



***Technological, Organoleptic and Nutritional
Qualities of Cladodes Powder of Cactus
(Opuntia ficus indica)***

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2. Materials and Methods

3. Results and Discussion

- **Technological Criteria of Cactus Cladode Powders by Age**
- **Organoleptic Criteria of Cactus Cladode Powders by Age**
- **Nutritional Criteria of Cactus Cladode Powders by Age**

4. Conclusion

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Introduction



**Cladodes
Powder
Technology**



**Way of valorizing
cactus cladodes**



**Cladode by-product
diversification for the market:
Food, cosmetic, pharmaceutical ingredients**



- An important element for the human diet
- Considerable potential for medical use
- Shampooing, humectant cream, savon
- etc.

Adding value



Improving farmer's income

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Introduction

Objectives:

- 1. Study of the Suitability of Cladodes of Different Ages for Processing into Powders**
- 2. Evaluation of Technological, Organoleptic and Nutritional Qualities of the Cladode Powders by Age**

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Materials and Methods



1. Cladode ages:

4 ages



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2. Production Area:



Harvested in Skhour Rhamna Region

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3. Determination of Quality Criteria of Fresh and Cladode Powders

- Humidity
- Powder Yield
- Water absorption index (WAI)
- pH
- Total Titratable Acidity
- Water activity (a_w)
- Sorption behavior
- Color $L^*a^*b^*$ (Hunter Lab scale)
- Soluble Solids
- Cellulose
- Ash

4. Statistical Analysis of Data:

- Analysis of variance (ANOVA)
- Student-Newman-Keuls method
- Hierarchical cluster

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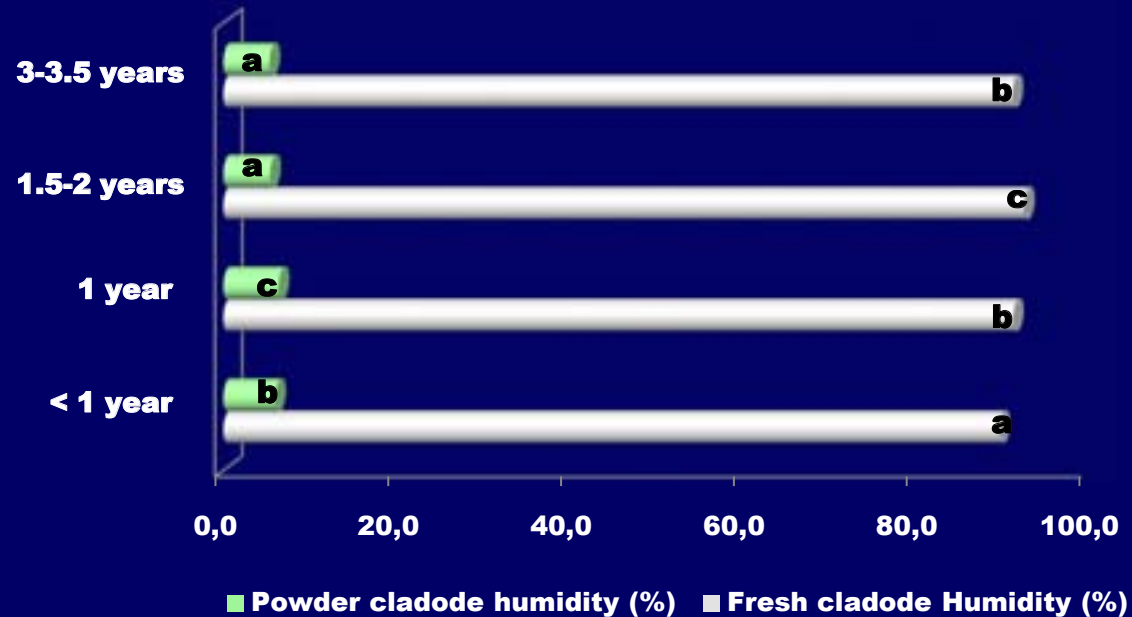
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Results and Discussion

