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Research Article

HYPOGLYCEMIC EFFECT OF BANANA FLAVONOIDS

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ABSTRACT

Banana flavonoids constitute one of the largest groups of naturally occurring phenols. They are ubiquitous in all parts of green plants and as such are likely to be encountered in any work involving plants extracts. Hypoglycemic effects of banana flavonoids have been reported by many investigators. In this study, the relationship between polyphenol intake and the blood glucose response in healthy and diabetic volunteers was examined and reported the hypoglycemic activity of flavonoids. The present investigation demonstrates that flavonoids isolated from raw banana inhibit the elevation of blood sugar and promote the enhancement of glucose utilization and storage in normal laboratory rats when administered at 1 mg/100 g BW daily.

Keywords: Flavonoids, Hypoglycemic, Diabetes, Banana.

INTRODUCTION

Many plants reported to be useful for the treatment of diabetes mellitus in Ayurvedic medicines (Gregg *et al*., 2003) have been tested for their hypoglycemic activity by various investigators (Kirtikar & Basu, 1975). Several reports are now available on the hypoglycemic activity of tannins (Ahmad *et al*., 1991; Hii & Howell, 1984; Teitzel *et al*., 2006). Antidiabetic activity of epicatechin from the bark of *Pterocarpus marsupium* was reported in alloxan induced diabetic rats (Chakraborty *et al*., 1981) It was shown that in isolated hepatocutes from fasted rats, (+) catechin inhibited glycogenolysis and stimulated glycogen synthase activities (Nyfeler *et al*., 1970). The relationship between polyphenol intake and blood glucose response in healthy and diabetic volunteers was reported by many authors. Since raw banana contains appreciable amounts of flavonoid compounds, it was felt promising to conduct some experiments in order to provide sufficient information in these aspects.

MATERIALS AND METHODS

Male rats of the Sprague-Dawley strain approximately 100 g were housed in groups of six, in polypropylene cages maintained at 28+/- 5 °C. Animals of group I were treated as controls. Animals of groups II and III were given flavonoids extracted from raw banana at doses of 0.5 mg and 1 mg /100 g BW/day respectively. Flavonoids were extracted by a procedure of (Markham, 1982). The rats were provided normal laboratory diet and water *ad-libitum.* The duration of the experiment was 45 days. At the end of experimental period, rats were fasted overnight (except the rats for analyzing liver glycogen), and sacrificed by decapitation and blood and tissues were collected for various estimations (Bergmeyer & Bernt, 1974; Crane & Sols, 1953; Criss, 1971; Scott & Glimcher, 1971).

RESULTS AND DISCUSSION

Blood glucose levels were significantly lowered in the experimental groups than the control group. 1 mg dose showed maximum glucose lowering effect. The liver glycogen level showed significant increase in experimental animals than the control animals. Animals received 1 mg flavonoids showed higher glycogen level than the rest. The activities of glycogen synthase, glycogen phosphorylase, phosphoglucomutase hexokinase and isocitrate dehydrogenase (Table 1-7) were increased in the liver of rats received 1 mg flavonoids.

Antidiabetic herbs and their compounds were proven to significantly manage glucose intolerance and the associated complications of diabetes mellitus. Flavonoids

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form the biggest family of polyphenolic herbal compounds which are being demonstrated to possess anti-hyperglycemic activities (Grassi *et al*., 2008). Banana is one of people's favorite fruit, but most of its by-product banana peel is not fully utilized. The researches on the peel of banana show that the banana peel is rich in starch, crude protein, crude fat, pectin, cellulose, hemicelluloses, total dietary fibre, and polyunsaturated fatty acids (Emaga *et al*., 2007).

Flavonoids as general compound of the diet have been implicated in a variety of modified responses, both positive and negative. The present investigation demonstrates that flavonoids isolated from raw banana inhibit the elevation of blood sugar and promote the enhancement of glucose utilization and storage in normal laboratory rats, when administered at 1 mg/100 g BW daily.

Table 1. Concentration of Blood glucose.

Groups	Doses mg/100g BW/day	Blood glucose
I	-----	90.3+/-2.25
II	0.5	80.7+/-1.69[b]
III	1.0	78.1+/-1.52[a]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I. a =p< 0.01, b=0.01<p<0.05.

Table 2. Concentration of liver glycogen.

Groups	Doses mg/100g BW/day	Liver glycogen (mg/100g wet tissues)
I	----	22.89+/-0.45
II	0.5	26.7+/-0.60 [a]
III	1.0	31.6+/-0.79 [a]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I. a =p< 0.01.

Table 3. Activity of glycogen synthase (µ mol UDP formed/min/g protein**).**

Groups	Doses mg/100g BW/day	Liver
I	-----	27.32+/_0.54
II	0.5	31.74+/-0.69 [a]
III	1.0	36.16+/-0.9 [a]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I.a =p< 0.01.

Table 4. Activity of phosphoglucomutase (µ mol of Pi. Liberated/ g protein).

Groups	Doses mg/100g BW/day	Liver
I	-----	20.64+/-0.41
II	0.5	26.71+/-0.61 [a]
III	1.0	29.35+/-0.73 [a]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I. =p< 0.01.

Table 5. Activity of glycogen phosphorylase (µ mol of Pi. Liberated/min/g protein).

