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Effect of *Solanum aethiopicum* and *Solanum macrocarpon* Fruits on Weight Gain, Blood Glucose and Liver Glycogen of Wistar Rats

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Abstract This study investigated the effects of dietary supplements of two African eggplants, *Solanum aethiopicum* and *S. macrocarpon*, on weight gain and glucose metabolism in rats. FiftyWistar rats, divided into 5groups, were fed with diets supplemented with graded levels of the fruits as follows: Group 1 (control), 0%; Group 2, 4% *S. aethiopicum*; Group 3, 8% *S. aethiopicum*; Group 4,4% *S. macrocarpon*; and Group5,8% *S. macrocarpon*. Weight gain, blood glucose and liver glycogen levels of the rats were determined after 28 days. Results showed significant ($p<0.05$) reduction in weight gain by the two eggplants, marginal decrease in liver glycogen by 8% *S. macrocarpon* and no significant change in blood glucose level. Weight gain was54.63±6.96 g for the control; it was reduced to 39.80±3.37 g (27.15%) and 25.00±1.34 g (54.24%) respectively by 4% and 8%supplement of *S. aethiopicum*, and to 40.47±3.37 (25.92%) and 31.54±2.84 g (42.24%) respectively by 4% and 8%supplement of *S. macrocarpon*. Blood glucose level was 83.80±4.05 mg/dl for the control, 81.65±4.22 and 81.34±4.11mg/dl respectively for 4% and 8%*S. aethiopicum* supplement; it was 79.10±2.61 and78.69±2.21 respectively for 4% and 8%supplement of *S. macrocarpon*. Both eggplants exhibited a dose-dependent, weight-reducing effect on the rats. *Solanum macrocarpon* also showed significant hypoglycemic effect. These indigenous food crops could be exploited to mitigate the challenge of obesity.

Keywords: *Solanum aethiopicum, S. macrocarpon, weight gain, blood glucose, liver glycogen*

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1. Introduction

Obesity has become a worldwide phenomenon and a major health problem of our time. Its rising prevalence has been attributed to several factors including genetic factor, changes in lifestyle and low basal metabolic rate [1]. Obesity is a natural accompaniment of hyperglycemia that may occur due to excessive consumption of carbohydrate-containing food. Obesity, overweight and excessive weight gain are recognized as risk factors to type II diabetes, cardiovascular diseases; post-menopausal breast cancer and colon cancer [2]. Dietary control and physical exercise are the most common, effective, and inexpensive methods of the several approaches for the reduction of body weight and obesity in individuals [3].

Entrenched in nature are compounds capable of tackling the myriad ailments of ancient prevalence and those of current emergence. Many African plants with medicinal values have been documented. Extensive studies of some indigenous food plants have established their potentials as natural remedies for old and emerging health challenges [4]. African eggplants, *Solanum* species, have been described to have beneficial effects and potential uses in reduction of weight gain and hyperlipidemia [5,6] and in the treatment of several ailments such as pains, inflammation, asthma, and glaucoma [7,8,9,10]. Their fruits and leaves are prepared in traditional medicines as tonics and used as anti-rheumatics, remedies for colds, fevers and dizziness, or as potherbs and used as mild anticonvulsants [11]. *Solanum aethiopicum L.* and *S. macrocarpon L.* are African eggplants with enormous nutritional, medicinal and economic values [12, 13]. This present work examined the effects of inclusion of the fruits of *Solanum aethiopicum* and *S. macrocarpon*on weight gain and glucose metabolism in rats.

2. Material and Methods

2.1. Collection and Identification of Specimens

Fruits of *S. aethiopicum L.* and *S. macrocarpon L.* were obtained from Mile 12 market in Lagos, Southwest Nigeria. The plants were identified and authenticated by botanists in the Department of Biological Sciences, Covenant University. The fruits were selected and thoroughly washed in water to remove dirt and unwanted

particles. The stalks were removed and the fleshy fruits were sliced into small pieces, dried, pulverized and incorporated in the animal feed.

2.2. Experimental Design

Fifty (50) male Wistar strain albino rats were obtained from the Federal University of Agriculture Abeokuta, Nigeria and acclimatized for a week. The rats, weighing about 100g each, were divided into 5 groups; 10 rats were allotted into each group. Food and water were given *adlibitum* throughout the period of the experiment. The diets consisted of grower's mash supplemented with different levels of dried fruits of *S. aethiopicum* and *S. aethiopicum* (Table 1).

Table 1. Percentage content of *S. aethiopicum* and *S. aethiopicum* in the diet of each group of rats

Group	Content (%)			
	Solanum aethiopicum	*Solanum macrocarpon*	Grower's Mash	Total
1 (Control)	0	0	100	100
2	4	0	96	100
3	8	0	92	100
4	0	4	96	100
5	0	8	92	100

All treatments were carried out in accordance with the principles of laboratory animal care of the NIN guide for Laboratory Animal Welfare as contained in the NIN guide for grants and contracts, vol. 14, No. 3, 1985.

