



Short note [Nota corta]

FATTY ACID COMPOSITION OF WILD YAM (*Dioscorea* spp.)
[COMPOSICIÓN DE LOS ÁCIDOS GRASOS DEL ÑAME SILVESTRE
(*Dioscorea* spp.)]

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SUMMARY

Samples of wild yam tubers (*Dioscorea alata*, *D. bulbifera* var. *vera*, *D. esculenta*, *D. oppositifolia* var. *dukhumensis*, *D. oppositifolia* var. *oppositifolia*, *D. pentaphylla* var. *pentaphylla*, *D. spicata*, *D. tomentosa* and *D. wallichii*) were analyzed for its fatty acid composition. Linoleic acid was found to be predominant among all the investigated *Dioscorea* spp. which ranged from 26.3 – 33.21% .Thus, the present investigation demonstrate that, the *Dioscorea* spp. act as a good source of fatty acid.

Key words: *Dioscorea*; linoleic acid; PUFA.

RESUMEN

Se evaluaron muestras de raíces de ñame silvestre (*Dioscorea alata*, *D. bulbifera* var. *vera*, *D. esculenta*, *D. oppositifolia* var. *dukhumensis*, *D. oppositifolia* var. *oppositifolia*, *D. pentaphylla* var. *pentaphylla*, *D. spicata*, *D. tomentosa* y *D. wallichii*) para determinar su composición de ácidos grasos. Se encontró que el ácido linoleico fue el ácido graso predominante entre las diversas especies estudiadas con un rango de 26.3 a 33.2%. El presente trabajo muestra que *Dioscorea* spp. es una buena fuente de ácidos grasos.

Palabras clave: *Dioscorea*; ácido linoleico; ácidos grasos poli insaturados.

INTRODUCTION

The genus *Dioscorea* (yam) belongs to the family Dioscoreaceae. It comprises 350-400 species (Caddick *et al.*, 2002) and is distributed throughout the tropics and subtropic regions especially in West Africa, parts of Central America and the Caribbean, the Pacific islands and Southeast Asia. *Dioscorea* has been suggested to have nutritional superiority when compared with other tropical root crops. They are reported as good sources of essential dietary nutrients (Bhandari *et al.*, 2003; Shanthakumari *et al.*, 2008; Maneenoon *et al.*, 2008; Arinathan *et al.*, 2009). These wild yams make a significant contribution in the diets of the tribal people of India. The tubers were found with a high amount of protein, a good proportion of essential amino acids and appeared as a

fairly good source of many dietary minerals. Information regarding the chemical and nutritional content of wild edible tuber is meager (Babu *et al.*, 1990; Nair and Nair, 1992; Shanthakumari *et al.*, 2008; Alozie *et al.*, 2009; Arinathan *et al.*, 2009). Reports on fatty acid contents of other common varieties of yam are available previously (Opute and Osagie, 1978; Muzac – Tucker *et al.*, 1993; Kouasei *et al.*, 1988). However, their fatty acids may be beneficial to human beings, since plant fatty acids have become a major player in the alleviation of most human diseases. In this present investigation, an attempt was made to understand the fatty acid composition of underutilized tubers of nine species of *Dioscorea* for the first time. *Dioscorea* spp are cooked and eaten by the Indian tribal sects, Palliyars living in the Giant Squirrel Wildlife Sanctuary,

Virudhunagar District and Kanikkar, living in the Agasthiarmalai Biosphere Reserve, Tirunelveli District, Tamil Nadu, India (Shanthakumari *et al.*, 2008; Arinathan *et al.*, 2009; Shajeela *et al.*, 2011).

MATERIALS AND METHODS

Plant samples

Nine samples of wild yam tubers (*Dioscorea alata*, *D. bulbifera* var. *vera*, *D. esculenta*, *D. oppositifolia* var. *dukhumensis*, *D. oppositifolia* var. *oppositifolia*, *D. pentaphylla* var. *pentaphylla*, *D. spicata*, *D. tomentosa* and *D. wallichii*) grown in sandy loam soil is consumed by the tribal Kanikkars / Palliyars, were collected using multistage sampling technique in three consecutive rainy seasons during August and January 2010 from the South Eastern Slopes of Western Ghats, Virudhunagar district, Madurai district and Kanyakumari district, Tamil Nadu.

Lipid extraction and fatty acid analysis

The total lipid was extracted from the tubers according to the method of Folch *et al* (1957) using chloroform and methanol mixture in ratio of 2:1 (v/v). Methyl esters were prepared from the total lipids by the method of Metcalfe *et al* (1966). Fatty acid analysis was performed by gas chromatography (ASHMACO, Japan; Model No: ABD20A) using an

instrument equipped with a flame ionization detector and a glass column (2mx3mm) packed with 1% diethylene glycol succinate on chromosorb W. The temperature conditions for GC were injector 200 °C and detector 210 °C. The temperature of the oven was programmed from 180 °C and the carrier gas was nitrogen at a flow rate of 30 ml/min. Peaks were identified by comparison with authentic standards, quantified by peak area integration and expressed as weight percentage of total methyl esters; the relative weight percentage of each fatty acid was determined from integrated peak areas.