Cladode Powder Humidity

Technological criterion



Fresh cladodes : 91.24%

Powder cladodes : 5.79%

High decrease after drying the fresh cladodes



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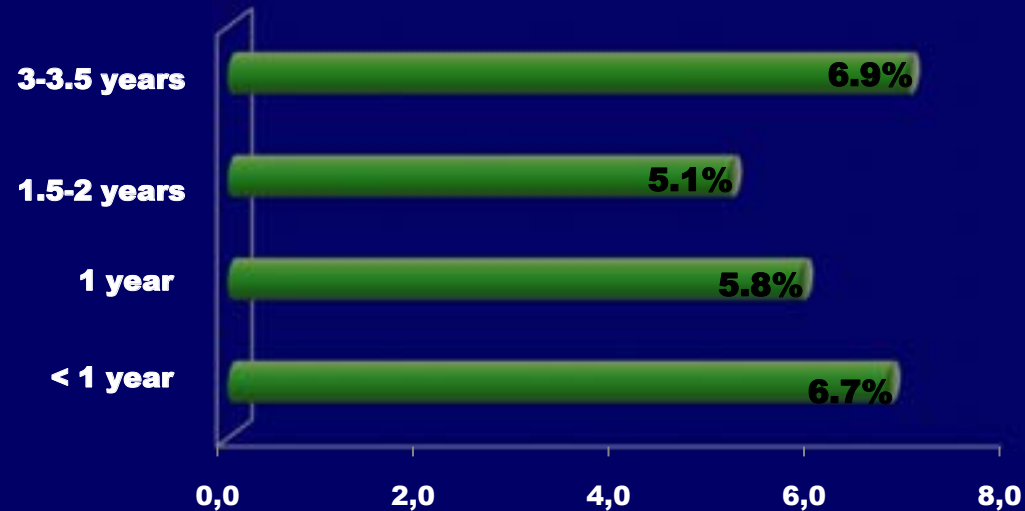
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Cladode Powder Yield

Technological criterion



Non significant negative correlation between yield and fresh cladodes humidity

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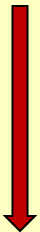
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Cladode Powder Water Absorption Index

Technological, organoleptic and nutritional criterion

Age	WAI (mL/g)
< 1 year	6.00 a
1 year	6.47 a
1,5 à 2 years	6.90 ab
3 à 3,5 years	7.76 b



● **Distinct rheological properties of powders when using as an ingredient in liquid or semi-solid formulations: Crème, soupe, flan... (Thicken product).**

● **Rich en hydrocolloids (mucilages): High nutritional value for health.**

● **Different saturation effects when using in food preparations (weight loosing).**

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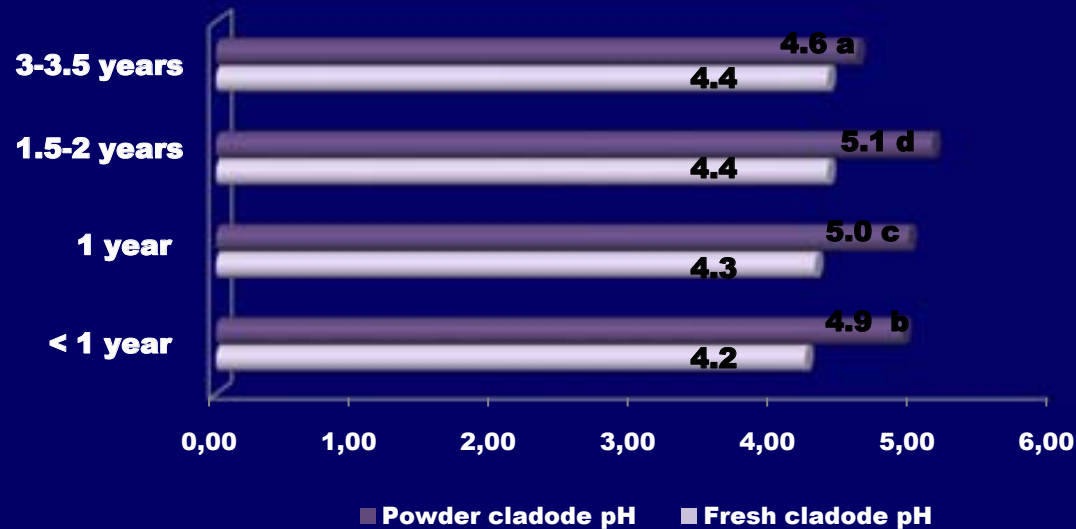
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Cladode Powder pH

