

**Development of light cream cheese with the addition of Chia seeds (*Salvia hispanica* L.)**

**Desenvolvimento de queijo cremoso leve com a adição de sementes de Chia (*Salvia hispanica* L.)**

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**ABSTRACT**

Currently, due to the increasing incidence of heart disease and obesity worldwide, the market demand requires foods with lower rates of lipids. The dietary fiber allows the reduction of carbohydrate and/or fat in a series of processed foods. Thus, soluble fibers, such as fibers of chia seed (*Salvia hispanica* L.), may be an ingredient in the processing of cream cheese differentiated. The aim of this study was to develop cream cheese with low fat content and adding chia seeds. The products developed, have been

evaluated by untrained volunteers. Sensory analysis indicated good acceptability of the samples with respect to all parameters. The results suggest that the preparation of cream cheese without adding fat and reduced fat were not well sensory acceptance. However, the cream cheese made with chia seed without reducing fat or partial replacement (50%) of fat obtained excellent acceptance by the evaluators. We therefore conclude that chia seeds were not able to replace the sensory properties of fat in fat-free cream cheese prepared. However, the addition of chia seed as a source of fiber was well accepted both in whole and reduced fat content cream cheese.

**Keywords:** fat replace, chia seed, cream cheese, sensory evaluation.

## RESUMO

Atualmente, devido à crescente incidência de doenças cardíacas e obesidade em todo o mundo, a demanda do mercado exige alimentos com taxas mais baixas de lipídios. A fibra dietética permite a redução de carboidratos e/ou gordura em uma série de alimentos processados. Assim, fibras solúveis, tais como fibras de semente de chia (*Salvia hispanica* L), podem ser um ingrediente no processamento de queijo creme diferenciado. O objetivo deste estudo foi desenvolver queijo cremoso com baixo teor de gordura e adição de sementes de chia. Os produtos desenvolvidos, foram avaliados por voluntários não treinados. A análise sensorial indicou boa aceitabilidade das amostras em relação a todos os parâmetros. Os resultados sugerem que o preparo do creme de queijo sem adição de gordura e gordura reduzida não foi bem aceito sensorialmente. Entretanto, o queijo cremoso feito com semente de chia sem redução de gordura ou substituição parcial (50%) de gordura obteve excelente aceitação por parte dos avaliadores. Portanto, concluímos que as sementes de chia não foram capazes de substituir as propriedades sensoriais da gordura no queijo cremoso sem gordura preparado. Entretanto, a adição de semente de chia como fonte de fibra foi bem aceita tanto em queijo creme de leite integral quanto em queijo creme de leite com teor reduzido de gordura.

**Palavras-chave:** substituição de gordura, semente de chia, requeijão cremoso, avaliação sensorial.

## 1 INTRODUCTION

Cream cheese is a typical Brazilian product that originated in the former producers of cream for a manufacture of butter, in which skimmed milk, previously considered a by-product, was used in its manufacture. According to Lopes (Lopes et al., 2007), the dairy sector is one of the most important in the Brazilian agro-industrial complex, according to the annual turnover of around US\$ 10 billion. Cream cheese is a type of creamy melted cheese obtained by melting a mass of dried and washed curd obtained by acidic and/or enzymatic coagulation of the milk, with the addition of milk cream and/or butter and/or anhydrous milk fat and/or butter oil (Ningtyas et al., 2018; Sainani et al., 2004; Silva et al., 2012).

With the advancement of technology in ingredients, as some types of colloids and protein concentrates, it became possible to manufacture light cream cheese, with fat content between 9 and 12%. Market demand requires foods with lower lipid rates because it is associated with increased health concern and healthy eating, so the search for lower-calorie products with "healthier" appeal has been increasing significantly in recent years (Bemer et al., 2016; Gutiérrez-Méndez et al., 2019; Ningtyas et

al., 2018). Basically, what differs from a light cream cheese of a traditional cream cheese is the reduction in energy content contributing to the production of a healthier curd, since the lipid content is greatly reduced during production (Silva et al., 2012).

