HYPOGLYCEMIC EFFECT OF CAMEL MILK ON MONOSODIUM GLUTAMATE DIABETES INDUCED-RABBITS

Sanusi AZ.[1*], Yahaya M.A.[1], Jamilu R.Y. [1], Asambe A. [1], and Felicia J. [1]

[1] Department of Animal Science, Federal University Dutsinma

* Corresponding Author email: usalisu@fudutsinma.edu.ng

ABSTRACT

The hypoglycemic efficacy of camel milk on monosodium glutamate diabetes induced-rabbits was evaluated in this study. 20 Adult male rabbits weighing between 1.2 - 1.7 kg were randomly distributed into four groups of five rabbits each. Diabetes was induced using monosodium glutamate (MSG) at a dose of 6.66mg/ml of drinking water given ad libitum for two weeks to rabbits in three groups (T2, T3 and T4). T1 served as control and received no MSG. Diabetic state was confirmed using a glucometer (Accu-check® and Accu-check test strips). Two diabetic groups of rabbits received raw camel milk T2 and T3 while one diabetic group (T4) of rabbits received Glucophage®. T2 received 2.5mls of raw camel milk daily for 2 weeks while T3 received 5mls of raw camel milk daily for the same duration. Rabbits in T4 were treated with 18.75 mg/kg of Glucophage daily. It was noted that MSG led to increase in body weight of the diabetic rabbits. Rabbits in T4 showed most significant decline in blood glucose levels followed by T3. T2 recorded the least decline in blood glucose. It was concluded that camel milk had a significant hypoglycemic effect at 5ml/day on diabetic rabbits and it was recommended that further studies be carried out to determine if camel milk has hypoglycemic effect on diabetic patients and the optimal amount of camel milk that averts hyperglycemia as well as to establish the mechanism of action of this hypoglycemic effect.

KEY WORDS – Rabbits, camel milk, hypoglycemia, monosodium glutamate

INTRODUCTION

Diabetes is a chronic health problem with devastating, yet preventable consequences. It is characterized by high blood glucose levels resulting from defects in insulin production, insulin action, or both (Onkamo et al., 1999). The incidences of diabetes mellitus have been increased worldwide (Onkamo et al., 1999). The global prevalence of DM for all age groups was estimated at 2.8% in 2000, and is expected to rise to 4.4% in 2030 (Wild,2004). A major part of this increase is expected to occur in Third World countries with the number of diabetics increasing to 35% in 2025 among those aged 20 years or older.

Prevention and early treatment are important because diabetes interrupts normal development in children and carries the threat of severe complication in the more active period of life (Dahl Quist, 1999). Its primary treatment is insulin replacement, however, at present, entire physiological insulin replacement cannot be achieved in clinical practice and metabolic disturbances cannot be normalized. There is a growing worldwide trend that camel milk consumption helps in prevention and control of diabetes (Malik et al 2012).

Diabetes is a chronic disease for which control of the condition demands patient self-management (Langford et al, 2007). Although new treatments and technology have aided in controlling the disease in many individuals, the challenges of diabetes self-management are overwhelming for most.

Thus there is need to explore alternative methods of treatment of diabetes that are effective, cheaper and readily available for the populace considering the high rate of diabetes in human beings. Rabbits serve as excellent models for human studies. Hence this study to explore the possibilities of the use of camel milk as one of such new means for the controlling diabetes mellitus.

MATERIALS AND METHODS

Study Area

The study was conducted at Teaching and Research Farm Department of Animal Science, Federal University Dutsinma, Katsina State, Nigeria. Dutsin-Ma is a Local Government Area (LGA) in Katsina State, Nigeria. It lies on latitude 11^{o}22’48.684 N and longitude 7^{o}33’21.0024 E. The town is located in the central part of Katsina state, bounded to the west with Safana Local Government to the south by Danmusa Local Government, to the north by Kurfi and to the east by Charanchi Local Governments. The population of Dutsin-Ma Local Government at the 2006 census was 169,671 and the local government has an area of 527km (Tiri *et al*, 2014).

Experimental Animals and Their Management

Twenty (20) adult male rabbits of mixed breeds weighing 1.2-1.7kg sourced from the National Animal Production Research Institute (NAPRI) were used for the study. The rabbits were housed intensively in well-constructed hutches that are made of wire and wood with trays to collect the feces for easy cleaning of the hutches. Five rabbits were kept in a hutch. Each hutch was equipped with a feeder and drinker. All management protocols were adhered to. The rabbits were conditioned for two weeks before the experiment was started.

