Variability Of The Phenolic Profile Of Banana From Gran Canaria During Maturation

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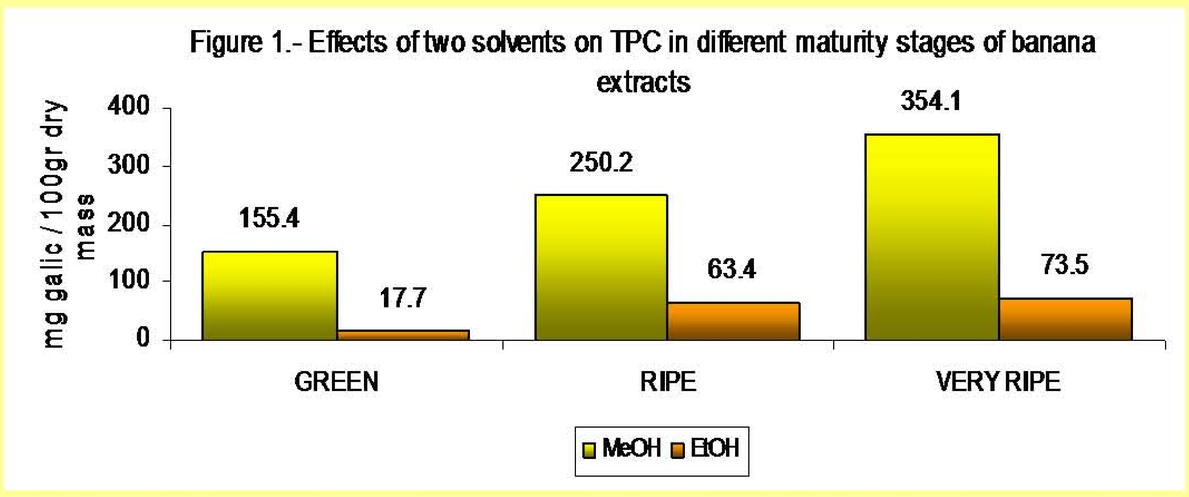
Introduction

Polyphenols have been reported to improve the quality and nutritional value of food due to their disease preventing potential (1). Therefore the effects of different extracting solvents and conditions have been tested for the extraction of the phenolic compounds from plant material (2). The banana is a widespread agricultural product in the Canary islands, being of great importance in the economy of the islands. The temperature in the islands ranges from 17º to 24º C all the year with intense sunlight. These weather conditions force plants to develop defense mechanisms against ultraviolet radiation and excessive production of free radicals through the accumulation of antioxidant substances such as phenolic compounds. On the present study we compared the phenolic profile and the antioxidant activities of several extracts of banana in different maturation states.

Determination of total phenolic contents (TPC)

TPC was evaluated using the colorimetric Folin-Ciocalteu assay (3). The results were determined by the regression equation of a calibration curve (y = 0.00029x – 0.00025, r=0.9992) and were expressed as mg gallic acid/100gr dry banana pulp. As a general rule, methanol extracts gave higher content of phenolics than ethanol extracts (Figure 1).



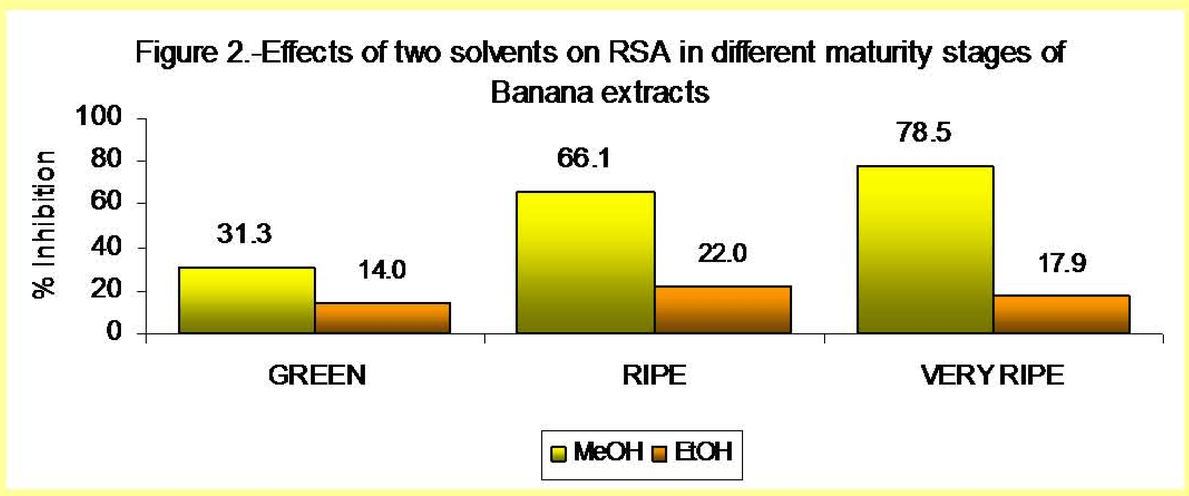
In table 1 are showed the TPC values in fruits and vegetables available in previously reported studies (4).

