

ABSTRACT

Biochemical and Molecular Characterization of Yams (*Dioscorea* spp.) Grown in Jamaica

INGRID MUZAC

Yam (*Dioscorea sp.*) tubers of 11 cultivars from 5 common *Dioscorea* species grown in Jamaica were analyzed for their protein content, total phenolics, vitamin C, total lipids, fatty acid composition and activity of the polyphenol oxidase enzyme. The results showed that the yams grown in Jamaica are of good nutritional value with proteins (1- 1.5 % dry wt.), vitamin C (0.2 - 0.5 % dry wt.), low lipids (0.1 - 0.3 % dry wt.) with only one cultivar *D. alata* (renta yam) possessing high levels of phenolic compounds (10.50 % dry wt.). The fatty acids found in the total lipid samples show that yam tubers possess high levels of saturated fatty acids, mainly palmitic acid. However, *D. alata* cv. white yam and *D. trifida* cv. yampie have high levels of the unsaturated fatty acid, linolenic (78.09 % and 60.09% respectively). All polyphenol oxidases from the 11 cultivars showed activities towards the diphenol substrates, catechol and DL-DOPA (DL-3,4-dihydroxyphenylalanine). However, no oxidation was observed with L-tyrosine, a monophenol substrate. Acid phosphatase was determined from two species of yams, *D. cayenensis* and *D. rotundata*. The acid phosphatase enzyme was partially purified and was found to be generally the highest in *D. rotundata*

cv. negro (6032 units. mg^{-1} protein). The enzyme was significantly inhibited by EDTA (the enzyme activity was reduced down to 1.5 %) and β -mercaptoethanol and activated by Mg^{2+} (the enzyme activity was enhanced up to 140 %). All cultivars had different lengths of dormancy which varied with storage conditions. When the harvested tubers were washed, sunned and stored at 20°C in the dark, it was possible to extend their lengths of dormancy by a further 11 weeks. It was also found that for the extraction of starch from yam tubers, different conditions could be used for different yam types in order to obtain a better amount of starch. Statistically different results in starch content were obtained with different extraction methods. Extraction of starch from *D. alata* cv. sweet yam could be performed at 30°C with 1:9 dilution to obtain 50.37 g/100 g fresh wt of starch whereas for *D. rotundata* cv. negro it could be done at 45°C with a 1:4 dilution factor. The highest amounts of free amino-acid was obtained for *D. trifida* cv. yampie (0.76 g/100 g dry wt) and *D. alata* cv. St. Vincent (0.69 g/100 g dry wt). The lowest amount of free amino-acid was obtained for *D. alata* cultivars -sweet yam_a (0.12 g/100 g dry wt) and sweet yam_m (0.05 g/100 g dry wt).

Total lipids and fatty acid composition of yam tubers with short-term storage was also examined. The yam tubers contain an average of 0.1 % of total lipids at harvest, which increased to approximately 0.5 % at the onset of sprouting. However after sprouting, the amount of total lipids in the yam tubers decreased slowly. Newly harvested yam tubers had a high amount of saturated fatty acid mainly palmitic acid ($\text{C}_{16:0}$) and stearic acid ($\text{C}_{18:0}$). At the onset of sprouting, a

larger spectrum of fatty acids is found in the yam tubers with an increase of unsaturated fatty acids such as oleic ($C_{18:1}$), linoleic ($C_{18:2}$) and linolenic ($C_{18:3}$) acids. Once sprouting started, only two types of fatty acids were detected, palmitic and linoleic acid.

The DNA isolation showed that the yam DNA fragments isolated had a molecular weight of about 49 kb. *TaqI* and *HinfI* restriction enzymes were selected for RFLP (restriction fragment length polymorphism) studies with yam DNA. The pRR217 probe from Dr. Terauchi (Japan), which was found to be successful in showing polymorphisms in Guinea yam DNA, was used for RFLP analysis. The RFLP analysis showed a considerable amount of DNA polymorphism among the different yam cultivars. Using random DNA primers, DNA polymorphisms were observed among the different yam cultivars. The cultivar tau of the *D. rotundata-cayenensis* species was found to possess more similarities with the *D. rotundata* species than *D. cayenensis*.