Experimental Layout

A complete randomized design (CRD) was used for the study. Twenty adult male rabbits of mixed breeds were randomly divided into four treatment groups of five each.

Control group – were given feed and water ad libitum without monosodium glutamate

Treatment 1, 2 and 3 were given feed and water ad libitum and then induced with diabetes using MSG at dose of 6.6mg/ml of drinking water from weeks 3-6 and treated using 2.5ml/kg bodyweight of camel milk, 5ml/kg bodyweight of camel milk and 18.75 g of Glucophage® respectively for weeks 7 and 8 of experiment.

The feed used for this experiment and the monosodium glutamate (Aijonomoto®) and camel milk were sourced locally. The diet, which consisted of grower mash, groundnut hay and vegetables, and water was provided and libitum. Before the rabbits were induced with diabetes blood sample was collected randomly from three rabbits in each treatment to check the glucose levels.

Sample Collection

Blood sample was obtained via the ear vein using a syringe and needle. The blood glucose levels were determined using glucometer (Accu-chek® Active glucometer and test strips). The samples were collected randomly from three rabbits in each group weekly.

Data Analysis

All data generated was presented using descriptive statistics in charts and tables. One-way ANOVA (analysis of variance) shall be used to check for difference between categorical variables using statistical analysis software (SAS) version 9.0. P values of <0.05 were considered significant.

RESULTS AND DISCUSSION

Blood Glucose levels of Monosodium Glutamate Diabetes Induced-Rabbits

The normal glucose levels of the experimented rabbits ranged from 30-45 mg/dl at first week of acclimatization (Table 1). Following administration of monosodium glutamate it ranged from 50-100mg/dl in the first week and from 120-150mg/dl at second week of monosodium glutamate administration. There was a significant difference ($P < 0.05$) between blood glucose levels of MSG treated groups and the control. This was in tandem with the work of Zahra Bahadoran *et al, (2009*) who induced mice with diabetes using monosodium glutamate and achieved increase glucose levels.

Table 1: Blood glucose levels of monosodium glutamate induced-rabbits

Groups	Initial Glucose levels mg/dl (mean)	1st week Glucose levels mg/dl (mean)	2nd week Glucose levels mg/dl (mean)
Treatments	37.66[a]	71.66 [a]	95.66[a]
Control	36.66[a]	37.00[b]	37.33[b]
SEM	2.23	4.27	5.95

*Values with same superscripts are not statistically significant.

Table 2 shows the effect of MSG on weight gain in rabbits. Rabbits in Treatments 1-3 that received MSG at 6.66mg/ml recorded higher weight gain than the control group which did not receive MSG (Table 2). However there was no statistical significance observed for this finding (Table 2). Weight gain is a common symptom of diabetes which may be as the result of the cells converting the unutilized glucose into fat for a long-term storage.

These findings are in agreement with those of Zahra *Bahadoran et al, (2009*) and Jianpu *et al.*, (2010) that induced diabetes by using MSG and alloxan monohydrate respectively and both observed increase in body weight. However kale *et al.*, *(2016),* observed decrease in body weight as the result of using Streptozotocin (STZ) injection to induce diabetes.

