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DETECTION OF SORBATE POTASSIUM IN BRAZILIAN COMMERCIAL FERMENTED MILKS

Detecção de sorbato de potássio em leites fermentados comercializados no Brasil

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ABSTRACT

This study aimed to determine the sorbic acid and its salts presence in fermented milk marketed in Brazil, as well as to quantify it when the sample was positive. Twenty-six commercial samples were analyzed (n = 3), totaling 78 samples. The samples were divided into two groups: natural (5 samples) and with non-dairy ingredients (21 samples). A total of 61.53% were positive for the sorbic acid and its salts. In these, 3.85% were natural fermented milk, which is fraud, according to Codex Alimentarius and Brazilian legislation. In addition, all samples were outside the Brazilian legislation (0.3 $g.kg^{-1}$) but not for Codex Alimentarius (1.0 $g.kg^{-1}$). It can be concluded that the sorbic acid and its salts were detected in fermented milk both natural and with non-dairy ingredients.

Keywords: preservative; sorbic acid; yogurt; fraud.

RESUMO

Este estudo teve o objetivo de determinar a presença de ácido sórbico e seus sais em leites fermentados comercializados no Brasil, bem como quantificá-lo quando a amostra foi positiva. Vinte e seis amostras comerciais foram analisadas (n = 3), totalizando 78 amostras. As amostras foram divididas em dois grupos: amostras naturais (5) e com adição de ingredientes não lácteos (21). Um total de

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61,53% amostras foram positivas para ácido sórbico e seus sais. Nestes, 3,85% eram de leites fermentados naturais, o que segundo o *Codex Alimentariu*s e a legislação brasileira é caracterizado como fraude. Além disso, todas as amostras estavam fora da concentração máxima de sorbato de potássio de acordo com a legislação brasileira (0,3 $g.kg^{-1}$) vigente, no entanto, estavam dentro dos parâmetros aceitáveis pelo *Codex Alimentarius* (1,0 $g.kg^{-1}$). Podemos concluir que o ácido sórbico e seus sais foram detectados em leite fermentado natural e com ingredientes não lácteos.

Palavras-chave: conservante; ácido sórbico; iogurte; fraude.

INTRODUCTION

Milk presents a high nutritional value that is a source of proteins, essential fatty acids, carbohydrate, vitamins, and minerals (ALBENZIO et al., 2012). Economically, the fermented milks are an essential dairy product. It is considered a product with high potential for the development of new products. Besides, fermented milk consumption is associated with health, which is explored by the dairy industries (COSTA; CONTE JUNIOR, 2013; COSTA et al., 2013). However, some additives, as preservatives, can be present in fermented milk. According to Brazilian legislation and Codex Alimentarius, the additives presence, such as sorbic acid and its salts, is allowed in fermented milks with non-dairy ingredients, which is transferred through the optional ingredients (BRASIL, 2007; CODEX ALIMENTARIUS, 2010). These compounds may have implications for consumer health, once these products are consumed daily.

Several studies have evaluated the different preservative content in foods, including sorbic acid and its salts (CRESSEY; JONES, 2009; AKBARI-ADERGANI et al., 2013; ESFANDIARI et al., 2013). However, there were not found studies which evaluated these compounds presences and concentration in fermented milks. For these reasons, the present study aimed to verify the sorbic acid and its salts presence or absence in fermented milks Brazilian marketed. In addition, in the positive samples, the potassium sorbate was quantified.

MATERIALS AND METHODS

Location of the collection and sample storage

The fermented milk samples for this experiment were purchased in Rio de Janeiro and Salvador markets. Immediately afterward, they were transported in an isothermal box to the laboratory and stored at 4 ± 1 ºC until the analysis. Twenty-six fermented milks were subdivided into 18 yogurts (5 natural and 13 with non-dairy ingredients) and 8 fermented milks (all with non-dairy ingredients). From each sample, 3 different lots (n = 3) were collected, totaling 78 samples (Figure 1).

Sorbic acid and its salts

The sorbic acid and its salts qualitative analysis were used as a screening method in fermented milks. The qualitative analyzes in fermented milks were carried out according to the protocol established by Brasil (2006), with some modifications. Initially, 1 g of the samples was weighed in triplicate, then 20 mL of distilled water and 0.6 mL of sulfochromic solution were added. This mixture was taken to the fire. After boiling, 1mL of the 0.3% 2-thiobarbituric acid solution was added with further reading. Sorbic acid or its salts oxidize

to the malonic aldehyde to form a compound of red or pink coloration. In this way, the formation of red to pink color indicates these compounds presences. On the other hand, the yellowish coloration indicates the absence.