Several fat substituents can be used in dairy products, so as not to affect the acceptance of the product with reduced fat and can be divided into fat substitutes and fat mimetics. Fat substitute agents are still poorly used and are nonpolar and non-nutritive molecules, such as sucrose polyester (Olestra) (Adapa et al., 2000; Bemer et al., 2016). Fat mimetics, however, are more commonly used, usually polar, and include protein, stabilizing agent, emulsifying agent, chelating agent and fibers. Fat mimetics generally retain a lot of water, increasing the humidity of the final product. Various dairy products can suffer from reduced fat, such as fluid milk (pasteurized and UHT), milk powder, yogurt, cheese, butter, ice cream, milk sweet, among others (Adapa et al., 2000).

Still little researched, *Salvia hispanica* L., popularly known as "Chia" is a plant of the family Lamiceae, originating in Mexico and parts of South America. The seeds of this plant have become a popular food with health appeal because of its highly nutritious composition. Research has demonstrated its high content of oil, minerals, proteins and dietary fiber (Ixtaina et al., 2008). In addition, it contains natural antioxidants, such as phenolic glycosides, chlorogenic acid, caffeic acid, quercetin and kaempferol, which protect against some cardiovascular diseases and some cancers. Thus, it can be considered a promising food for health promotion and disease prevention (Capitani et al., 2012; Ixtaina et al., 2008). The high content of nutrients, such as fibers, minerals, proteins and the presence of long chain essential fatty acids (omega 3 and 6) allows Chia to be used in the preparation of bakery products (biscuits and breads), pasta and dairy products, increasing the supply of products with high fiber content, both for healthy consumers and for those who present some pathology (intestinal constipation, high cholesterol, obesity, among others) (Alfredo et al., 2009; Capitani et al., 2012).

In addition, an extremely important characteristic is the high water retention capacity of Chia seeds, which can absorb about 27 times their weight in water, being superior to other types of fibrous residues like passion fruit, orange, beans, soybeans, bark of corn and wheat. This high hydration capacity is due to the presence of large quantities of mucilage that act as soluble dietary fibers in Chia seeds. This water retention property has great potential as a functional ingredient to be used as a food thickener, as well as acting beneficially by increasing the volume of fecal cake acting against constipation (Alfredo et al., 2009; Ixtaina et al., 2008).

Bad eating habits has a direct influence on health, favoring the appearance of obesity, heart disease, cancer, among others, which are frequent causes of death. Faced with this reality, several researches have been carried out aiming at improvements in the quality of the food products leading to

an ideal nutrition, introducing foods with low caloric content and equally nutritious. Therefore, the objective of this work was the elaboration of light creamy cheese with partial replacement of the fat by Chia crushed seed, aiming its inclusion in the nutritional improvement of the traditional creamy cheese formulation without loss of sensorial quality.

## 2 MATERIALS AND METHODS

### 2.1 PREPARATION OF CREAM CHEESE

The following ingredients were used to make the cream cheese: Chia crushed, unsalted butter, integral and skimmed UHT milk, salt, sodium citrate and white vinegar. All ingredients were obtained in the local market and the proportions of each formulation are in Table 1.

Table 1. Ingredients used in cream cheese formulations.

Formulation	Milk type	Butter (g)	Chia (g)
Control	Integral	50	0
T1	Integral	50	10
T2	Integral	25	10
Light	Skimmed	0	0
T3	Skimmed	25	10
T4	Skimmed	0	10

\*The amount of the other ingredients (salt and sodium citrate) was the same in all formulations.

This work was carried out at the Federal University of Pampa, through the elaboration of cream cheese with total and partial replacement of fat (butter) by Chia seed, and the addition of this one in the standard curd cheese. The Chia seed was crushed in a blender and used in the preparation of the cream cheese. It was elaborated 6 cream cheese - a control (whole milk and 100% butter), a cream cheese with whole milk, 100% butter with 10g chia (T1), a cream cheese with whole milk, 50% butter and 10g chia (T2), a cream cheese with skim milk and 0% butter (Light), a cream cheese with skimmed milk, 50% butter and 10g chia - (T3), and a cream cheese with skim milk, 0% butter and 10 g of chia (T4) (Table 1). All formulations were performed at least in duplicate (n = 2).