RESULTS AND DISCUSSION

The results of the fatty acid composition of wild yam (*Dioscorea* spp) are presented in Table 1. The fatty acid composition of wild *Dioscorea* spp. ranged from 1.25% to 38.30%. The results revealed that, palmitic (29.30-38.30%) and linoleic (26.30-33.21%) acids were the predominant fatty acids in the investigated *Dioscorea* spp. The most abundant saturated fatty acid was palmitic acid, while the total saturated fatty acids ranged from 38.37 to 47.76%. Similarly, the most abundant unsaturated fatty acid was linoleic acid, while the total unsaturated fatty acids ranged from 48.83 to 59.37% of total fatty acids. The polyunsaturated to saturated fatty acid (P/S) ratio were obtained; they ranged from 0.75 to 1.09.

Table 1. Fatty acid composition of *Dioscorea* spp^a.

Fatty acids	<i>Dioscorea alata</i>	<i>Dioscorea bulbifera</i> var. <i>vera</i>	<i>Dioscorea esculenta</i>	<i>Dioscorea oppositifolia</i> var. <i>dukhumensis</i>	<i>Dioscorea oppositifolia</i> var. <i>oppositifolia</i>	<i>Dioscorea pentaphylla</i> var. <i>pentaphylla</i>	<i>Dioscorea spicata</i>	<i>Dioscorea tomentosa</i>	<i>Dioscorea wallichii</i>
Palmitic acid (C16:0)	29.3	31.33	34.3	34.3	30.13	32.48	38.3	34.14	29.46
Palmitoleic acid (C16:1)	2.41	-	2.01	4.31	3.28	3.1	-	2.16	4.32
Stearic acid (C18: 0)	9.2	11.48	8.21	9.4	8.24	9.78	9.46	8.36	10.21
Oleic acid(C18: 1)	11.36	9.36	15.78	11.26	10.06	12.31	11.3	10.48	11.52
Linoleic acid (C18: 2)	30.66	29.34	26.54	30.34	29.48	29.76	26.3	29.48	33.21
Linolenic acid (C18: 3)	14.11	14.91	15.04	9.02	15.21	9.26	11.23	14.12	10.03
Others	2.96	3.58	4.12	1.37	3.6	3.31	3.41	1.26	1.25
Unsaturation ratio*	1.04	0.95	0.82	0.91	1.04	0.94	0.75	0.89	1.09
O/L ratio*	0.37	0.32	0.59	0.37	0.34	0.41	0.43	0.36	0.35

^a All values are of two determinations

*O/L ratio means: Oleic acid/ Linoleic acid

*Unsaturation ratio = C18:2+C18:0/ C16:0+ C18:0

The fatty acid compositions of the various species of *Dioscorea* tubers investigated in the present study was found to be in agreement with earlier investigation in the tubers of *Dioscorea alata* (Ciacco and D' Appolonia, 1978); *Dioscorea transversa* (Brown *et al.*, 1985); *Dioscorea dumetorum* varieties (Kouassei *et al.*, 1988). Similarly all the investigated *Dioscorea* spp. contained more amount of unsaturated fatty acid, linoleic. This is in consonance with an earlier report in the tubers of *D. alata* and *D. trifida* (Muzac-Tuckar *et al.*, 1993). The unsaturation ratio of the investigated *Dioscorea* spp. is lower than the values reported earlier of *D. alata* (1:4), *D. bulbifera* (1:4), *D. rotunda* (1:8), *D. cayenensis* (1:8) (Opote and Osagie, 1978) and *D. dumetorum* (Alozie *et al.*, 2010). Palmitic acid was the dominating saturated fatty acid followed by the unsaturated fatty acid, linoleic acid. Among the investigated *Dioscorea* spp., *D. spicata* contained more amount of palmitic acid. *D. wallichii* contained higher amount of linolenic acid when compared with other presently investigated species. The nutritional value of linoleic acid is due to its metabolism at tissue levels which produce the hormone like prostaglandins. The activity of these prostaglandins includes lowering of blood pressure and construction of smooth muscle (Aurand *et al.*, 1987). Linoleic and linolenic acids are the most important essential fatty acids required for growth, physiological functions and maintenance (Pugalethi *et al.*, 2004). The fatty acid composition and high amounts of unsaturated fatty acids make *Dioscorea* a special tuber, suitable for nutritional applications. The presence of high levels of unsaturated fatty acids, in all the presently investigated *Dioscorea* tubers, is nutritionally desirable. The O/L ratios of lipids of *Dioscorea* spp. are lower in comparison with the averages suggested earlier (Attia *et al.*, 1996).

The role of fatty acids, especially the polyunsaturated fatty acids (PUFAs) in the management of coronary heart disease can be considered as the function of fatty acids of plant origin. It has been reported that, dietary changes achieved greater reductions in cardiovascular risk factors and coronary heart disease mortality in a secondary prevention trial than any of the cholesterol lowering studies till date (De Lorgeril *et al.*, 1999). The consumption of *Dioscorea* spp. will therefore supplement dietary fat with such essential fatty acids as linoleic acid and others, which are high in the wild yam.

CONCLUSION

The present investigation shows that, the *Dioscorea* spp. Can act as a good source of fatty acid.

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