“Effect of ripening stage at harvest on phytochemical composition of “huamiche” (*Ferocactus histrix*) fruit”

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ABSTRACT

Ferocactus histrix, a member of the Cactaceae family, is an important underutilized barrel cacti from the central arid part of México. The stem, floral bottoms and fruit (huamiches) have been traditionally consumed by rural communities, however, its phytochemical composition and nutraceutical potential is still unknown. Phytochemical and physicochemical characterization of the fruits could enhance sustainable production of F. histrix in arid and semiarid regions. The fruits from these cacti present an oval shaped, a characteristic bittersweet flavor, and yellow or red external colour attributed to betalain pigments: betaxanthins and betacyanins. In this work, total phenolic, flavonoid and betalain (betaxanthins, betacyanins) contents, DPPH antioxidant capacity, colour parameters (L*, a*, b*), titrable acidity, pH, TSS, weight and size were measured in red and yellow F. histrix fruits of two ripening stages (ripe and unripe) collected at San Luis de la Paz, Guanajuato, Mex. (N 21° 16´48.43¨, W 100° 30 ´16.68¨). Overall, yellow fruits were larger and heavier than red ones, and the phytochemical contents and physicochemical variables were affected by the ripening stage. The highest phenolic and flavonoid contents were observed in unripe red fruits, 0.44 ± 0.19 mg GAE/ g and 0.29 ± 0.09 mg CE / g respectively. Total betalain contents were also higher in unripe fruit (≈ 20%) despite the color. Maximum betacianin and betaxanthin contents were observed for red and yellow unripe fruits respectively. F. histrix fruits have similar or higher phytochemical contents compared to other cacti fruits, and could represent a source of nutraceutical food in arid and semiarid regions of México.

Introduction

Ferocactus histrix fruits (Huamiches) are consumed in the last ripening stages, since senescent fruit is preferred due to its sweetness. The physicochemical changes and phytochemical content of the fruit during ripening have not been described yet. The study of the nutraceutical potential of F. histrix could enhance its sustainable production in arid and semiarid regions.

Material and methods

Plant material was collected at San luis de la Paz, Guanajuato, Méx. (N 21° 16´48.43¨, W 100° 30´16.68¨) and clasified in to 4 different groups according to the percentage of red pigmentation, at two maturity stages (ripe and unripe) (Figure 1). Total Soluble Solids, titrable acidity, pH and colour were measured according to (Total phenols, flavonoids and DPPH antioxidant capacity were measured spectrophotometrically (2), in methanolic extracts of the lyophilized fruits. Betalains were extracted in water, filtered and measured at 483 (betaxhantins, bx) and 535 (betacianins, bc) (3).

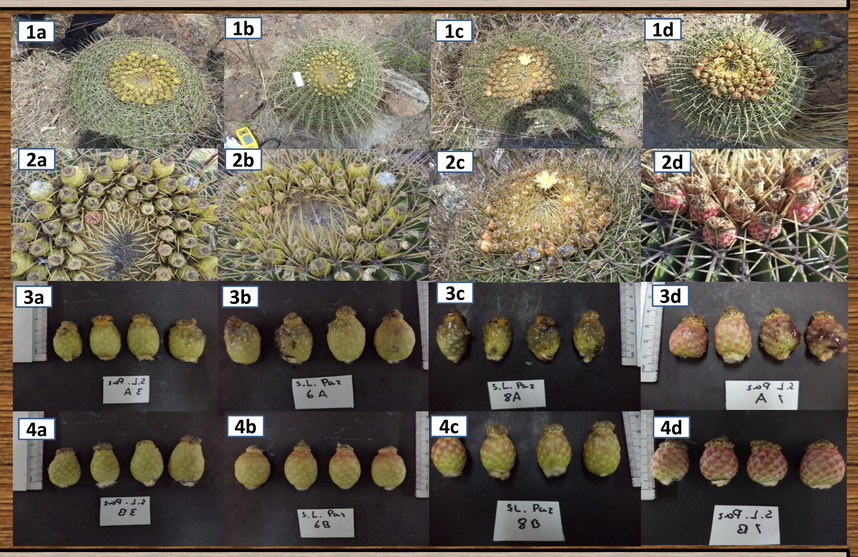

Figure 1. Cacti barrel *F. histrix* with fruits (1a, 1b, 1c, 1d). Fruits with 4 diferent pigmentations, 2a 0 % red; 2b 1-33 % red; 2c 34-66 % red; and 2d 67-100 %. Ripe fruit (3a, 3b, 3c, 3d); and unripe fruit (4a,4b,4c,4d).

Results

During ripening, the physicochemical parameters change; pH and a* colour parameter decreased. While, the SST, titrable acidity, and weigth increased (Table 1).