To prepare the cream cheese we performed the following procedure: 1L of pasteurized milk was boiled, 30ml of white vinegar was added and the curd was expected to form (20-25min). The product was leach in a sieve and the curd (ricotta) was separated, and then beaten in the blender along with butter, sodium citrate and salt. After warm milk was added gradually until obtaining a cream homogeneous and with bright aspect. The curd cheeses were packed in appropriate containers and stored in a refrigerator until consumption.

### 2.2 SENSORY ANALYSIS

The cream cheese was evaluated for two consecutive days, according to the following requirements: color, taste, texture, appearance and overall acceptance, using a subjective sensory

method (Dutcosky, 2011). The subjective methods measure how much a population liked a product, to evaluate preference or acceptability, being that the acceptability can be dimensioned by the rate of liking related to a single product, while the preference can be dimensioned by the rate of liking from the comparison between two or more food products (Hernandez, 2005; Silva et al., 2012).

Sensory analysis was performed with 41 untrained evaluators, distributed between sex and age, made up of students, teachers, and employees of the Unipampa Uruguaiiana campus who showed interest in participating in this research. The samples were coded with random 3-digit numbers and presented to consumers in a balanced and randomized manner. The cream cheese was served with wafer water and salt. Mineral water at room temperature was added to the samples to clean the palate. In the test sheets, delivered to the evaluators, the characteristics to be analyzed by the volunteer were described as appearance, color, texture, taste and overall acceptance, as well as the purchase intention and suggestions regarding the 6 types of cream cheese. A hedonic scale of 7 points was used, which is the most widely used for studies of preference with adults.

### 2.3 STATISTICAL ANALYSIS

The results were submitted to one-way analysis of variance (ANOVA) followed by Tukey post hoc comparisons ( $p < 0.05$ ). All analyzes were performed using the SPSS® program for Windows 8.0.

### 3 RESULTS AND DISCUSSION

Results obtained in terms of appearance, color, texture, taste, and overall acceptance are expressed in Table 2 and Figure 1. It can be observed that in relation to appearance and color, cream cheese with whole milk cream and 100% butter (Control) was more widely accepted, probably because it had a more appreciable appearance, creamy and a more uniform and bright coloration due to the presence of fat content in the formulation. On the other hand, cream cheese with skimmed milk, chia and without butter (T4) obtained the lowest acceptance, probably due to the lack of fat in the formulation, which changed the brightness and creaminess of the product (Figure 1). Moreover, this product had a dark coloration due to the addition of crushed chia seed, which probably must have negatively influenced the opinion of the judges.



Table 2. Mean scores of sensory attributes of cream cheese

Formulation*	Sensorial analysis			
	Appearance	Color	Texture	Taste
Control	6,60±0,58 <sup>a</sup>	6,51±0,71 <sup>a</sup>	6,53±0,59 <sup>a</sup>	6,58±0,63 <sup>a</sup>
T1	5,60±1,20 <sup>b</sup>	5,68±1,12 <sup>b</sup>	6,02±1,10 <sup>ab</sup>	6,07±1,03 <sup>ab</sup>
T2	5,63±1,04 <sup>b</sup>	5,56±1,00 <sup>b</sup>	6,00±0,94 <sup>ab</sup>	5,60±1,39 <sup>b</sup>
Light	5,60±1,37 <sup>b</sup>	5,58±1,30 <sup>b</sup>	5,36±1,46 <sup>bc</sup>	5,51±1,18 <sup>b</sup>
T4	4,00±1,37 <sup>c</sup>	4,17±1,22 <sup>c</sup>	4,65±1,40 <sup>c</sup>	4,51±1,18 <sup>c</sup>
T3	5,12±1,16 <sup>b</sup>	5,26±1,07 <sup>b</sup>	5,36±1,29 <sup>bc</sup>	5,29±1,53 <sup>bc</sup>

Results expressed as mean ± SD. Means followed by different letters in the same column differed by Tukey's test ( $P < 0.05$ ). Attributes assessed through a hedonic scale of seven points (1. I greatly disliked 7. I liked it very much).