Table 2: Effect of Monosodium Glutamate on Weight Gain

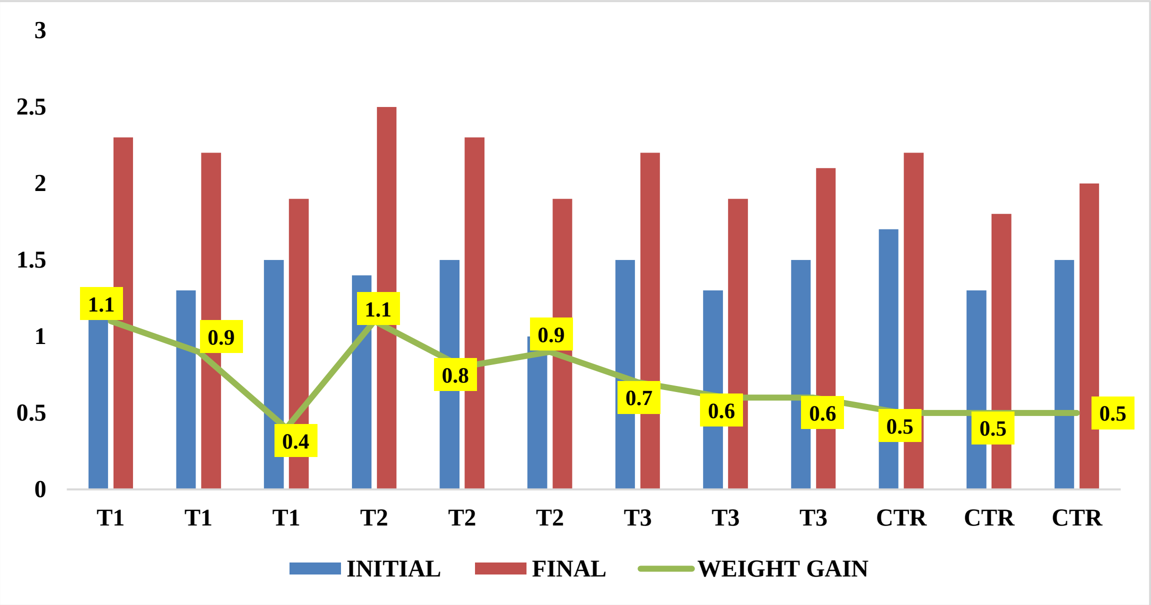
Groups	**Initial weight (Kg) (mean)**	**Final weight (kg) (mean)**	**Weight Gain (kg)**
Treatments	1.43[a]	2.06[a]	0.63[a]
Control	1.5[a]	2.00[a]	0.50[a]
SEM	0.047	0.024	0.024

*Values with same superscripts are not statistically significant.

Effect of Camel Milk on Weight Gain in Monosodium Glutamate Diabetes Induced-Rabbits

There was an increase in weight gain of rabbit's treated with camel milk than those that did not receive camel milk (Figure 1). The difference in weight between camel milk treated groups and the control was found to be statistically significant ($P < 0.05$) (Table 3). This may be as the result of the nutrients in camel milk such as protein, vitamin and energy (Kamal, 2012)

Figure 1: Effect of camel milk on weight gain.



This finding was similar to that of Kalle *et al., (*2016) and Sbouil *et al., (2010a)* who treated diabetic rats and dogs respectively using camel milk and all observed increase in body weight.

Table 3: Effect of camel milk on bodyweight in monosodium glutamate diabetes induced-rabbits

Treatments	Initial weight (kg) (mean)	Final weight (kg) (mean)	Weight Gain (Kg)
Treatment 1	1.33[a]	2.13	0.80[ab]
Treatment2	1.30 [a]	2.23	0.93[a]
Treatment3	1.44 [a]	2.07	0.63[ab]
Control	1.50 [a]	2.00	0.50[a]
SEM	0.055	0.065	0.057

*Values with same superscripts are not statistically significant.

Key: Treatment 1: diabetes rabbits receive 2.5ml camel milk/rabbit/day

Treatment 2: diabetes rabbits receive 5ml of camel milk/rabbit/day

Treatment 3: diabetes rabbits receive 18.75g of Glucophage/day

Effect of Camel milk on Glucose levels of Monosodium Glutamate Diabetes Induced-Rabbits