Technological and Organoleptic criterion



Non significant increase of fresh cladodes pH by age

Very high significant difference of powder cladodes pH by age

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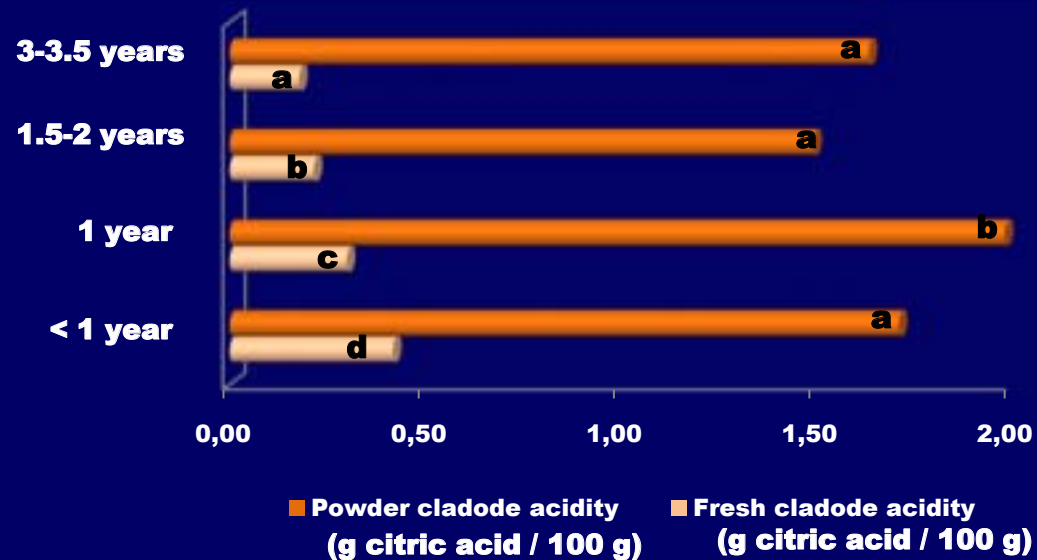
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Powder Cladode Total Acidity

Organoleptic and nutritional criterion



Very high significant decrease by age for fresh cladodes

Acidity concentration for cladodes powder

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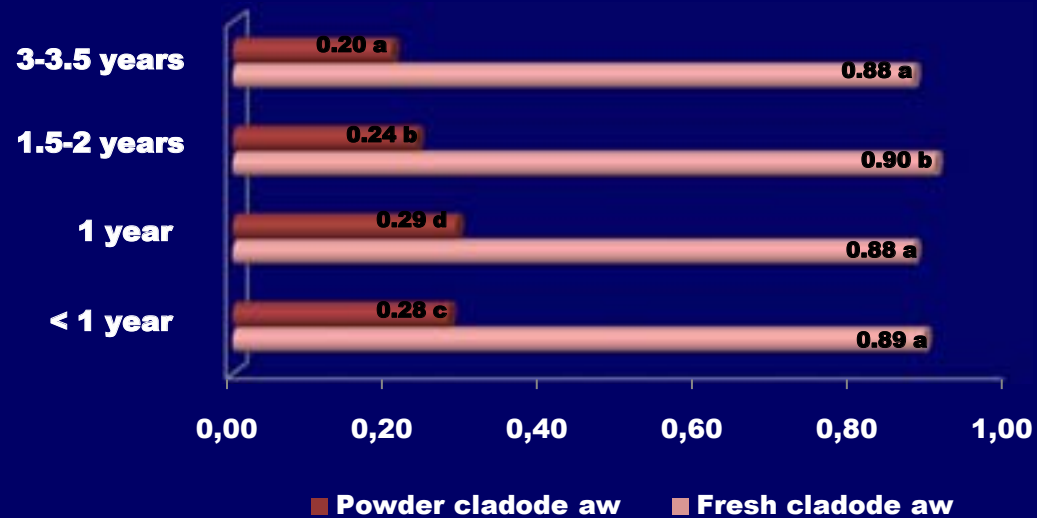
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Cladode Powder Water Activity

