EFFECT OF THE CLADODES PEELING IN THE FUNCTIONAL, TECHNOLOGICAL, CHEMICAL CHARACTERISTICS AND BIOACTIVE COMPOUNDS IN CLADODES POWDER (*Opuntia ficus-indica*)

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INTRODUCTION

Cactus cladodes powder is rich in dietary fiber and could be used as a functional ingredient in foods. The herbaceous aroma and the relation soluble/insoluble fiber could be improved preparing the powder using cladodes with or without epidermis.

OBJECTIVE

To study the functional, technological and chemical characteristics of 2 types of cactus cladodes powder (with and without epidermis).

MATERIALS and METHODS

Cladodes (2-3 years) from the University of Chile Garden varieties were used. The cladodes were washed, sliced (0.5 cm) and dried in an air forced tunnel (80°C, [illegible] hours). Two grounds (blades mills) were realized until a particle size close to 200µ. Apparent density (g mL^{-1}), moisture (g $100g^{-1}$), water retention capacity (WRC), swelling (CH) (g mL^{-1}), water absorption capacity (WAC), oil absorption index (OAC) (Femenia et al., 1997), and crude and dietary fiber (SDF and IDF) were determined in the powders (Lee et al., 1992). Antioxidant capacity was measured using the DPPH method (TEAC and EC50) (Brand-Williams et al., 1995). Total phenolic content was determined using the Folin-Ciocalteu reagent (mg GAE 100 g^{-1}) (Singleton and Rossi, 1965). The data were analyzed by ANOVA using Statgraphics Extra 5.1 program.

RESULTS and DISCUSSION

The results showed that there was not differences ($p<0,05$) in the technological characteristics of the powders for moisture, WRC, CH, WAC, OAC (Table 1).

Table 1. Technological characteristics

Parameter	Whole nopal	Peeled nopal
Aparent dnsity (g mL^{-1})	0.50	0.54
Moisture (g $100g^{-1}$)	6.77 ± 0.19	5.93± 0.22
Dry matter (g $100g^{-1}$)	93.23± 0.19	93.89± 0.22
Water abpsortion capacity (g g^{-1})	8.94± 0.52	9.51± 0.14
Swelling (g mL^{-1})	5.86± 0.09	6.49± 0.76
Oil abpsortion index (g g^{-1})	1.48± 0.09	1.34± 0.08
Water retention capacity (g mL^{-1})	10.22±0.13	10.08± 0.15

There was significant differences for the SDF and for the bioactive composition (Table 2); where the powder from cladodes with epidermis have a greater SDF content (14.03±0.38 g $100g^{-1}$) similar to that reported by Sáenz et al. (2010) and greater phenolic concentration (4.32±0.06 mg GAE g^{-1}), capacity antioxidant (1.86±0.02 TEAC) and lipids (2.74±0.69 g 100 g^{-1}) compared to powders obtained from cladodes without epidermis (2.96±0.07 mg GAE g^{-1}; 1.03±0.05 TEAC; 0.66±0.73 g 100 g, respectively) (Table 3).

Table 2. Dietary fiber

Parameter	Whole nopal	Peeled nopal
Insoluble fiber (IDF) g $100g^{-1}$	41,9± 2,33	41,66± 1,08
Soluble fiber (SDF) g $100g^{-1}$	14,03± 0,38	9,15± 0,19

Table 3. Bioactive compounds and antioxidant capacity

Parameter	Whole nopal	Peeled nopal
Total phenolics (mg GAE g^{-1})	4.32± 0.06	2.96± 0.07
Antioxidant activity EC_{50}	0.27± 0.02	0.47± 0.01
Antioxidant activity (TEAC)	1.86± 0.02	1.03± 0.05

The ash content and crude fiber were greater ($p>0,05$), in the powders from cladodes without epidermis (10.59±1.06 g $100g^{-1}$ and 7.25±0.29 g 100 g^{-1}, respectively) compared with the whole cladodes powders (0.75±0.28 g $100g^{-1}$ and 6.03±0.02 g $100g^{-1}$, respectively). This unexpected difference can be attributed to the peeling that it could eliminate part of the epidermis layers containing mucilage (soluble fiber). In conclusion the use of whole cladodes, besides avoiding the peeling, provides powders with greater dietary fiber and bioactive compounds content.

CONCLUSIONS

The cladodes powder including the peel shows greater phenolic content with higher antioxidant activity. Having also a higher content of soluble fiber than the powder of peeled cladodes, this can be due to the epidermis mucilages.

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