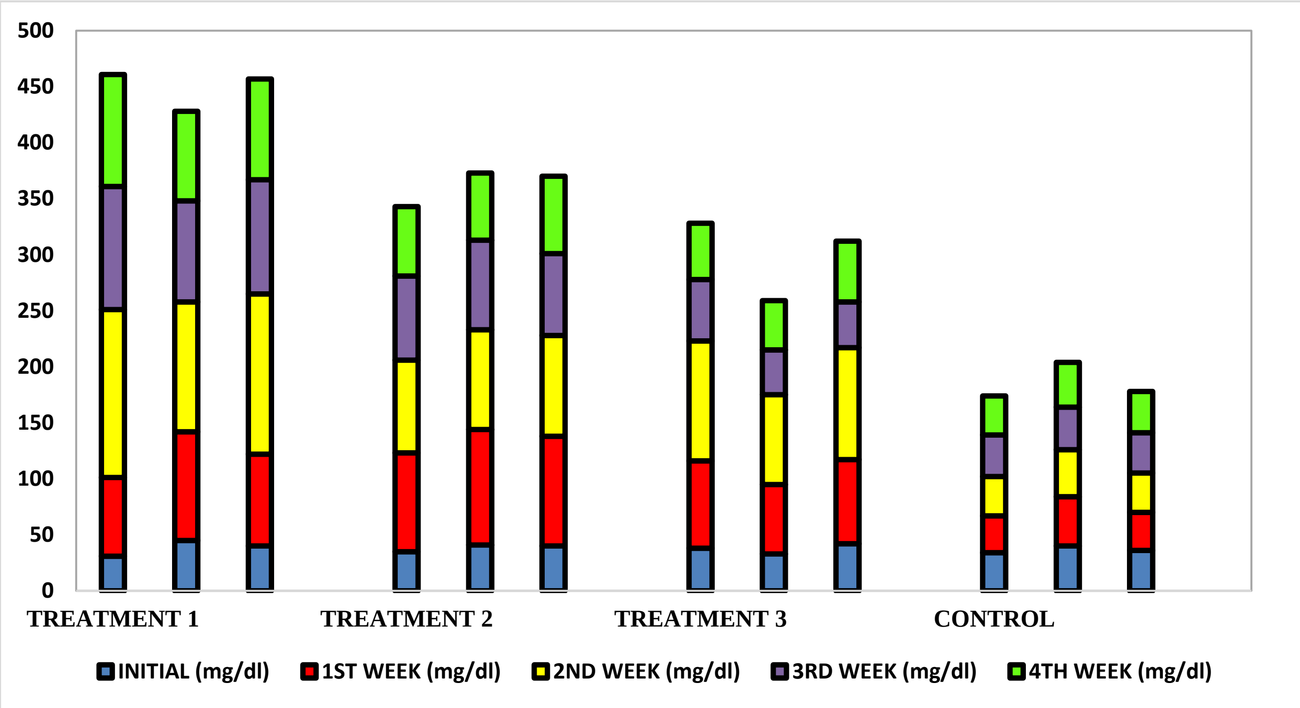
Treatment 3 that was treated with Glucophage® at 18.45.mg/kg showed the most significant hypoglycemic effect followed by treatment 2 which received 5ml of camel milk per day (Table 4). Treatment 1 which received 2.5ml of camel milk per day recorded the least hypoglycemic effect (Table 4). These findings were in agreement with Agrawal *et al.*, (2003) who made use of camel milk to induce hypoglycemia in diabetic rabbits. A similar finding was reported in a study carried out in Egypt that investigated the impact of camel's milk intake in the control of diabetes *(*Agrawal *et al., 2003*)

Table 4: Average Blood Glucose Levels (Mg/Dl) of All Groups (I to IV) Before and After Treatment

TREATMENTS	Initial Glucose levels mg/dl (mean)	1st week Glucose levels mg/dl (mean)	2nd week Glucose levels mg/dl (mean)	3rd week Glucose levels mg/dl (mean)	4th week Glucose levels mg/dl (mean)
Treatment 1	38.67[a]	83.00 [a]	136.33 [a]	100.67 [a]	90.00 [a]
Treatment2	38.67 [a]	96.33 [a]	87.33 [a]	76.00 [a]	63.67[ab]
Treatment3	37.67 [a]	71.67[ab]	95.67 [a]	45.33 [b]	48.67 [b]
Control	36.67 [a]	37.00[b]	37.33 [b]	37.33 [b]	37.33 [b]
SEM	2.744	5.406	6.766	3.933	3.488

*Values with same superscripts are not statistically significant.

Figure 2: **Blood Glucose Levels**



There was significant decrease in blood glucose levels in diabetic rabbits treated with 5ml of camel milk when compared to those treated with 2.5ml of camel milk ($P < 0.05$). This finding could be due to the reported high concentration of insulin i.e. 52 U/L to 59 U/L (Hamad *et al.*, 2011) in camel milk. The milk also contains one protein that possesses many characteristics similar to human insulin (Hamad *et al.*, 2011). This finding could also be as a result of the potential of camel milk to either increase the effect of insulin or by increasing the release of insulin from the pancreatic beta-cells (Sboui et al, 2010b).

CONCLUSIONS AND RECOMMENDATIONS

It was concluded that camel milk does possess hypoglycemic effect and that in rabbits more hypoglycemia was induced with increase in amount of camel milk administered**.** It was recommended that further studies should be carried out to determine the effect of camel milk on human diabetic patients and the optimal consumption level of camel milk for achievement of hypoglycemic effect in diabetic patients as well as to study the potential of camel milk in treatment of other conditions.

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