Technological criterion



$0.88 < a_w$ Fresh cladodes < 0.90 : ➔ 71.1 %

$0.20 < a_w$ Powder cladodes < 0.29 :

➔ Good microbial and enzymatic stability

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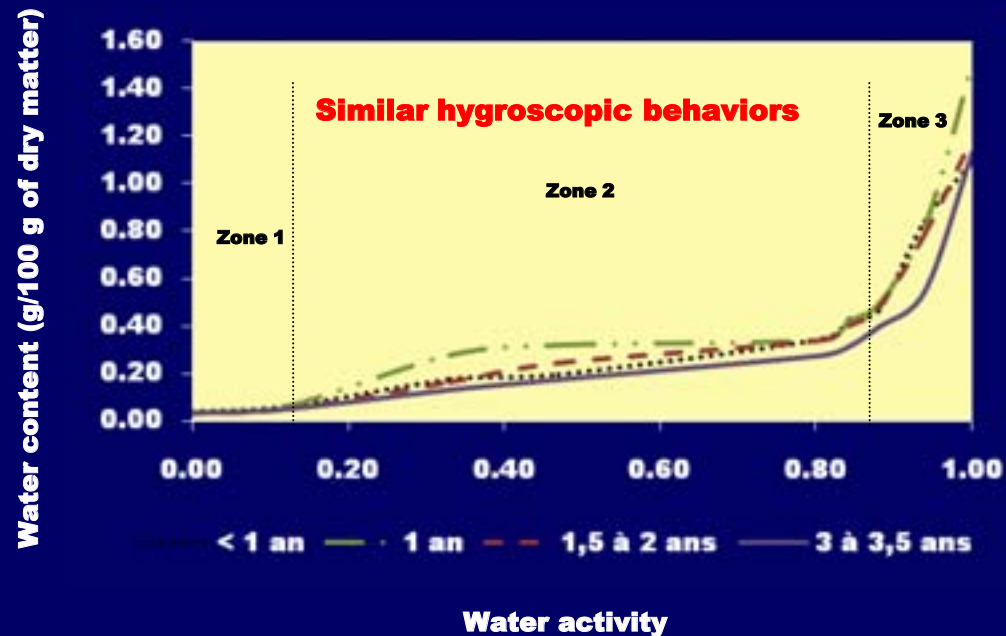
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Cladode Powder Sorption Behavior

Technological criterion



Moderately hygroscopic : relatively resistant to the water absorption (especially cladodes powder of 3 to 3.5 years).



