the analysis of variance according to steel and Torrie (1980) and the means were separated using Duncan Multiple Range Test according to Duncan.

RESULTS AND DISCUSSION

The result of growth performance of Guinea pig is presented in table 1 below. The result revealed that there was significant (P>0.05) difference in initial body weight of the Guinea pigs, with T4 and T1 having the highest weight (307.3 and 302.0 g/kg) among the treatments. The results of the final body weight obtained revealed that, there were significant (P>0.05) differences across the treatments, where T1 had superior final body weight (323.3 g/kg) as compared to T2, T3 and T4 (255.3, 278.7 & 227.0 g/kg) having the lowest values obtained. However, the weight gain revealed that T4 had the highest weight gain (80.33 g/kg) which made it significantly (P>0.05) difference from the rest of the treatments. There were significant (P>0.05) differences across all the treatments in terms of feed intake, with T3 having the highest (44.17 g/kg) volume of feed consumed whereas, T4 had superior (2.370 g/kg) feed conversion ratio. The result of the present study was not in conformity with the finding of Guan *et al.* (2023) who recorded lower initial body weight of (154.8 kg/pig) on Pig fed diet containing *Momordica charantia.* But recorded higher final body weight of (723.0 kg/pig) and higher average weight gain of (962.154 kg/pig) with lower feed intake of (13.662 kg/pig). However, the feed conversion ratio recorded was similar to feed conversion ratio obtained in the present study (2.39).

Table 1: Growth Performance of Guinea pigs

Parameters	T1	T2	T3	T4	SEM	LOS
Initial weight k/dkg	302.0^{a}	235.3^{c}	262.7^{b}	307.3^{a}	51.9	NS
Final weight k/dkg	323.3^{a}	255.3^{b}	278.7^{b}	227.0^{c}	52.9	NS
Weight gain k/dkg	21.33^{a}	20.00^{a}	16.00^{a}	80.33^{b}	10.21	*
Feed intake k/dkg	35.00^{a}	35.50^{a}	44.17^{b}	33.92^{a}	1.553	*
FCR	0.606^{a}	0.553^{a}	0.363^{a}	2.370^{b}	0.306	*

$^{a-b}$ means within rows bearing different superscripts differs significantly at $p > 0.05$; NS= not significant differences (p<0.05) *= significant differences (<0.05) SEM= standard error of means. LSD= least significant differences

Effect of *Mormodica charantia* on Viscerals of Induced diabetic Guinea Pigs

The result of the effect of *Momordica charantia* of visceral organs on induced diabetic guinea pig were presented in table 2 below. The result revealed that there were no significant (P<0.05) differences across all the treatments. The result was in agreement with the findings of Haruna and Muhammed (2018) who reported that the visceral values fall within the values reported in the present study.

Table 2: Effect of *Mormodica charantia* on visceral organs of induced diabetic Guinea pigs

Parameters	T1	T2	T3	T4	SEM	LOS
Liver (g)	11.250	8.500	8.250	8.750	2.038	NS
Spleen (g)	0.600	0.500	0.500	0.400	0.180	NS
Bile (g)	0.150	0.200	0.150	0.150	0.043	NS
Heart (g)	1.350	1.050	1.600	1.050	0.290	NS
Kidney (g)	1.300	1.300	1.150	1.200	0.207	NS

$^{a-b}$ means within rows bearing different superscripts differs significantly at $p > 0.05$; NS= not significant differences (p<0.05) *= significant differences (<0.05) SEM= standard error of means. LSD= least significant differences.

The effect of *Momordica charantia* on visceral weight of induced diabetic Guinea pig is presented in table 3 below. The result showed that there were no significant (p<0.05) differences across all the treatments. but there were numerical differences among them**.**

The result of the present study was not in conformity with the finding of Yahayya *et al.* (2024) who reported significant (P<0.05) differences in liver and spleen weight. Yahayya *et al.* (2024) restated that the significant (P<0.05) of these internal organs might be attributed to variation of physiological activities of the organs due to the varied level of inclusion of *M. charantia* in the diet across all the treatments. The findings of Yahayya *et al.* (2024) further indicated a contradicting value were no significant (P>0.05) differences were recorded in the heart, kidney and bile parameters. The result was in agreement to the findings of Haruna and Muhammad (2018) where the visceral organs values fall within the values reported in this study.

Table 3: Effect of *Momordica charantia* on The Visceral Weight of Induced Diabetic Guinea Pig

Parameters	T1	T2	T3	T4	SEM	LOS
Bile (g)	0.150	0.200	0.150	0.150	0.061	NS
Spleen (g)	0.600	0.500	0.500	0.400	0.225	NS
Liver (g)	11.250	8.500	8.250	8.750	2.880	NS
Heart (g)	1.350	1.050	1.600	1.050	0.411	NS
Kidney (g)	1.300	1.300	1.150	1.200	0.294	NS

[a-b] means within rows bearing different superscripts differs significantly at $p > 0.05$; NS= not significant differences (p<0.05) *= significant differences (<0.05) SEM= standard error of means. LSD= least significant differences.

CONCLUSION

It could be concluded that *M. charantia* can be used to modulate and normalized growth performance, carcass characteristics parameters in diabetic induced guinea pigs with little or no detrimental effect. Supplementation of *M. charantia* have influenced in reducing visceral organs damage and significant pathological lesion in diabetic induced guinea pigs. It also plays significant role in the improvement of liver cells (hepatocytes) and other cells that play a significant immunocompetent role such as cholangiocytes and Kupffer's cells. It is therefore recommended that *M. charantia* can be used up to 1g/kg diet in order to improve the performance, visceral, and other lymphoid organs of hyperglycemic animals.

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