After 28days of feeding on the experimental diets, the rats were fasted for 18 hours and sacrificed after light ether anaesthesia. Blood was collected by cardiac puncture into a tube containing heparin as anticoagulant. Plasma was separated by centrifuging the whole blood at 1500rpm for 10minutes. Liver of each rat was excised, homogenized and used for glycogen test.

2.3. Weight Gain

Weight of each rat was measured at the beginning and at weekly intervals. The average weight of rats in each group (at the beginning and end of the study) was used for calculations.

Weight gained
= Weight after 28 days
−Weight at the beginning of the experiment.

2.4. Blood Glucose and Liver Glycogen Content

Blood glucose level was determined using cypress test kit based on the glucose oxidase – peroxidase method [14]. Liver glycogen was determined by Anthrone method [15].

2.5. Statistical Analysis

Data analyses were performed using SPSS software (SPSS 15.0 for Windows, SPSS Inc, Chicago, IL). All data are expressed as mean±SEM. Analysis of variance was used to test for differences between the groups. Duncan's multiple range test was used to determine the significance of differences among the mean values at the level of $P<0.05$.

3. Result

Consumption of *Solanum aethiopicum* and *S. macrocarpon* fruits at the experimental dose resulted in a significant ($P<0.05$) decrease in weight gained among rats as showed in Figure 1. The reduction in weight gain increased with higher doses (8%) of the fruits (Table 2). There was no significant effect of the fruit supplement on the blood glucose level (Figure 2). Blood glucose was 83.80±4.05 mg/dl for the control; it was 81.65±4.22 and 81.34±4.11mg/dl respectively for 4% and 8%*S. aethiopicum* supplement, and 79.10±2.61 and78.69±2.21 respectively for 4% and 8%supplement of *S. macrocarpon*. There wasa significant decrease in the liver glycogen of rats fed diet supplemented with 8% of *S. macrocarpon* fruit; the glycogen level reduced from 1126.10±159.38 (for the control) to 792.38±75.49.

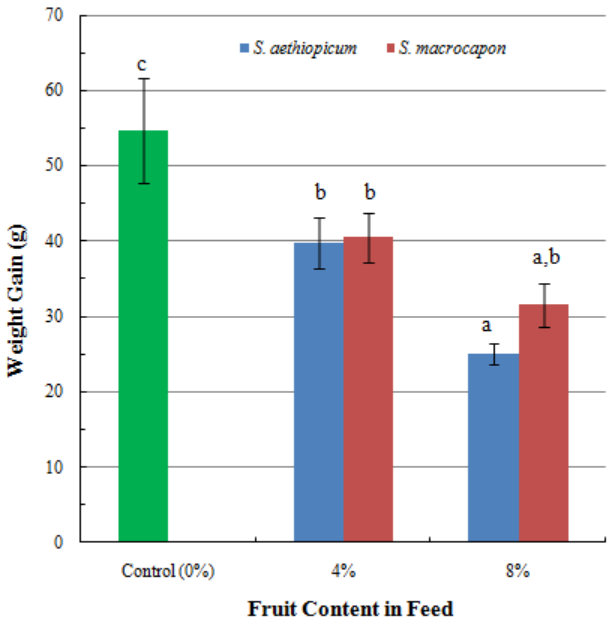

Figure 1. Effect of graded concentration of *S. aethiopicum* and *S. macrocapon* fruits on weight gain of Wistar rats

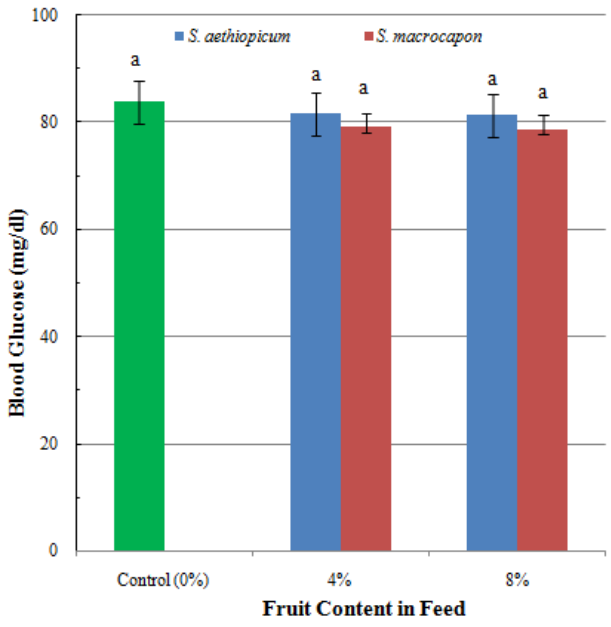

Figure 2. Effect of graded concentration of *S. aethiopicum* and *S. marocapon* fruits on blood glucose of Wistar rats