\*Control (cream cheese with integral milk and 100% butter); T1 (cream cheese with integral milk, 100% butter and 10g chia); T2 (cream cheese with integral milk, 50% butter and 10 g chia); Light (cream cheese with skimmed milk, without butter); T3 (cream cheese with skimmed milk, 50% butter and 10g chia); T4 (creamed skim milk, without fat and 10g chia).

Despite the growing demand for natural and/or complete products, there is still resistance from some consumers to integral products that are darker and less attractive in color (Figure 1) (Elleuch et al., 2011). On the other hand, the other formulations that had addition of chia seed and a partial reduction in the fat were more accepted than the formulations with drastic reduction of fat, demonstrating that the addition of fiber can be well accepted in the cream cheese, since its characteristics of brightness and creaminess are maintained.

Figure 1. Photos of cream cheese. Control (creamy cheese with integral milk and 100% butter); T1 (cream cheese with integral milk, 100% butter and 10g chia); T2 (cream cheese with integral milk, 50% butter and 10 g chia); Light (cream cheese with skimmed milk, without butter); T3 (cream cheese with skimmed milk, 50% butter and 10g chia); T4 (creamed skim milk, without fat and 10g chia).



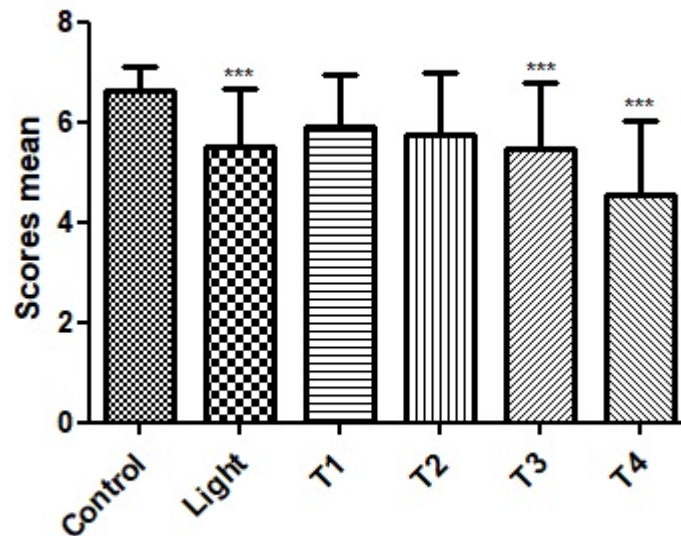
In the same way as observed in this study, the use of  $\beta$ -glucan and phytosterols used both individually and in combination on the particle size, microstructural and rheological characteristics of functional cream cheese and compares them against commercial product demonstrated that these can be used as as fat replacers in low-fat cream cheese (Ningtyas et al., 2018). Inulin, a complex

carbohydrate (fiber source) is increasingly used in industrially processed dairy and non-dairy products because it is a bulking agent for use in fat replacement, textural modification and organoleptic improvement. Addition of inulin to different kinds of cheese can be beneficial in the manufacture of a reduced- or low-fat, texturized, symbiotic product (Karimi et al., 2015). Thus, fiber addition on dairy products as cream cheese can becoming a healthier alternative for consumption.

In relation to texture and taste (Table 2), once again the most accepted cream cheese is the control, together with the cream cheese with integral milk, 100% butter and with addition of 10 g chia (T1) and integral milk, butter (50%) and with addition of 10 g of chia (T2); which, again, may be due to the presence of fat, which has maintained the taste, creaminess and brightness, which are already expected in a traditional cream cheese (Figure 1). However, we again observed that the presence of the crushed chia seed was well accepted by the judges demonstrating that its addition did not affect its taste and still made it healthier. It should be noted that although fat removal has not been well accepted by the judges, the addition of chia seeds did not harm the product and may incorporate beneficial components into the diet, since the chia grain is rich in omega 3, soluble and insoluble fibers, proteins, antioxidants (polyphenols), minerals and vitamins (riboflavin, niacin, thiamine), as well as calcium, phosphorus, potassium, zinc and copper (Capitani et al., 2012; Ixtaina et al., 2008).

