CHEMICAL AND SENSORY EVALUATION OF SANDWICH COOKIES MADE WITH CAROB POWDER

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RESUMO- Este estudo pretende investigar a viabilidade da substituição do cacau por alfarroba em pó no desenvolvimento de biscoitos recheados e avaliar suas características químicas e sensoriais. Três formulações foram testadas: biscoitos recheados com alfarroba, alfarroba e proteína texturizada de soja (PTS), e cacau. Avaliou-se proteínas, ácidos graxos, fibras, cinzas, umidade, carboidratos e calorias. 48 avaliadores não treinados analisaram a aceitabilidade e intenção de compra. Umidade, cinzas, proteínas, lipídeos, calorias por porção apresentaram características químicas semelhantes para todas as amostras. Biscoitos de cacau apresentaram maior teor de fibra bruta. Biscoitos de alfarroba apresentaram maior teor de carboidratos, no entanto biscoitos de alfarroba e PTS apresentaram maior teor de proteínas e baixo teor de lipídios. Os atributos aparência, textura, sabor e aceitação global apresentaram características semelhantes para todas as amostras. A cor apresentou maior aceitabilidade em biscoitos de cacau, no entanto, a intenção de compra foi semelhante para todas as amostras. Achei que acabou em resultados, sem conclusão, mas estamos sem caracteres

ABSTRACT-This study aimed to investigate the viability of replacing cocoa by carob powder in the development of sandwich cookies and to evaluate their chemical and sensory characteristics. Three formulations were tested: carob sandwich cookies, carob and textured soy protein (TSP) sandwich cookies and cocoa sandwich cookies. It was evaluated protein, fatty-acids, fiber, ashes, moisture, carbohydrates and calories. 48 judges analyzed the cookies acceptability and purchase intention of the cookies. Moisture, ash, protein, lipids, calories per portion showed similar chemical characteristics for all the samples. Cocoa cookies presented the highest content of crude fiber. Carob cookies presented highest content of carbohydrate, however Carob and TSP cookies showed the highest content of proteins and the lower content of lipids. The attributes appearance, texture, flavor and global acceptability showed similar characteristics for all the samples. Attributed color showed higher acceptability in Cocoa cookies, nevertheless the purchase intention was similar for all the samples.

PALAVRAS-CHAVE: *Ceratonia siliqua*; alfarroba; biscoito; PTS; cacau.

KEYWORDS: *Ceratonia siliqua*; carob; cookies; TSP; cocoa.

1. INTRODUCTION

Carob (*Ceratonia siliqua*) belongs to the Leguminosae family (Biner *et al.*, 2007). The fruit of carob has a high content of insoluble fiber and polyphenols (tannins), with supposed beneficial effects for human health (Zunft *et al.*, 2001).

Carob seeds are mostly used in food industry for production of gum due to high levels of galactomannans, used as thickening agent in food preparations (Santos *et al.*, 2005). The carob pulp is roasted and milled to produce carob powder and it is sold as a substitute for cocoa. Its flavor and appearance is similar to cocoa. In terms of nutrition, carob powder has a high sugar content, moderate protein and low fat content compared to cocoa powder. Additionally, it is well established that carob powder is free of cafeine and theobromine (Yousif and Alghzawi, 2000) and contain important amino acids and minerals (K and Ca) (Ayaz *et al.*, 2007).

This study aimed to investigate the viability of replacing cocoa by carob powder in the development of sandwich cookies and to evaluate their physicochemical and sensory characteristics.

2. MATERIALS AND METHODS

The sensory analysis were conducted at the Dietetic Laboratory of the Nutrition course at the Medicine School (FAMED) of Federal University of Rio Grande do Sul (UFRGS).

Elaboration of sandwich cookies: The sandwich cookies were elaborated with cocoa powder being replaced by carob powder, resulting in three different formulations: for sandwich cookie of carob powder (CC) only carob powder; for sandwich cookie of carob powder and textured soy protein (CSC) carob powder and textured soy protein; and for the of cocoa powder (CoC) only this was added. Ingredients used: refined sugar, corn starch, cocoa powder, carob powder, whole wheat flour, butter, egg, textured soy protein and powdered milk.

All ingredients were weighted and the cookies were prepared as follows: the butter was heated in microwave, after that it was homogenized manually with the egg. Furthermore, refined sugar was manually added in order to make a uniform batter and slowly added whole wheat flour, white wheat flour and corn starch until making it homogeneous. To prepare the filling of CC and CSC, it was added in a blender, boiling water, refined sugar, milk powder and carob powder to obtain a totally homogenous filling. Later, that filling was cooked on low flame, into a stainless pan, with the butter until reaching non sticking point. For the filling of CoC, the carob powder was replaced by cocoa powder. The sandwich cookies were finished with one table spoon of filling (5 g) between two cookies.

Chemical analyses: The chemical analyses were conducted at the Animal Nutrition Laboratory of the Animal Science Department of UFRGS, in quadruplicate. Moisture, ash, lipids, proteins and crude fiber analyses were performed following AOAC (1996), while carbohydrate was determined by difference. The calories were obtained by the values stipulated by RDC n° 360/2003, 4.0 kcal for 1g carbohydrate, 4.0 kcal for 1g protein and 9.0 kcal for 1g lipid. These values were multiplied by each macronutrient and finally were summed to obtain the total caloric value.

Sensory analysis: The judges were 48 non-trained students and teachers of the university. The three sandwich cookies samples were evaluated in terms of global acceptance, texture, color, flavor, and appearance. A 9-points hedonic scale of was used (1 - dislike extremely and 9 - like extremely). It was also evaluated the purchase intention (1 - would certainly not buy it and 5 - would certainly buy it). This study was approved by the Ethics Committee of UFRGS.