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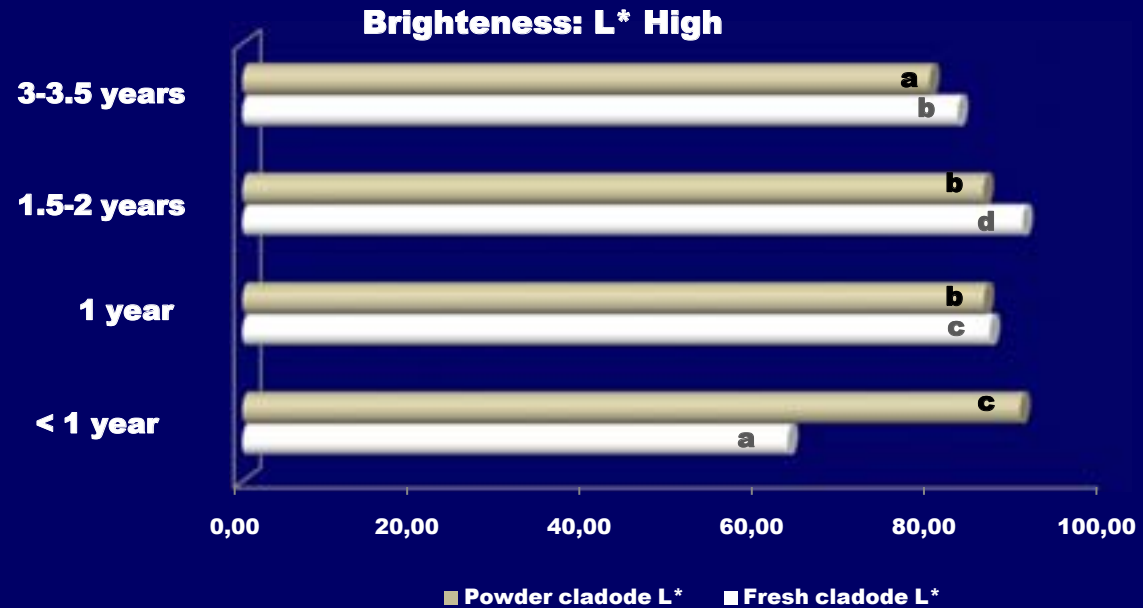
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Cladode Powder Color L* a* b*

Organoleptic criterion



Brightness increase by age for fresh cladodes

Brightness decrease by age for cladodes powders

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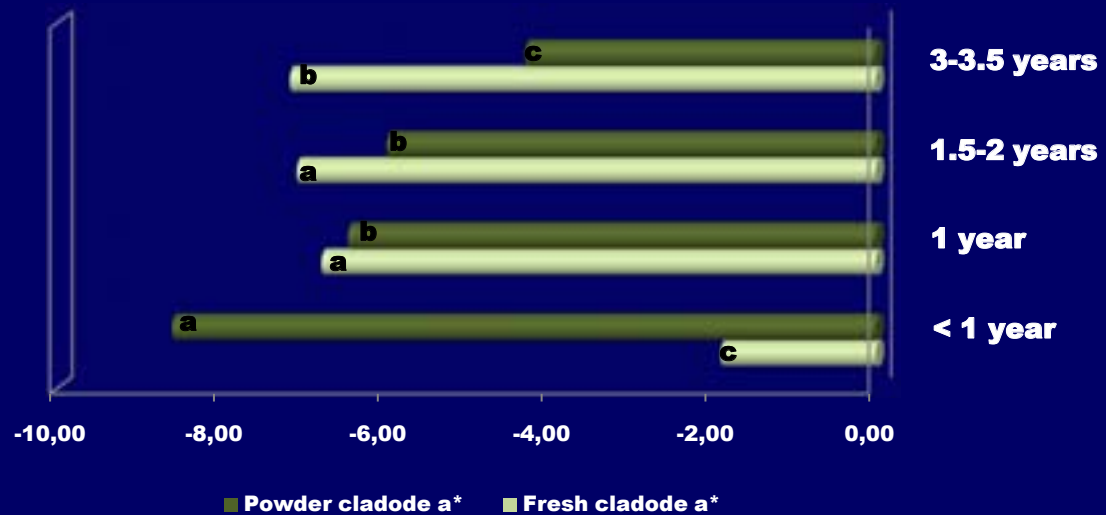
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Cladode Powder Color L* a* b*