Potassium sorbate quantification

In the quantitative analysis, sixteen positive samples (n = 48) were evaluated. The potassium sorbate content was estimated based on the method described by Brasil (2006). The samples were weighed (2 g), and 10 mL of 2 N sulfuric acid was added. Then, 10 g of magnesium sulfate heptahydrate was added to the distiller by steam stripping to obtain a 125 mL of distillate. Distilled water was added to complete the 250 ml volume, and 2 mL of 0.3 N sulfuric acid solution and 2 mL of 0.147% potassium dichromate solution were added to the water bath for 5 minutes. The beaker tubes were immersed in cold water, 4 mL of the 0.5% 2-thiobarbituric acid solution was added and then they stood in the water bath for another 10 minutes before cooling down. Subsequently, the spectrophotometer (SP22 – Biospectro) was calibrated at 532 nm. The potassium sorbate results were expressed in $g.kg^{-1}$ of sorbic acid.

Statistical analysis

The qualitative data were organized in a Microsoft Office Excel® spreadsheet, and descriptive statistical analysis tools were used to show the percentage values found. The quantitative results were analyzed by analysis of variance (ANOVA) and reported as means ± standard deviations. All ANOVA results were submitted to the Tukey test at $P < 0.05$ using the XLSTAT version 2013.2.03 (Addinsoft, Paris, France). In this experiment, three different sample batches (n = 3) were evaluated.

RESULTS AND DISCUSSION

The qualitative results demonstrated that

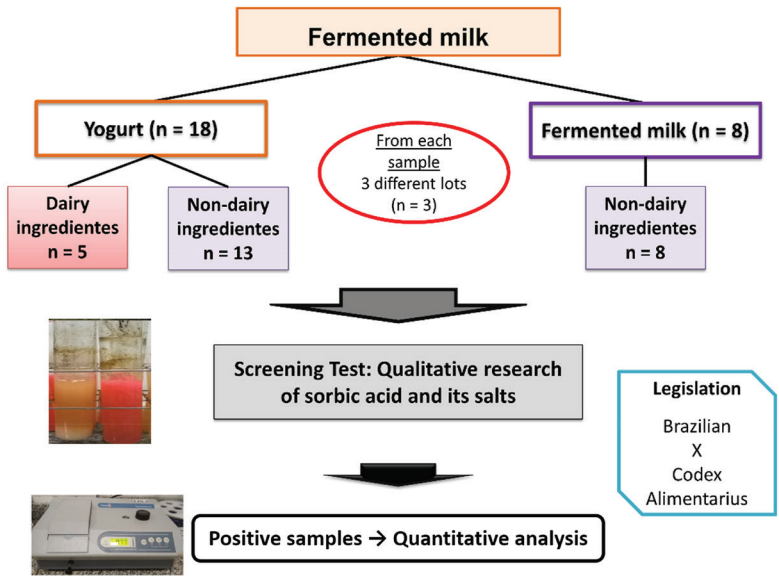

Figure 1 – Study design illustrating the stages involved in the experiment

61.53% of the samples were positive for sorbic acid and its salts presence, and 38.47% of the samples were negative (Figure 2). Moreover, 3.85% of the fermented milks (yogurts) without non-dairy ingredients presented a positive result for these compounds (Figure 2). Based on Brazilian legislation (BRASIL, 2007) and Codex Alimentarius (CODEX ALIMENTARIUS, 2010), in some fermented milks it is accepted the sorbic acid and its salts presence, including fermented milk with fruit pulp aggregate (or fruit preparation for industrial use) and flavored fermented milks. In both references, the preservative presence, including sorbic acid and its salts, in fermented milks without non-dairy ingredient addition is prohibited. Thus, positive samples in natural fermented milk (Figure 2), that is without non-dairy ingredients, are characterized as fraud. Therefore, 26 fermented milks analyzed (3.85%) disagree with the legislation.

Consequently, the sorbic acid and its salts qualitative analysis is a useful screening method to analyze the fraudulent addition of this preservative in fermented milks without non-dairy ingredients. However, in fermented milks added with non-dairy ingredients, it is relevant to quantify the sorbic acid and its salts levels. Since, its presence is permitted with a maximum concentration established (0.3 $g.kg^{-1}$ and 1.0 $g.kg^{-1}$, Brazilian legislation and Codex Alimentarius, respectively).

