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CHEMICAL COMPOSITION, PHYSICAL CHARACTERISTICS, AND SENSORY EVALUATION OF COOKIES WITH CAROB ADDITION

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INTRODUCTION

- Cookies
  - Consumed by people of all ages
  - Relatively long shelf life
  - In the formulation - lipids are essential

- Flour carob (*Ceratonia siliqua* L.)
  - Mediterranean native
  - Color and flavor similar to cocoa
  - Not presenting compounds allergenic and stimulants of the nervous system
  - High in fiber and low in lipids

- The objective of this work was to partially replace wheat flour by using carob powder.

MATERIAL AND METHODS

- **Material →** carob powder (donated by Carob House company-Campina Grande do Sul, PR) and wheat flour (from BRS Pastoreio cultivar-Embrapa).
- **Percentage of addition Tests →** performed to define the use of 30% of carob powder in substitution of wheat flour (the best results in relation to the cookie technological characteristics).
- **Cookies production method →** according to method n° 10-50.05 (AACCI, 2010), with adaptations.
- **Physico-chemical analyzes performed:** moisture content (oven at 105ºC); ash (muffle incineration at 550ºC/4 hours); lipids (by hot solvent extraction); crude protein (Kjeldahl method), performed according to Adolfo Lutz Institute (2008) and AOAC (2000). Total carbohydrate: calculated by difference. Fiber determination: according to Van Soest method (1967).
- **Cookie physical characterization:** *mass and diameter of the cookie after baking* (measured with pachymeter); *spread ratio or expansion factor* (the quotient between the average diameter and cookie thickness); *specific volume* (by millet seeds displacement method); *cookie color* (obtained in the CIEL*a* b system, with illuminant D_{65} and reading angle of 10°, in Minolta colorimeter); *water activity-Aw* (performed in AquaLab equipment) and *cookie hardness (in* a texture analyzer TA.XT Plus). The evaluations were carried out with 10 cookies, except Aw, which used three cookies.
- **Cookie sensory analysis** (*cookies with 30% of carob powder + HVF and 30% of carob powder + vegetable oil*): acceptance test with a structured hedonic scale of nine points (methodology adapted and described by Adolfo Lutz Institute (2008). A total of 74 untrained consumers, men and women between the ages of 18 and 60, participated in the analysis. For the calculation of the acceptance index, the grades (1-9) given by the consumers were transformed into %: [Acceptance index = (average scores per attribute / 9) × 100], where 9 represents the maximum score. *This work was submitted and approved by the Human Research Ethics Committee of IFRS, report nº. 2,254,785*.
- The data were analysed by ANOVA (variance analysis), and the means were compared by the Duncan's test ($p \leq 0.05$).

RESULTS AND DISCUSSION

The results of the cookie chemical composition of 30% carob + HVF (fat) and 30% carob + VO (oil) are presented in Table 1. There was a significant increase of crude protein and carbohydrates in the cookie with 30% carob + VO (oil) in relation to 30% carob + HVF (fat) cookie.

Table 1 – Chemical composition of cookies.

Cookie sample	Moisture (%)	Fixed Mineral Residue (%)	Ethereal extract content (%)	Crude protein content (%)	Carbo-hydrates (%)	Detergent neutral fiber content (%)	Detergent acid fiber content (%)
30% carob + HVF (fat)	9.65^{a}	1.32^{a}	14.90^{a}	5.72^{b}	68.39^{b}	14.80^{a}	11.98^{a}
30% carob + VO (oil)	9.57^{a}	1.38^{a}	13.55^{b}	6.37^{a}	69.11^{ab}	11.5^{b}	11.13^{a}

*Averages followed by the same letter do not differ statistically by the Duncan test at the 5% level of significance.

Table 2 presents the results of the physical characterization of cookies with 30% carob + HVF (fat) and 30% carob + VO (oil). A significant difference in the diameter after baking, volume, thickness, spread ratio, hardness and color between cookies.

Table 2 – – Physical characteristics of cookies.

Cookie sample	Mass after baking (g)	Diameter after baking (cm)	Thickness (cm)	Volume (mL)	Spread ratio	Specific volume (mL.g^{-1})	Hardness (kgf)	Cookie color			Water activity
								Brightness (L*)	a*value (-60: green, +60: red)	b*value (-60: blue, +60: yellow)	
30% carob + HVF	20.17^{b}	6.96^{a}	0.87^{b}	233^{b}	8.03^{a}	11.59^{a}	91,52^{a}	23.34^{b}	5.84^{b}	2.70^{b}	0.69^{a}
30% carob + VO	21.26^{a}	6.63^{b}	0.94^{a}	238^{a}	7.10^{b}	11.20^{a}	54,04^{b}	26.07^{a}	6.33^{a}	3.49^{a}	0.69^{a}

*Averages followed by the same letter in column do not differ statistically by the Duncan test at the 5% level of significance.

Both samples had *acceptance indexes* higher than 70% when the attributes of *color, aroma and taste* were evaluated, which leads us to believe that the use of different lipids does not interfere with the final product. On the other hand, the attributes of *crispness, chewiness and softness*, showed that the use of vegetable oil in the formulation caused a reduction in the acceptability..

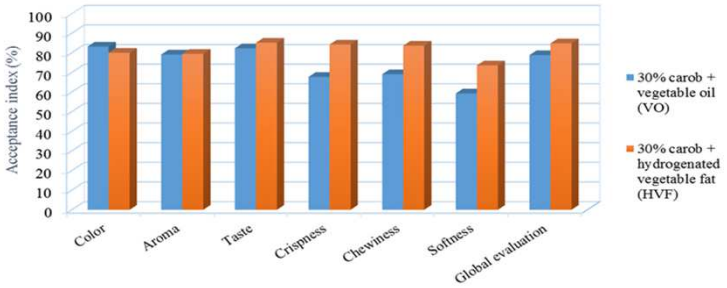

Figure 1 - Acceptance index of cookies with 30% carob addition

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