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Periodic Validation of High Antidiabetic Potentials of Unripe Plantain in Comparison with Glibenclamide and Fansidar

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Abstract: Problem statement: The antidiabetic potentials of aqueous extract of musa paradisciaca (unripe plantain fruit) were investigated in alloxan induced diabetic rats. The extract at a dosage of 120 mg kg^{-1} produced a significant ($p<0.001$) reduction in glucose level by 85% on day 7, 78% on day 14, 64% on day 21 and 44% on day 28. **Approach:** The extract at the dosage of 80 mg kg^{-1} produced a significant ($p<0.01$) reduction in glucose concentration by 86% on day 7, 79% on day 14 64%, day 21 and 458% on day 28. With 40 mg kg^{-1} glucose level was 83% on day 7, 75% on day 14, 68%, day 21 and 58, 64% on day 21 and 58% on day 28. **Results:** Fansidar at the calculated average animal dosage 9-22.5 mg kg^{-1} from that of man produced a significant ($p<0.01$) reduction in glucose concentration by 81% on day 7 71% on day 14, 58% on day 21 and on day 28 a shooting to 111%. Comparing the fasting blood glucose levels of extract and fansidar with known antidiabetic drug; Gliben clamide of 6.75 mg kg^{-1} had the following on day 7; it was 96, 86% on day 14, 45% on day 21 and 81% on day 28. **Conclusion:** It is concluded that extract of unripe plantain fruit showed high antidiabetic properties than glibenclamide a known potent antidiabetic drug and fansidar is also demonstrated a good degree of antidabetic potentials.

Key words: Unripe plantain, fansidar, antidiabetic potentials

INTRODUCTION

Management of the disease; diabetes with orthodox drugs are associated with a lot of side effects which has continued to impact increase explorations into alternative therapy particularly the herbal one. Major plants have been documented in the treatment of diabetes. However, unripe plantain seems not to be scientifically documented. The common name is plantain while the botanical name is musa paradisciaca from a family of musaciae and kingdom plantae, genus; Musa and order Zingiberales; (Hoffbrand and Moss, 2011). It is mainly a tropical plant eaten popularly when riped. The unripe fruit is not accepted by most people as attracted menu particularly the youth and children who prefer sweet foods. However, the adult of a low population eat the unripe plantain cooked with or without pumpkin leaves as porridge and in many other forms. It is also eaten when smoked with palm oil and as chips when fried which many preferred. The hypoglycemic potentials of unripe plantain and its likely antidiabetic properties investigation as compared with known potent antidiabetic drug is an attempt to encourage exploration of hidden food substances with medicinal properties. Plantain is rich in fiber, iron, vitamins minerals and serotonin.

Fansidar is a known antimalarial preventive drug with the constituents of pyrimethamine and sulphadoxine taken per weight at single dosage. It acts by sequential blockage of enzymes involved in the biosynthesis of folinic acid by the malaria parasites as synergistic action. The sulphonamide component of the drug is the likely basis for its hypoglycemic properties and the related blood glucose effect.

This hypoglycemic properties would adversely affect malaria patients and in disease situation, malaria patients don't eat, however, such properties seem not to be explored as there is increase in the diabetes population in our environment hence the importance of this study.

Diabetes is a metabolic disease characterized by high blood sugar or glucose level as a result of insulin defects in secretion and availability. Diabetes may result in blindness, kidney failure, stroke and coronary heart disease. It is the third leading cause of death after heart disease and cancer and more than 120 million people are affected worldwide. Diabetes with its complications e.g associated heart attack results in high

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mortality. There is therefore high need to explore alternative curative therapy through continuous exploration of the plant kingdom and validation of their potentials through comparative studies.

MATERIALS AND METHODS

Animal: The animals used for the study were thirty adult albino rats of average weight 130-150g. The animals were kept in a well ventilated room in the Faculty of Pharmacy animal house. They were fed with pelleted food and water for the period of study.

Preparation of unripe plantain fruits: The fruits of unripe plantain were washed, peeled, sliced and air dried. The dried slices were pulverized into powder form and 1200 g of it macerated with 300 mL of distilled water. The mixture was filtered after a day and the filtrate evaporated at 45°C with water bath using methods of Trease (1966).

