

## ECONOMIC ANALYSIS OF CACTUS PEARS BIO-FUNCTIONAL, MEDICINAL, NUTRACEUTICAL AND COSMETIC PROPERTIES (PÓSTER)

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### 1 Introduction and objectives

There is a vast potential for non-food uses of cactus pear, exploiting its bio-functional, medicinal, nutraceutical and cosmetic properties (El-Mostafa et al., 2014). Chemical and nutritional components of prickly pear fruit have already been studied (Andreu-Coll et al., 2019; Andreu et al., 2017; El Kossori et al., 1998; Gurrieri et al., 2000; Mena et al., 2018). Furthermore, it has been shown that cactus pear fruit extract holds antiulcerogenic, anti-inflammatory, antidiabetic, antioxidant, anticancer, neuroprotective, hepatoprotective and antiproliferative activities (Allegra et al., 2014; Antunes-Ricardo et al., 2015; Kuti, 2004; Park et al., 2001). Cactus pears have also been reported as a good source for red and yellow food coloring agents (Castellar et al., 2003; Esatbeyoglu et al., 2015; Fernández-López et al., 2012, 2002; Fernández-López et al., 2001; García-Cayuela et al., 2019). There has been also research regarding cactus pear as a source of bioactive compounds for nutrition, health and disease (Ayadi et al., 2009; Esatbeyoglu et al., 2015; Melgar et al., 2017; Nuñez-López et al., 2013; Pinedo-Espinoza et al., 2017). However, there is not an economic analysis of the value of these properties linked to the cactus pear production. So, the objective of this work is to explore the economic opportunities of Opuntia cultivation in Spain regarding non-food uses of cactus pear (exploiting its bio-functional, medicinal, nutraceutical and cosmetic properties).

### 2. Materials and Methods

A revision of literature has been made to establish the quantity of components with bio-functional, medicinal, nutraceutical and cosmetic properties that cactus pear holds. Market prices of these compounds have been obtained through a questionnaire among main producers. Then, an estimation of the quantities that could be obtained from a hectare of cactus pear in Spain has been calculated considering the production data obtained in the questionnaire carried out to producers.

### 3. Results

**Table 1** shows the average content of bio-functional, medicinal, nutraceutical and cosmetic components in cactus pears according to the existing scientific literature. Extractions are usually done with methanol and water (different proportions according to the procedure) and analyzed by HPLC. **Table 2** summarizes current prices for the main bio-functional, medicinal, nutraceutical and cosmetic components, as declared by main commercial companies. Finally, **Table 3** shows the normal weights and average prices of bio-functional, medicinal, nutraceutical and cosmetic components sold in the market compared with the average quantity (in micrograms) of these components present in a gram of cactus pear dry weight.

**Table 1.** Average quantity of bio-functional, medicinal, nutraceutical and cosmetic components in cactus pears (quantities are expressed in  $\mu\text{g g}^{-1} \text{dw}$ )

Compound	Average content ( $\mu\text{g g}^{-1} \text{dw}$ )	References
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Kaempferol	34.04	El-Mostafa et al. (2014), García-Cayuela et al. (2019), Mena et al. (2018), Tesoriere et al. (2005)
Myrcetin	65	Mena et al. (2018)
Isorhamnetin (and derivatives)	590	El-Mostafa et al. (2014), García-Cayuela et al. (2019), Mena et al. (2018), Yeddes et al. (2013)
Luteolin	8.4	El-Mostafa et al. (2014)
Ferulic acid (and derivatives)	1050	Mena et al. (2018)
Catechin	50	Mena et al. (2018)
Guaiacyl(t8-O-4)guaiacyl-hexoside	105	Mena et al. (2018)
Guaiacyl(8-O-4)syrinigyl(8-8)guaiacyl-hexoside	60	Mena et al. (2018)
Syrinigyl(t8-O-4)guaiacyl	60	Mena et al. (2018)
Sinapic acid (and derivatives)	1140	Mena et al. (2018)
Quercetin (and derivatives)	91.1	El-Mostafa et al. (2014), García-Cayuela et al. (2019), Mena et al. (2018), Yeddes et al. (2013)
Narigin (and derivatives)	75	Mena et al. (2018)
Syringaresinol	105	Mena et al. (2018)
4-Hydroxy-benzoic acid	665	García-Cayuela et al. (2019)
Piscidic acid	18865	García-Cayuela et al. (2019)
Betaxantins	196	Cano et al. (2017); García-Cayuela et al. (2019), Tesoriere et al. (2005)
Betacyanins	328	Albano et al. (2015); Cano et al. (2017), García-Cayuela et al. (2019)