Organoleptic criterion

Green color: negative value of a*



Green color increase by age for fresh cladodes

Green color decrease by age for cladodes powders

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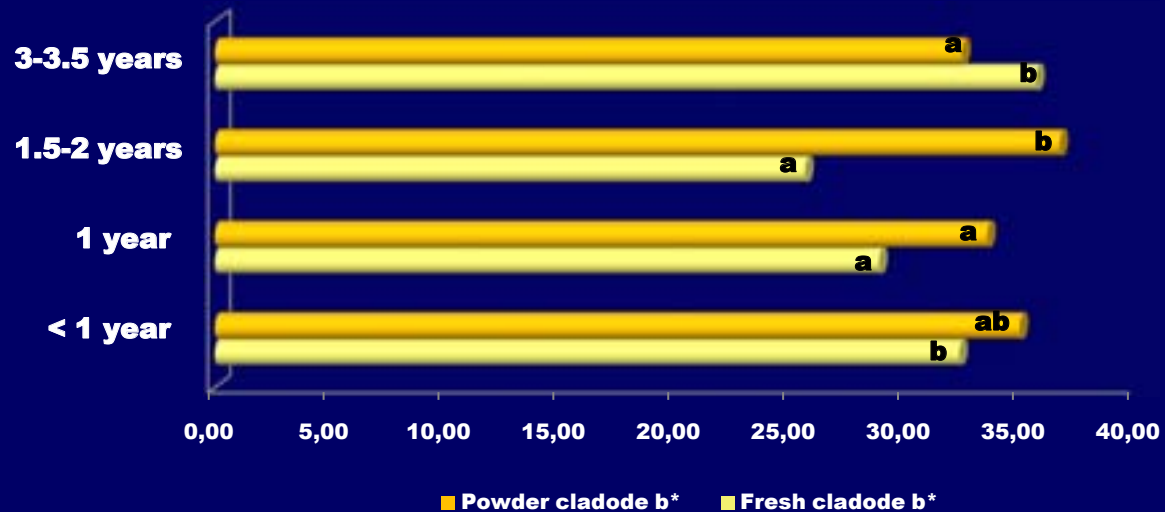
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Cladode Powders Color L* a* b*

Organoleptic criterion

Yellow color: positive value of b*



Yellow color decrease and increase by age for fresh cladodes

Yellow color almost similar by age for cladodes powders



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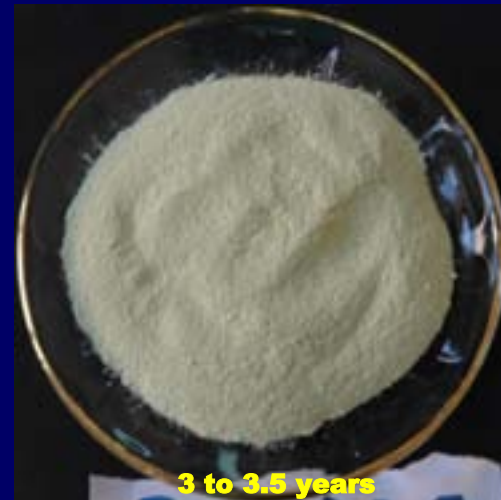
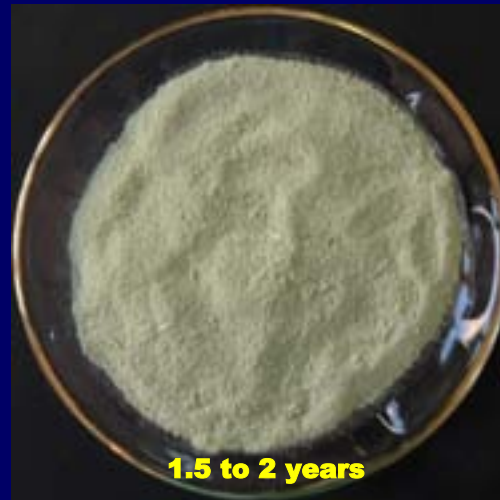
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**The smaller the cladodes age,
the greenest the resulting powder**

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Cladode powders Soluble Solids

Nutritional criterion



Very high significant increase after drying

Significant decrease in fresh and powder cladodes by age



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Cladode Powder Cellulose

Nutritional criterion

Age	Cellulose (g/100 g of dry matter)
< 1 year	5.42 a
1 year	6.14 a
1,5 à 2 years	6.13 a
3 à 3,5 years	6.44 a

Non significant increase by the cladodes age.



