

ABSTRACT

Tubers of two wild (*Dioscorea polygonoides* and *Rajania cordata*) and seven cultivated varieties of Jamaican yams (*Dioscorea* spp.) were assayed for natural products (saponins, cyanoglucosides, phenols, lectins, and protease inhibitors). Sapogenins were isolated and characterized from the yam variety with the highest levels (*D. polygonoides*). The crude sapogenin extract was then fed to streptozotocin-induced diabetic rats and the effects on lipid metabolism were studied.

Protein levels ranged from 47.8 ± 2.6 to 88.0 ± 2.5 g/kg dry weight. The lowest level was seen in *D. cayenensis*. The range for the dietary fibre content in the tubers was 16.4 ± 0.7 to 63.5 ± 0.4 g/kg dry weight, with the wild yam varieties recording higher levels. Saponin content was <600 mg/kg in all the tubers analysed except for bitter yam (2962.5 ± 60.5 mg/kg). Total phenol content ranged from 1.3 ± 0.1 to 79.3 ± 6.1 g/kg while total condensed tannin content ranged from 0.1 ± 0.0 to 26.7 ± 3.8 g/kg dry wt. Samples that showed high levels of phenols also had high levels of condensed tannins. All samples contained low levels of lectins.

Data from the natural products analyses showed that bitter yam could be exploited for nutraceutical/pharmaceutical purposes owing to the high saponin content. Hence, sapogenins were extracted from acid hydrolysed tubers of Jamaican bitter yam (*Dioscorea polygonoides*), analysed by thin layer chromatography and

purified using column chromatography. Using NMR spectroscopy and other physical data, the compounds were tentatively identified as pennogenin, diosgenin, Δ^3 diosgenin, β -sitosterol and stigmasterol.

The effect of dietary supplements on lipid metabolism in streptozotocin-induced diabetic rats was investigated. Diets supplemented with 1% crude bitter yam steroidal sapogenin extract, bitter yam or commercial diosgenin were fed to diabetic male wistar rats ($n = 40$) for three weeks.

Diabetic rats fed supplemented and unsupplemented diets lost weight significantly compared to the normal group even though there was no significant difference in their feed intake. Supplementation of the diet with bitter yam and bitter yam sapogenin extract significantly lowered blood glucose compared to diabetic controls. The activities of intestinal disaccharidases and ATPases were significantly reduced by bitter yam and bitter yam sapogenin extract supplementation. Dietary supplementation with bitter yam steroidal sapogenin extract significantly increased α -amylase activity.

Plasma total cholesterol, LDL + VLDL-cholesterol and triglyceride levels decreased significantly, while HDL-cholesterol levels increased significantly in rats fed supplemented diets compared to diabetic controls. These changes were more pronounced in rats fed diets supplemented with bitter yam extract. There were no significant changes in the levels of phospholipids.

There was a significant increase in faecal total cholesterol, VLDL + LDL-cholesterol and HDL-cholesterol excretion in rats fed bitter yam or its sapogenin extract. Bitter yam significantly decreased faecal triglycerides and phospholipid excretion. There was a significant decrease in faecal magnesium and sodium levels and a significant increase in faecal iron excretion in rats fed bitter yam and bitter yam steroidal sapogenin extract.

The feeding of bitter yam or bitter yam sapogenin extract, reduced liver and kidney lipid peroxidation as can be seen by the significant decrease in conjugated dienes and thiobarbituric acid reactive substance (TBARS) compared to the unsupplemented diabetic groups. Bitter yam and bitter yam sapogenin extract also caused a significant decrease in the diabetes-induced increase in liver alanine transaminase activity.

Supplementation of the diet with bitter yam sapogenin extract and bitter yam did not significantly alter villus length, intervilli space, width of the glycocalyx and epithelial cells compared to the diabetic controls, however there was a significant increase in villus width. Supplementation with bitter yam sapogenin extract significantly decreased crypt depth towards that of the normal controls.

Treatment with bitter yam and bitter yam steroidal sapogenin extract significantly increased the activities of some key enzymes in carbohydrate and lipid metabolism. The activity of glucose-6-phosphatase was significantly reduced in

the liver. There was a significant increase in the activity of liver and kidney glucose-6-phosphate dehydrogenase activity.

This study shows that the feeding of bitter yam steroidal sapogenin extract to diabetic rats lowered the indices of diabetes (blood glucose, lipid levels and lipid peroxidation) which may be beneficial in the management of diabetes.