The least accepted cream cheese was T4, together with the cream cheese with skimmed milk without butter (Light), and in the texture question also the cream cheese with skimmed milk, 50% of butter and with 10g of chia (T3) (Table 2 and Figure 2). These results again prove that the reduction or absence of fat leaves the product with a texture and taste less pleasing to consumers, probably due to the loss of creaminess, brightness, and taste. In addition, we observed that chia seeds, although rich in soluble fibers that exhibit some lipid-like characteristics such as texture and gloss, were not able to substitute fat in the elaborated cream cheese. Contrary to this work, (Seabra et al., 2002) observed that the results of sensorial acceptability in low-fat burgers with addition of cassava starch or oatmeal flour showed a good viable alternative for partial substitution of fat.

Figure 2. Sensory evaluation of the global acceptance of the cream cheese: Control, Light, T1, T2, T3, T4. Control (cream cheese with integral milk and 100% butter); T1 (cream cheese with integral milk, 100% butter and 10g chia); T2 (cream cheese with integral milk, 50% butter and 10 g chia); Light (cream cheese with skimmed milk, without butter); T3 (cream cheese with skimmed milk, 50% butter and 10g chia); T4 (creamed skim milk, without fat and 10g chia). Results expressed as mean  $\pm$  SD. \* Different of control by Tukey's test ( $P < 0.05$ ). Attributes assessed through a hedonic scale of seven points (1. I greatly disliked 7. I liked it very much).



Regarding the overall acceptance (Figure 2), the most acceptable cream cheese was control and T1, demonstrating that the fat really enhances the taste and leaves the cream cheese with the highest creaminess and brightness. However, the presence of chia did not displease the palate of the tasters and was well accepted, in addition to making the product more nutritious. In the same way as the one observed in this study, (Coelho; and Salas-Mellado;, 2014) reviewing the main food products developed with chia, described a work where adding chia in the food bar formulation obtained a high level of acceptance of the product, that is, 84% of the tasters attributed scores 8 (I liked it) or 9 (I liked it a lot) to the attribute overall impression.

The cream cheese that presented the lowest acceptance in all the attributes and in the global acceptance was the T4. As discussed earlier, this formulation was absent from fat since it was made with skim milk and without butter. In addition, it possessed chia seed to try to replace this fat reduction of the formulation. We observed that the chia seed does not present fat replacement characteristics in this product, since this cream cheese presented a less pleasant texture, with liquid release from the emulsion and reduction in creaminess and brightness. Different from this work, work described by (Coelho; and Salas-Mellado;, 2014) observed that the results of the sensory evaluation using the mucilage of chia both alone and in combination with other fat substitutes in the preparation of mayonnaise have proved to be a good alternative for the food industry in the production of foods with reduction of fat and cholesterol obtaining a good index of acceptability.



Appearance and color are essential aspects for the acceptance of the product by the consumer at the time of purchase, which could be observed in the analysis of the purchase intentions of the products. The purchase intent was higher for control cream cheese (78.05%), followed by T2 (46.34%) and T1 (19.51%) formulations. The intention to buy T1 and T2 cream cheese can be attributed, mainly, to the population's increasing search for natural and health-beneficial products. This intention to purchase fiber-enriched products is interesting, as there is some evidence that foods with a high fiber content, in general, and in particular those containing soluble fiber, lower blood LDL cholesterol levels and are also beneficial for people with diabetes, as well as helping intestinal function, among other health benefits (Elleuch et al., 2011; Vuksan et al., 2010). The addition of crushed chia seeds improves the nutritional properties of the creamy cheese, offering new variation of foods with a functional character and constituting a healthier food alternative.

#### **4 CONCLUSION**

The results showed that it is possible to make a cream cheese with addition of chia, and even partial replacement of the butter by it, to produce a more nutritious product for the population. Moreover, it was found that fiber enrichment was well accepted by the evaluators, since the sensory acceptability and the intention to buy had satisfactory results. These products are innovative, since there is no cream cheese in the market with the presence of chia seed in its composition.

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