Fruits	TPC[a]	Vegetables	TPC[a]
Banana	215	Melon	141
Apple	196	Papaya	222
Avocado	63.9	Mango	134
Kiwi	190	Pear	109

Table 1.- Total polyphenol contents in several fruits and vegetables in mg per 100 g of lyophilized dry material.

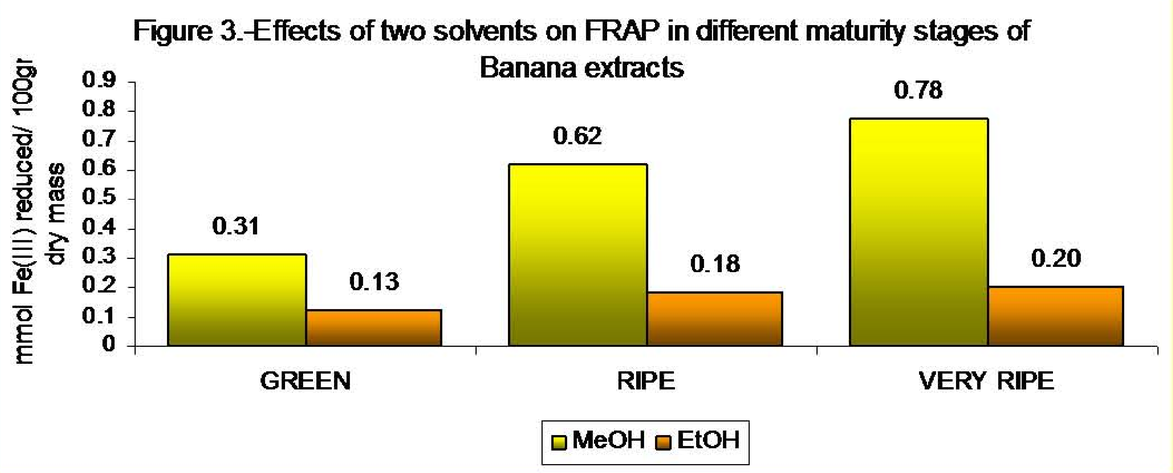
DPPH radical-scavenging activity

The radical scavenging activity (RSA, %) of extracts on DPPH radical was calculated by equation: RSA = 100×(1-Abs in the presence of sample/Abs in the absence of sample) (5). According to the results in Figure 2, methanol extracts showed the highest activities.



Ferric reducing power assay (FRAP)

Antioxidant activity was determined using the ferric reducing power assay (FRAP) (6). Banana extracts showed FRAP values ranged from 0.13 to 0,78 mmol Fe^{3+} reduced per 100 gram of dry material (Figure 3). High correlation betweeen FRAP, TPC and RSA was found in methanol extracts.



Reverse phase high performance liquid chromatography analysis (RP-HPLC)

The quantification of phenolics by reverse phase high performance liquid chromatography (7) showed that polyphenol content increased in the more mature fruit extracts.