Groups	Doses mg/100g BW/day	Liver
I	-----	6.1+/-0.152
II	0.5	5.9+/-0.128
III	1.0	5.6+/-0.112 [b]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I.b=0.01<p<0.05.

Table 6. Activity of hexokinase (mg glucose phosphorylated/min/g protein).

Groups	Doses mg/100g BW/day	Liver
I	-----	34.6+/-0.69
II	0.5	41.01+/-0.90[a]
III	1.0	46.73+/-1.16 [a]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I.a =p< 0.01.

Table 7. Activity of isocitrate dehydrogenase (Units/mg protein).

Groups	Doses mg/100g BW/day	Liver
I	-----	1.65+/-0.033
II	0.5	1.73+/-0.038
III	1.0	1.78+/-0.044 [b]

Average of the values of six rats in each group +/_ SE. Groups II and III are compared with group I.b=0.01<p<0.05.

Blood glucose levels were significantly diminished while a concomitant stimulation in the activities of the glycolytic enzymes, hexokinase and phosphoglucomutase was observed. Although there was an increase in the isocitric dehydrogenase activity in the liver of flavonoid fed rats, this increase was not of much significance as that of the glycolytic enzymes. Glycogen levels were significantly higher in flavonoid treated rats. This may be due to the higher rate of synthesis of glycogen as evidenced by the significantly elevated activity of glycogen synthase in the liver and markedly lower rate of glycogen phosphorylase activity. Although toxicity has been described to tannin in several studies, the dosage used in such experiments is rather high when related to the dosage selected in this study. Previous experiments in this laboratory indicate that higher doses exert opposite effects. However, these investigations denote that the flavonoids from raw banana exert hypoglycemic effect. The underlying mechanisms may be the increased rate of oxidation of glucose, elevated glycogenesis and diminished glycogen phosphorylase as evidenced by the findings of our experiments. Further characterization of the material and investigations in humans may prove useful in the development of an efficient drug.

CONCLUSION

Banana has very important role in the growth, maintenance, and repair mechanisms in the body. The investigations on the effects of flavonoids proved the health benefits of polyphenolic compounds. Blood sugar lowering effect of flavonoids from banana was higher when compared to the control animals. These compounds proved good for the better utilization of glucose when administered at low doses such as 0.5 and 1 mg level.

REFERENCES

Ahmad, F., Khalid, P., Khan, M.M., Chaubey, M., Rastogi, A.K., & Kidwai, J.R. (1991). Hypoglycemie activity of Pterocarpus marsupium wood. *Journal of Ethnopharmacology*, *35*(1), 71-75.

Bergmeyer, H.U., & Bernt, E. (1974). UV-assay with pyruvate and NADH *Methods of Enzymatic Analysis*,574-579.

Chakraborty, B., Gupta, S., Gambhir, S., & Gode, K. (1981). Epicatechin, novel antidiabetic drug. *Indian Drug*, *18*, 184-185.

Crane, R.K., & Sols, A. (1953). The association of hexokinase with particulate fractions of brain and other tissue homogenates. *Journal of Biological Chemistry*, *203*(1), 273-292.

Criss, W.E. (1971). A review of isozymes in cancer. *Cancer Research*, *31*(11), 1523-1542.

Emaga, T.H., Andrianaivo, R.H., Wathelet, B., Tchango, J. T., & Paquot, M. (2007). Effects of the stage of maturation and varieties on the chemical composition of banana and plantain peels. *Food Chemistry*, *103*(2), 590-600.

Grassi, D., Desideri, G., Necozione, S., Lippi, C., Casale, R., Properzi, G., Ferri, C. (2008). Blood pressure is reduced and insulin sensitivity increased in glucose-intolerant, hypertensive subjects after 15 days of consuming high-polyphenol dark chocolate. *The Journal of Nutrition*, *138*(9), 1671-1676.

Gregg, E.W., Gerzoff, R.B., Caspersen, C.J., Williamson, D.F., & Narayan, K.V. (2003). Relationship of walking to mortality among US adults with diabetes. *Archives of Internal Medicine*, *163*(12), 1440-1447.

Hii, C.S., & Howell, S.L. (1984). Effects of epicatechin on rat islets of Langerhans. *Diabetes*, *33*(3), 291-296.

Kirtikar, K., & Basu, B. (1975). Indian Medicinal Plants. Bishen Singh Mahendra Pal Singh, Dehradun, India. *International Book Distributor*, *2*(2), 894-895.

Markham, K.R. (1982). *Techniques of Flavonoid Identification.* Academic press London. 31.

Nyfeler, A., Spalti, A., & Vonarburg, H. (1970). Telemetry arrangements utilizing power distributing networks for measuring consumption. Google Patents.

Scott, B.L., & Glimcher, M.J. (1971). Distribution of glycogen in osteoblasts of the fetal rat. *Journal of Ultrastructure Research*, *36*(5-6), 565-586.

Teitzel, G.M., Geddie, A., Susan, K., Kirisits, M.J., Whiteley, M., & Parsek, M.R. (2006). Survival and growth in the presence of elevated copper: transcriptional profiling of copper-stressed *Pseudomonas aeruginosa*. *Journal of Bacteriology, 188*(20), 7242-7256.