Table 2. Effect of graded levels of *Solanum aethiopicum* and *S. macrocarpon* on weight gain

	Control (0%)	Solanum aethiopicum		Solanum macrocarpon	
		4%	8%	4%	8%
Weight gained (g)	54.63±6.96	39.80±3.37	25.00±1.34	40.47±3.37	31.54±2.84
Reduction in weight gained (%)	-	27.15	54.24	25.92	42.24

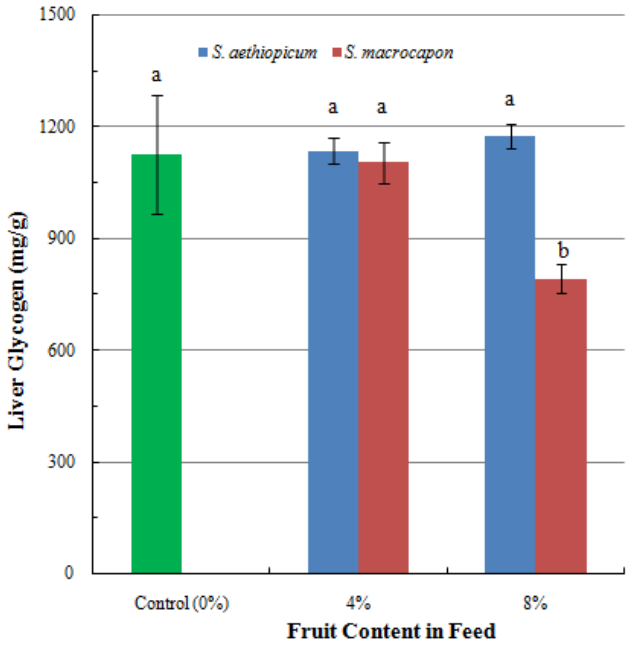

Figure 3. Effect of graded concentration of *S. aethiopicum* and *S. marocapon* fruits on liver glycogen of Wistar rats

4. Discussion

Weight gain and obesity as well as the risk factors associated with them have been on the increase in most part of the world. The detrimental effects of these conditions accentuate the need for effective preventive measures and hence this research work. Experimental results showed a significant and dose-dependent reduction in weight gained by the animals as a result of inclusion of the fruits in their diets. Eight percent supplement of *S. aethiopicum* and *S.macrocarpon* respectively caused 54.24% and 42.24%weight gain reduction in the rats. *Solanum* species such as *S. elaeagnifolium, S. melongena, S. gilo*and *S. aethiopicum* have been reported to reduce weight gains in animals [5,6,16]. Hence, the potential of the two eggplants could be exploited for mitigate weight gain.

Hyperglycemia, due to excessive intake of carbohydrate, is one of the few conditions that trigger the development of obesity and type II diabetes. Result from this work showed no significant change in the blood glucose level compared to that of the control in the experimental animals fed with graded levels of *S. aethiopicum* and *S. macrocarpon*. By maintaining the normal blood glucose level, the fruits do not trigger hyperglycemia. *Solanum aethiopicum* and S. *macrocarpon* contain minerals, macronutrients and phytochemical substances in addition to high crude fiber and protein [12]. Dietary fiber which is the indigestible portion of plant foods may contribute to the observed stability in blood glucose level. Fibers help to normalize blood glucose levels by slowing the rate at which food leaves the stomach and by delaying the absorption of glucose following a meal. It also increases insulin sensitivity [17]. Also, by slowing the rate at which food leaves the stomach, it promotes a sense of satiety, or fullness, after a meal, which helps to prevent overeating and weight gain. This can be verified by the quantity of food taken by the rats per day compared to that of the control. The main action of dietary fiber is to change the nature of the contents of the gastrointestinal tract, and to change how other nutrients and chemicals are absorbed [18]. Soluble fiber binds to bile acids in the small intestine, making them less likely to enter the body. Soluble fiber also attenuates the absorption of sugar, reduces sugar response after eating [19].

The liver glycogen test indicated a significant decrease in the rats fed with the diet containing 8% *Solanum macrocarpon* compared to that of the control. This may suggest a depleting of the glycogen reserve to main normal blood glucose level at high dosage of the fruit.

5. Conclusion

Supplement of African eggplants, *S. aethiopicum and S. macrocarpon*, substantially reduced weight gains in the experimental animals. Their weight reducing effects appear to be dose- dependent. The fruits had little effect on blood glucose and liver glycogen levels. The eggplants are readily available and accessible in West and Central African where the fruits are widely consumed. The study indicates that the fruits can be used to mitigate weight gain, obesity and type II diabetes.

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