Table 1 exhibits the quantitative results (mean ± standard deviation) of potassium sorbate, expressed as $g.kg^{-1}$ sorbic acid. Only natural yogurt, which should be absent from this preservative, showed a potassium sorbate concentration within the maximum permitted limit in Brazilian legislation. According to this, only fermented milk with an aggregate of fruit pulp or fruit preparation for industrial use can present sorbic acid and its salts at the maximum concentration of 300 $mg.kg^{-1}$ (0.30 $g.kg^{-1}$) in the final product (BRASIL, 2007). Thus, all samples were outside the standard proposed by the Brazilian legislation, characterizing fraud. On the other hand, for Codex Alimentarius a maximum concentration of 1000 $mg.kg^{-1}$ (1.0 $g.kg^{-1}$) as sorbic acid is accepted in flavored fermented milks (CODEX ALIMENTARIUS, 2010). In this case, for Codex Alimentarius, all samples were within the maximum permissible limit.

Sorbic acid and its salts are preservatives used to inhibit the formation of molds and yeasts in foods, including dairy products such as dairy drinks and dulce de leche (JAVANMARDI et al., 2015). However, regular

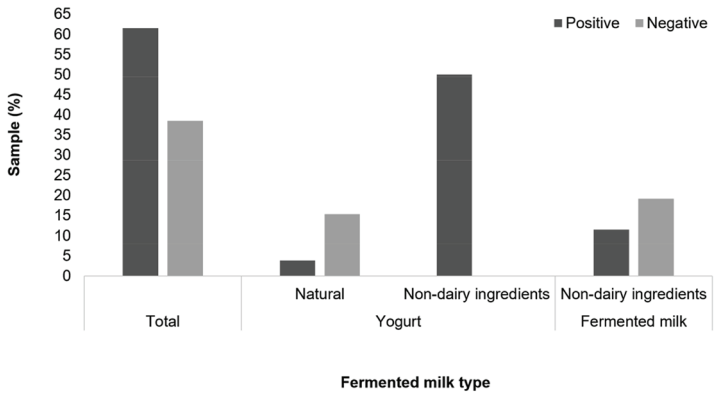

Figure 2 – The qualitative result (%) of the sorbic acid and its salts in fermented milk (natural and with fruit pulp)

consumption of these preservatives may favor allergic reactions, hives, toxicological and mutagenic damage, and elevated blood pressure. Furthermore, children are the principal consumer group of these products and may develop hyperactivity and attention deficit due to the consump-tion of preservatives (POLÔNIO; PERES, 2009). Therefore, it is essential to control the potassium sorbate concentration, respecting the maximum value allowed. Future studies should be carried out to evaluate the long-term effects of sorbic acid consumption on the health. In addition, it should also look for natural substances that can be used as a substitute for this preservative.

CONCLUSION

It was concluded that the potassium sorbate, a preservative, was detected in fermented milk both natural and with non-dairy ingredients. Moreover, in several cases, the concentration exceeded the maximum permissible by Brazilian legislation. Thus, there is a fraud by potassium sorbate addition in some fermented milks marketed in Brazil.

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Table 1 – Sorbic acid (g.kg-1) in fermented milks

Fermented milk	Non- dairy ingredients	Samples	Potassium sorbate
Yogurt	None	1	0.08 ± 0.00^{e}
	Sweetened	2	0.53 ± 0.03^{a}
	Sweetened	3	0.54 ± 0.01^{a}
	Sweetened	4	0.36 ± 0.01^{d}
	Fruit pulp	5	0.35 ± 0.01^{d}
	Fruit pulp	6	0.27 ± 0.00^{d}
	Fruit pulp	7	$0.44 \pm 0.01b^{c}$
	Fruit pulp	8	0.47 ± 0.00^{b}
	Fruit pulp	9	0.53 ± 0.00^{a}
	Fruit pulp	10	0.39 ± 0.00^{c}
	Fruit pulp	11	0.48 ± 0.00^{b}
	Fruit pulp	12	0.41 ± 0.00^{c}
	Fruit pulp	13	0.42 ± 0.01^{c}
Fermented milk	Sweetened	14	0.40 ± 0.00^{c}
	Sweetened	15	0.47 ± 0.00^{b}
	Sweetened	16	0.55 ± 0.01^{a}

$^{a\text{-}e}$ Different uppercase superscripts indicate significant differences ($p < 0.05$); n = 3.

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