Acute toxicity studies (LD50): The methods of Lorke (1983) was used with albino mice. Doses of 3500, 3000, 2000 and 1000 mg kg^{-1} when given to the mice intraperitoneally did not produce any harm, safety dosages. However, doses of 5000, 4500 and 4000 were harmful to the mice at administration and led to death. Two dosages, 120, 80 and 40 mg kg^{-1} were used after calculation of lethal and non lethal dosages and were administered weekly for 28 days into the rats orally using canula (Jimmy *et al*., 2007).

Preparation of fansidar and administration: Each tablet of fansidar contains 525 mg, 3 tablets of fansidar is a single dosage for adult. This therefore means 525 x 3 = 1575 mg of fansidar. Taking this by the average weight of man (70 kg) give 1575 divided by the 70 kg = 22.5 mg kg^{-1}. The 22.5 mg kg^{-1} was the dosage of the drug used for the study. This dosage was given per weight of the rats orally using canula for the period of 28 days; (Jimmy *et al*., 2007; Katzung, 2007; Robert *et al*., 1979).

Inducement of diabetes in rats: A single dose of alloxan (150 mg kg^{-1}) was administered as 5% W/V in distilled water (freshly prepared). The preparation was injected intraperitoneally into 14 h fasted rats. The animals were allowed 72 h of rest for blood glucose stabilization Williamson *et al.* (1996), before the inducement, initial blood glucose of each of the rats were measured.

Fasting blood glucose determination: Glucometer was used to determine the blood glucose levels of the alloxan induced diabetes treated with unripe plantain powder, fansidar and Glibenclamide.

The glucometer was switched on and the gluco strip inserted in the glucometer and the glucose levels measured in mg/dl after each 45 sec.

Grouping of the diabetic rats for treatment: The albino rats were divided into six (6) groups; group 1, 2 and 3 were given 40, 80, 120 mg kg^{-1} of unripe plantain (musa paradisciaca) extract group 4 was administered with 22.5 mg kg^{-1} of fansidar per weight of the rats (Table 1). Group5 was the control diabetic rats without treatment (with the dose of 10 mL kg^{-1} of distilled water while group 6 had 6.75 mg kg^{-1} of glibenclamide. The groups were treated weekly for 28 days and blood glucose level recorded.

RESULTS

The dosage of extract of musa paradiscia (plantain fruits) administered at weekly interval showed variation in the fasting blood glucose concentration in alloxan induced diabetic rats. A high dosage of 120 mg kg^{-1} extract given had the following results; on day 7 it was 228.40 ± 0.24 (85%) it was lower on day 14; 208.80 ± 0.58 (78%), also on day 21 it was reduced, 171.60 ± 0.50 (64%) and low level again on day 28; 119.40 ± 0.40 (44%) and all the weekly results were significantly different, $P < 0.00$. The middle dosage of 80 mg kg^{-1} of the extract had the following weekly blood glucose concentration, on day 7 it was 231.40 ±0.51, (86%), day 14; 213.40 ± 0.40, (79%), day 21, 173.00 ± 0.55 (64%) and on day 28 it was 122.00 ± 0.71 (45%). The results were significantly different ($P < 0.01$) and as compared with control. The low dose of 40 mg kg^{-1} of the extract gave the following glucose concentrations; on day 7 it was 238.40 ± 0.68 (83%), day 14; 215.00 ± 0.37 (75%), day 21; 194.00 ± 0.55 (68%) and day 28 it was 166.60 ± 0.75 (58%). The results were significantly different ($P<0.01$) on weekly basis with reduced glucose levels as compared with control.

Table 1: Effects of extract of musa paradisciaca, Fansidar and glibenclamide on blood glucose