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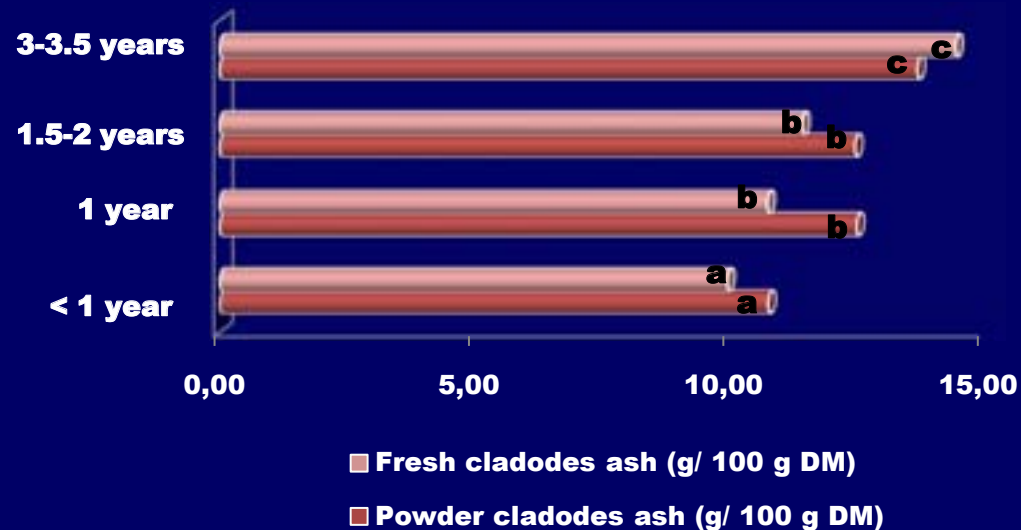
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Cladode Powder Ash

Nutritional criterion



Very high significant increase by age

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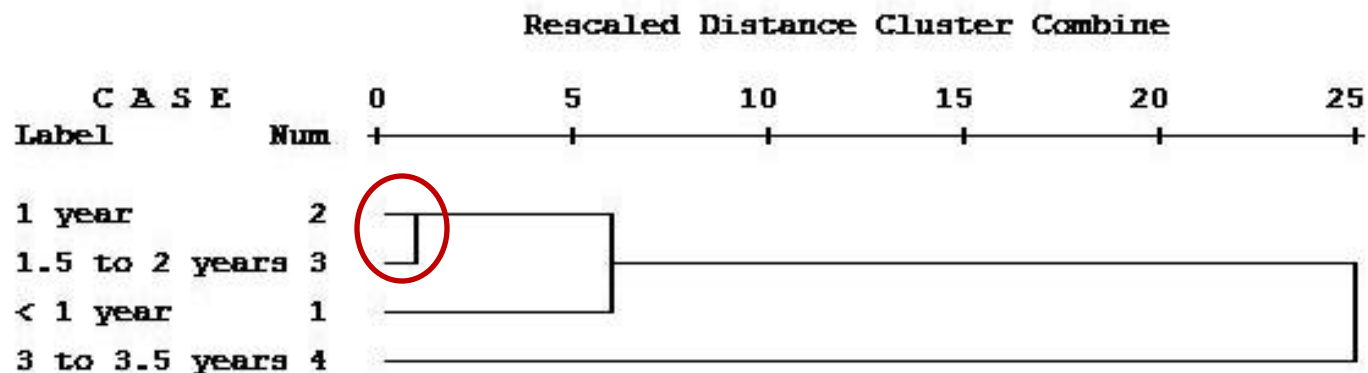
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Results and Discussion

Hierarchical Cluster Analysis of Cladode Powder

Technological and organoleptic criteria

Dendrogram using Average Linkage (Between Groups)



- Close similitude between: 1 year and 1.5 to 2 years
- < 1 year: Homogenous group
- 3 to 3.5 years: Homogenous group