**Table 2.** Average current prices and commercial quantities for the main bio-functional, medicinal, nutraceutical and cosmetic components

Compound	Weight	Average price (€)
Kaempferol (520-18-3)	20 mg	213.68
Myricetin (529-44-2)	20 mg	238.11
Rhamnetin (90-19-7)	10 mg	198.42
Fisetin (528-48-3)	10 mg	195.37
Isorhamnetin (480-19-3)	10 mg	204.53
Myrcene (123-35-3)	100 mg	134.32
Galangin (548-83-4)	20 mg	225.89
Kaempferide (491-54-3)	10 mg	177.05
Luteolin (491-70-3)	10 mg	189.26
Ferulic Acid (537-98-4)	1 g	134.32
Gossypetin (489-35-0)	10 mg	265.58
4-Coumaric acid (501-98-4)	1 g	134.32
3-Coumaric acid (14755-02-3)	1 g	134.32
2-Coumaric acid (614-60-8)	1 g	134.32
(+)- Catechin (154-23-4)	10 mg	186.21
Morin (480-16-0)	20 mg	195.37

**Table 4** presents the value in € of a g of cactus plant (dw, dry weight) according to its content of bio-functional, medicinal, nutraceutical and cosmetic components.

According to Butera et al. (2002), El-Mostafa et al. (2014), García-Cayuela et al. (2019), Mena et al. (2018), Tesoriere et al. (2005), the average quantity of water of cactus pear is 80 %. The cactus pear average production *per ha* is 234 t ha<sup>-1</sup> (ranging from 273 to 195 t ha<sup>-1</sup>) in Spain.

**Table 3.** Average quantities and average prices of several components in the marketplace compared with the average quantity (in micrograms) of these component present in a gram of cactus pear dry weight

MARKET PLACE			CACTUS PEAR	
Component	Average price (€)	Average quantity	Component	Average quantity (µg g <sup>-1</sup> dw)
Kaempferol (520-18-3)	213.68	20 mg	Kaempferol	34.04
Myrcetin (529-44-2)	238.11	20 mg	Myrcetin	65
Isorhamnetin (480-19-3)	204.53	10 mg	Isorhamnetin (and derivatives)	589.87
Luteolin (491-70-3)	189.26	10 mg	Luteolin	8.4
Ferulic Acid (537-98-4)	134.32	1 g	Ferulic acid (and derivatives)	1050
Catechin (154-23-4)	186.21	10 mg	Catechin	50

**Table 4.** Value of each g of cactus (dry weight) according to its composition

Component	Average price (€ µg <sup>-1</sup> )	Average content (µg) in 1 dw of cactus pear	Value (€) of 1 g dw of cactus pear
kaempferol (520-18-3)	0.010684	34.04	0.36
Myrcetin (529-44-2)	0.011906	65	0.77
Isorhamnetin (480-19-3)	0.020453	589.87	12.06
Luteolin (491-70-3)	0.018926	8.4	0.16
Ferulic Acid (537-98-4)	0.134320	1050	141.04
(+)- Catechin (154-23-4)	0.018621	50	0.93

#### 4. Conclusions

Quantities of compounds with bio-functional, medicinal, nutraceutical and cosmetic properties in *Opuntia* have been analysed. Average quantities and average prices of these highly-demanded components sold in the market compared with the average quantity (in µg) of these components present in 1 g of dried cactus pear has been presented. A further research should look at the cost of obtaining these compounds. These processes and their costs are dependent on the type of plant material and compound to be extracted but there are no studies on these factors in prickly pear. It seems that obtaining these compounds could be a way of increasing profitability of cactus pear production and creating jobs and value in rural areas.

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