Dosage	Day 7	Day 14	Day 21	Day 28
Diabetic rats without treatment (10 mL of dist. H_20)	269.60±0.51 103%	275.50±0.58 105%	285.80±0.37 109%	286.40±0.60 109%
120 mg kg^{-1} of extract of M.paradisciaca	228.40±0.24 (85%)	208.80±0.50 (78%)	171.60±0.51 64%	119.40±0.40 44%
80 mg kg^{-1} of extract of M.paradisciaca	231.40±0.51 -86%	213.40±0.40 -79%	173.00±0.55 -64%	122.00±0.71 -45%
40 mg kg^{-1} of extract of M.paradisciae	238.40±68 -83%	215.00±0.37 -75%	194.00±0.55 -68%	166.60±0.75 -58%
Fansidar 22.5 mg kg^{-1}	238.40±0.51 -81%	189.20±0.37 -71%	154.60±0.51 -58%	298.40±0.51 -111%
Gliben clamide 6.75 mg kg^{-1}	254.60±0.51 -94%	231.20±0.58 -86%	122.40±0.40 -45%	82.80±.37 -81%

Fansidar given at 22.5 mg kg^{-1} had the following results on the glucose levels. On day 7, it was 218.40 ± 0.51 (81%) day 14; 189.20 ± 0.37 (71%), day 21; 154.60 ± 0.51 (58%) and on day 28, it was 298.40 ± 0.51 (111%).

The mostly used and available antidiabetic drug; Glibenclamide given also on weekly basis had the following results, day 7, 254.60 ± 0.51 (94%), day 14; 231.30 ± 0.58 (86%), day 21; 122.40 ± 0.40 (45%) and on day 28 it was 182.80 ± 0.37 (81%). However, in rats with induced diabetes without treatment the following were the weekly fasting blood glucose level; day 7; 269 ± 051 (103%) day 14; 275.80 ± 0.58 (105%), day 21; 285.80 ± 0.37 (109%) and on day 28 it was 286.40 ± 0.60 (109%). But the fasting blood glucose level in rats before alloxan induced diabetes ranged between 70-100 mg dL^{-1}. Therefore, musa paradisciaca fruits had effected a good antidabetic potentials as the results lie within the normal blood glucose level compared with fansidar and glibenclamide.

DISCUSSION

The comparative studies of antidiabetic potentials of crude extract of musa paradisciaca and fansidar and glibenclamide had unveiled the high efficacy of the extract than glibenclamide, a known antidabetic drug. However, the efficacy of the extract was dose dependent (high dosage). But there was no strong significant difference between the high, middle and the low dosages in terms of the blood fasting glucose at the weekly basis. This implies that someone with already high iron deposits sickle cell patients in crises and blood transfusion, (Hoffbrand and Moss, 2011), e.g., may not be at risk of the high dosage of the extract. The fasting blood glucose levels decreased as the period of administration of the extract increased. This means that for effective glucose depletion the extract must be taken for a longer period. However, other factors like, the degree of processing e.g., method, time, heat, the starch content, Niba (2004) may influence the glucose response to the extract, P_1 Pi-Sunyer (2002). The interaction between the glucose and protein may also influence the affect of extract, Manders *et al*. (2005). The action of plantain flour is that of hypoglycemic effect compared to that of insulin. The major interest of this study is the availability of the antidiabetic potentials in plantain extract which is high available in our environment and the future approach of likely isolation and purification of the hypoglycemic contents for use of as antidiabetic drug. This is why it was compared with Glibenclamide, a potent antidiabetic drug. The hypoglycemic potentials of fansidar was earlier investigated, Jimmy *et al*. (2007) and the present results has tallied though the previous study did not compare fansidar with musa paradiscia extract. But the present study had proved the sensitivity of the earlier methods. But most importantly is the need to harvest the antidiabetic potentials of fansidar considering the side effect of continuous usage of insulin. But the observation in fansidar with hypoglycemic properties is contraindicative in malarial patients as most do not eat during the sickness and malaria spell its doom of hypoglycemia (Marsh *et al*., 1995). It is therefore imperative that health talks and public enlightenment be organized by health personnels and NGO's on the risk of medication without doctor's prescription. Jimmy *et al*. (2000). The study has shown that medicinal ingredients abound in our plants which may the leaves, fruits, stems, roots need be explored and not total dependent on orthodox drugs which not only be effective as herbal plants but with side effects and complications. Nwafor *et al*. (2005); Setiawan *et al*. (2001); Williamson *et al*. (1996) and Sofowora (1982). Hypoglycemic properties as indicator have proved very sensitive in drugs and food screening in this study.

CONCLUSION

The study recommends the utilization of unripe plantain as antidiabetic therapy as it is safer than antidiabetic drugs and highly available in our environment.

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