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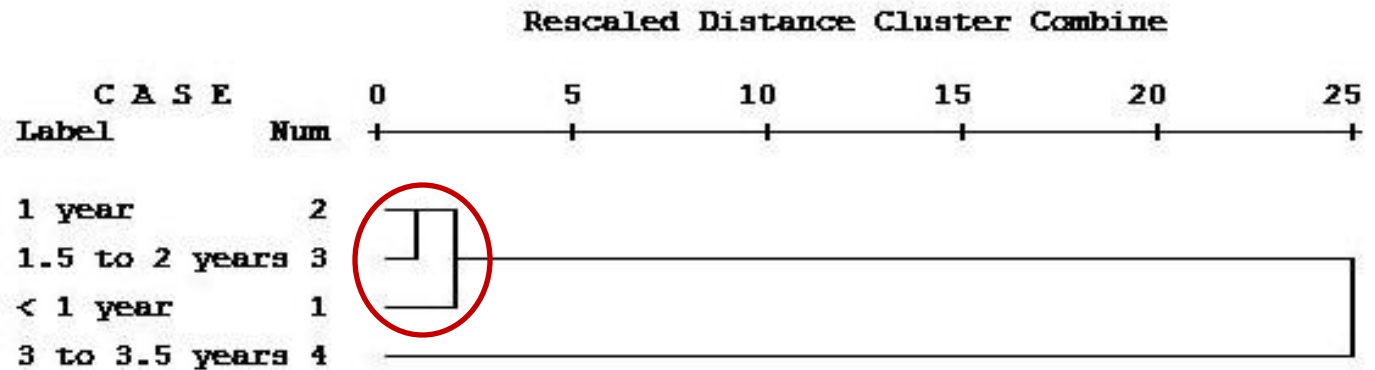
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Hierarchical Cluster Analysis of Cladode Powder

Nutritional criteria

Dendrogram using Average Linkage (Between Groups)



- Close similitude between: 1 year and 1.5 to 2 years
- < 1 year: Homogenous group nearest to 1 year and 1.5 to 2 years
- 3 to 3.5 years: Homogenous group

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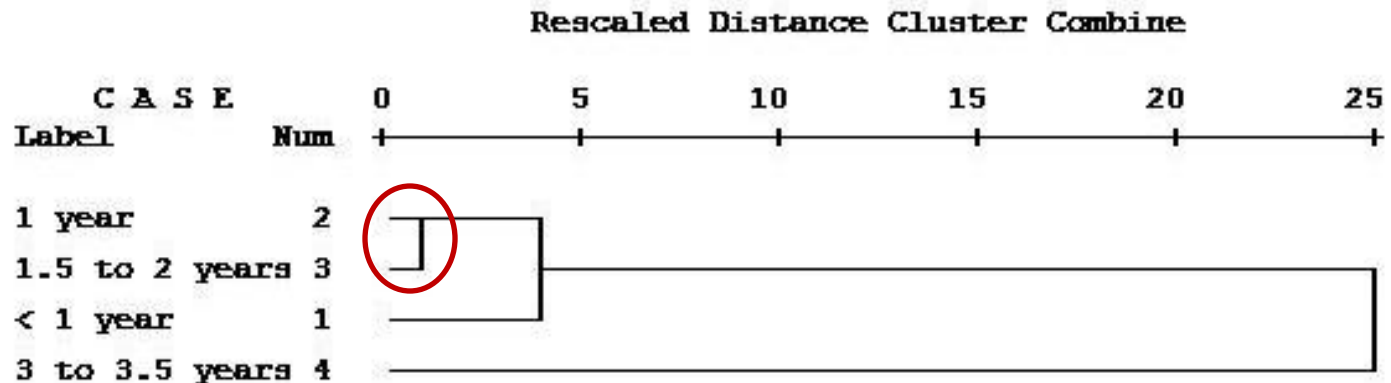
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Global Hierarchical Cluster Analysis of Cladode Powder

Technological, organoleptic, nutritional criteria

Dendrogram using Average Linkage (Between Groups)



- Close similitude between: 1 year and 1.5 to 2 years
- < 1 year: Homogenous group
- 3 to 3.5 years: Homogenous group

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- **High suitability of the cladodes of different ages for processing into powder.**

- **Distinct and interesting characteristics by age: Nutritional, organoleptic and technological.**

- **Important to choose the cladode age depending on the further utilization of the powder.**

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Thank you