Table 1. Physicochemical parameters comparison between ripe and unripe fruits

Parameter		% of change	Max.- Min
SST		55.35%	5.30 ± 0.03 to 12.72 ± 3.19
Tritable acidity (mg CAE)		50.76%	1.62 ± 0.06 to 4.02 ± 0.10
Weigth (g)		68.97%	3.69 ± 0.82 to 7.51 ± 1.68
pH		29.21%	3.56 ± 0.28 to 2.46 ± 0.10
Colour	a*	52.62%	71.90 ± 47.58 to -42.38 ± 15.22
	b*	53.55%	14.29 ± 5.24 to 30.77 ± 2.38

There is a decrease of phenolics content in ripe fruit from all colour groups, due to its process of senescence, and red colored fruits presented the highest content of total phenols and flavonoids, 0.44 ± 0.19 mg GAE/ g and 0.29 ± 0.09 mg CE / g respectively (Figure 2A and 2B), these values are higher than those of other cacti fruits like prickly pear (*Opuntia* spp.) (4) and dragon fruit (*Hylocereus* spp.) (5). Fruits presented similar proportions of betacyanins and betaxanthins, predominating betacyanins even in yellow fruits, no significant diferences were observed between ripe and unripe fruit (Figure 2C). The DPPH antiradical activity ranged between 52-65 absorbance inhibition % (Figure 2D), however low correlation with phenolic and betalain compounds was observed.

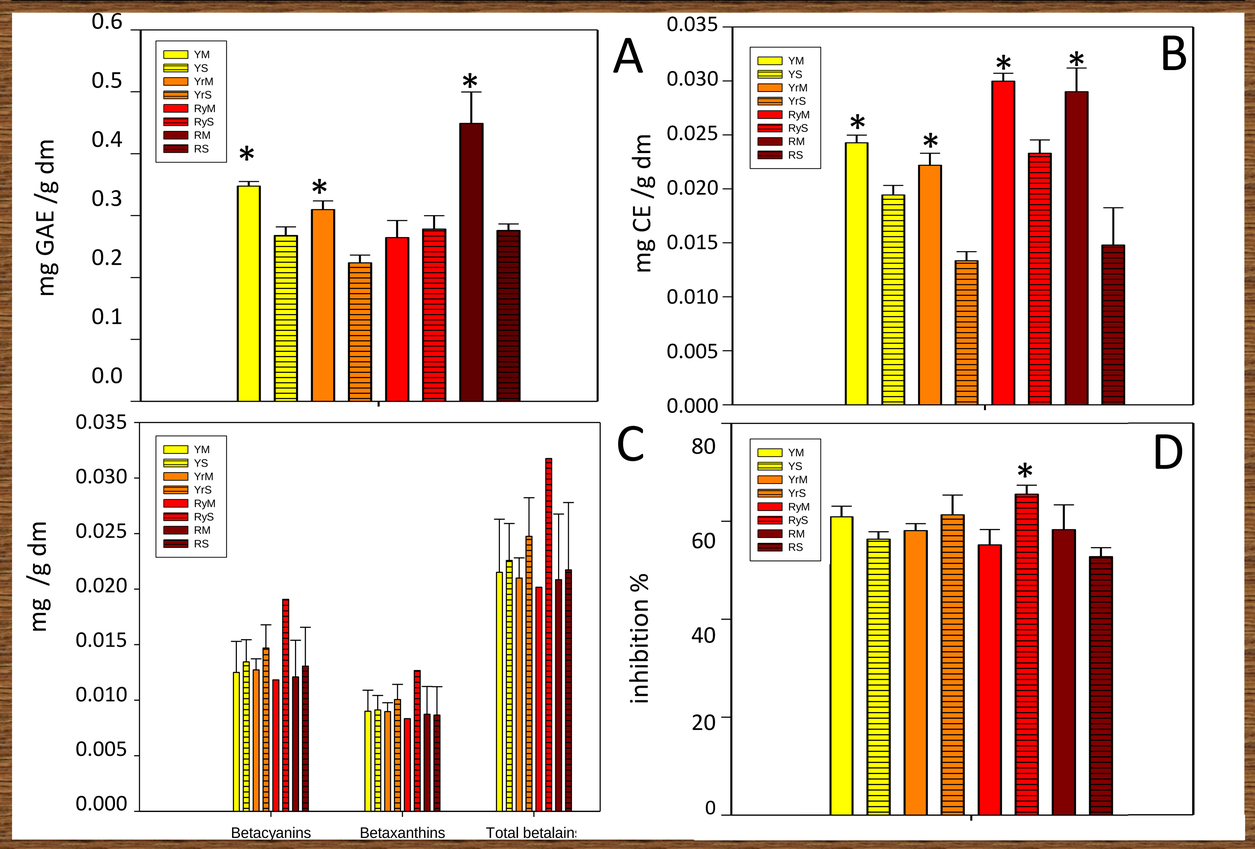

Figure 2. Total phenols (A), total flavonoids (B), betalains (C), and antioxidant capacity by DPPH assay (D) in fruits from the two maturity stages and colors. Asterisks mean there´s significant diferences by ANOVA, and student´s t with α = 0.05.

Conclusions

The ripening process of huamiches reduces its phytochemical content and enhances their flavor, however the fruit lose its quality and reduce its shelflife. Therefore, consumption of unripe fruit could be recommended among rural communities to improve human health.

Huamiches fruit could be considered an important source of antioxidants in arid lands of central México.

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