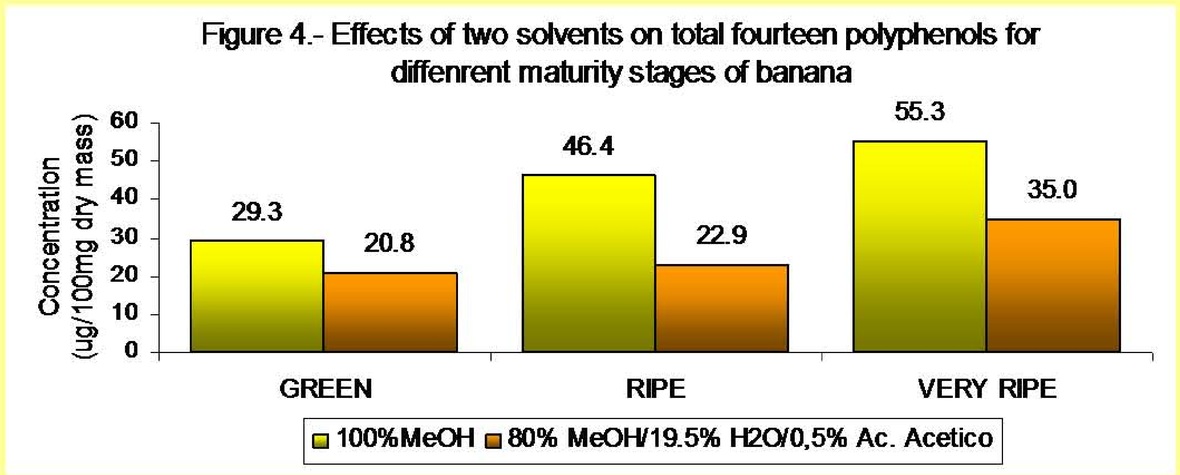


Table 2 shows that catechin was the predominant polyphenol in the extracts, followed by epicatechin and gallic acid.

Maturity Stages	100% MeOH Extracts		80% MeOH Extracts	
	Compound	(µg/100 gr dry mass)	Compound	(µg/100 gr dry mass)
Green	Catechin	11,332 ± 0,212	Catechin	6,027 ± 0,001
	Epicatechin	3,738 ± 0,029	Galic Acid	2,928 ± 0,020
	Galic Acid	3,667 ± 0,058	Epicatechin	2,257 ± 0,052
Ripe	Catechin	27,225 ± 0,480	Catechin	7,728 ± 0,157
	Galic Acid	4,444 ± 0,153	Galic Acid	3,167 ± 0,007
	Epicatechin	4,333 ± 0,040	Epicatechin	1,964 ± 0,053
Very Ripe	Catechin	29,956 ± 0,546	Catechin	17,413 ± 0,294
	Epicatechin	6,094 ± 0,032	Epicatechin	4,141 ± 0,165
	Galic Acid	5,520 ± 0,111	Galic Acid	3,457 ± 0,006

Table 2.- Predominant polyphenols in the banana extracts determined by RP-HPLC.

Conclusion

The maturity state and the extracting solvent significantly affected FRAP, TPC and RSA of crude extracts from banana pulp. Several reports have convincingly shown a close relationship between antioxidant activity and total phenolic content in extracts, concluding that polyphenols are the main responsible for this activity (8). Similar results were found in banana pulp in this study, therefore phenolics may be the main microconstituents contributing to the antioxidant activity. In conclusion, banana pulp is ideal for use in industry of healthy food and the food industry in general as an ingredient in other products, as well as in the pharmaceutical and cosmetic industry.

References

1. Southon, S. (2000). *Food Research International*, *33*, 211-217.
2. (a) Pinelo, M., Rubilar, M., Sineiro, J. & Nunez, M. J. (2004). *Food Chemistry*, *85*, 267-273. (b) Xu, B. J. & Chang, S. K. C. (2007). *Journal of Food Science*, *72*, S159-S166.
3. Julkunen-Tiitto, R. (1985). Journal of Agricultural and Food Chemistry, 330, 213-217.
4. Kumazawa, S., Ikenaga, M., Usui, Y., Kajiya, K., Miwa, S., Endo, J., Chikasawa, C., Suzuki, Y., Shimoi, K. and Nakayama, T. (2007). *Food Science and Technology Research*, *13*, 404-413.
5. Chu, Y.H., Chang, C. L., Hsu, H. F. (2000). *Journal of the Science of Food and Agriculture*, 80, 561-566.
6. Benzie, I.F., Strain, J.J. (1996). *Analytical Biochemistry 239*, 70–76.
7. López, A., Rico, M.,Suarez de Tangil, M., Rivero, A. (2011). *Food Chemistry*, *125*, 1104-1111.
8. Chew, Y.L., Lim, Y.Y., Omar, M., Khoo, K.S. (2008). *Food Science and Technology*, 41, 1067–1072

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