Statistical analysis: The statistical analysis was made using the program ESTAT®, version 2.0, with the Tukey's test. The results were given as means plus standard deviation. There were considered as being statistically significant the results that showed differences with $p<0.05$.

3. RESULTS AND DISCUSSION

Chemicals analyses: Table 1 presents the results of chemical characteristics of all sandwich cookies evaluated. Thus, it is possible to observe that there was no statistically significant difference ($p > 0.05$) among samples for moisture, ash, protein, lipids and calories per portion. However, for crude fiber it was observed statistically significant differences ($p < 0.05$) which CoC had the highest amount of fiber between CC and CSC. Carbohydrates also presented statistically significant differences ($p<0.05$) among all the samples. CC presented, CSC and CoC had the lowest amount.

Table 1: Chemical parameters of the sandwich cookies formulations

Parameters	Samples		
	CC	**CSC**	**CoC**
Moisture (%)	2.70±0.15[a]	3.27±0.67[a]	2.68±0.50[a]
Ash (%)	1.55±0.07[a]	1.73±0.08 [a]	1.73±0.11[a]
Protein (%)	9.65±0.82[a]	10.64±0.47[a]	10.03±0.49[a]
Lipids (%)	12.15±1.28[a]	11.90±1.16[a]	13.04±1.17[a]
Crude fiber (%)	1.30±0.10[b]	1.33±0.05[b]	1.85±0.17[a]
Carbohydrate (%)	75.35±0.43[a]	74.41±0.13[b]	73.36±0.53[c]
Calories per portion of 25g (kcal)	112.32± 1.65[a]	111.81± 2.24[a]	112.71± 1.69[a]

Values with different superscripts within the same row are significantly different ($p\leq0.05$). CC = sandwich cookies only with carob powder; CSC = sandwich cookies with carob powder with textured soy protein; CoC = sandwich cookies only with cocoa powder. 25g is the weight of two cookies plus filling

Yousif and Alghzawi (2000) founded that the fat, ash and protein values of carob powder (0.74%, 2.48%, 5.82%, respectively) was lower than those of cocoa powder (22.88%, 6.40%, 22.9%, respectively) and that the sugar were higher in carob powder (38.7%) than those of cocoa powder (2.16%).

50 and 75%) gradually significantly lowered the milk chocolate contents of caffeine (to be 22382.44, 1059.16 and 740.678 mg/100kg, respectively). The milk chocolate sample by 100% carob pod powder was caffeine free. Medeiros and Lannes (2009) showed methylxanthines (caffeine and teobromine) levels highest in cocoa powder (1.09%) when compared to carob powder (0.24 – 0.41%).

Properties sensory: In sensory analysis of the sandwich cookies samples, the attributes appearance, texture, flavor and global acceptability did not show statistically significant difference ($p > 0.05$) among all samples (table 2), although the CC and CSC samples presented lower rates when compared to CoC sample. The attribute color showed statistically significant difference ($p < 0.05$) between samples CoC (like moderately) and CC and CSC (like slightly). Table 2 presents the evaluator's purchase intention test, which indicated no statistically significant difference ($p > 0.05$) among the samples. That's indicates a good acceptability and similar sensory quality of CC and CSC when compared a CoC.

Table 2: Properties sensory of sandwich cookies formulations and purchase intention

Attributes	**CC**	**CSC**	**CoC**
Appearance	6.92± 1.51[a]	6.79± 1.33[a]	7.21± 1.47[a]
Color	6.71± 1.53[b]	6.58± 1.65[b]	7.48± 1.18[a]
Texture	6.60± 1.67[a]	6.75± 1.79[a]	7.08± 1.65[a]
Flavor	6.85± 1.50[a]	6.75± 1.74[a]	7.31± 1.68[a]
Global acceptability	6.87± 1.36[a]	6.81± 1.41[a]	7.25± 1.49[a]
Purchase intention	3.54± 1.03[a]	3.44± 1.20[a]	3.94± 1.12[a]

Values with different superscripts within the same row are significantly different ($p \leq 0.05$). CC = sandwich cookies only with carob powder; CSC = sandwich cookies with carob powder with textured soy protein; CoC = sandwich cookies only with cocoa powder.

Fernandes (2007) mentioned the texture soy protein such as improving texture in the formulations. The sandwich cookies made with carob powder and texture soy protein showed this result when compared to sandwich cookies made with only carob powder, but did not show this result when compared to sandwich cookies made with only cocoa powder.

According to Atasoy (2009), the sensory analysis of the yoghurts made with carob juice concentrate (10 mL) had taste and flavor rate major than those the standard, while texture and appearance had a similar rate in comparison to the standard.

Salem and Farhad (2012), showed that in milk chocolates with carob powder there was a significant difference in general appearance attribute between the control sample and the other samples. It was also found that there were significant differences among the carob powder samples as a result of increasing the carob amounts.

Sabatini et al. (2011) prepared ice cream with carob powder and submitted to sensory analysis. The attributes appearance, flavor and global acceptability showed approximated average 8 (“like very much”). Regarding the purchase intention, 54% said "Certainly I would buy", 39% "Probably I would buy", 6% "Maybe I would buy" and 2% "Probably I would not buy". With these results, it is observed that 93% of the tasters would buy the ice cream prepared in the study.

4. CONCLUSIONS

Thus, it was concluded that the carob sandwich cookies and carob and soy sandwich cookies maintaining the nutritional and sensory characteristics compared to cocoa sandwich cookies, being a consumption alternative for people allergic to cocoa.

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