APPLICATION OF YERBA MATE (Ilex paraguariensis A.St.-Hil.) IN FOOD - A REVIEW

Christiane Faccin¹, Letícia Rodrigues Vieira², Elisete Maria de Freitas³

Resumo: Considerando o crescente consumo de erva-mate (Ilex paraguariensis A.St.-Hil.) e a busca por alimentos cada vez mais nutritivos, o presente trabalho teve como objetivo, reunir estudos publicados nos últimos oito anos em que folhas ou extratos da planta tenham sido utilizados para a geração de alimentos. Foi realizado o levantamento bibliográfico em revistas científicas e bancos de dados (PubMed, Medline, Lilacs e Scielo), adotando-se, como critério de inclusão, artigos que indicam o uso da erva-mate na formulação de alimentos e sua interferência na composição de alimentos prontos para consumo. Foram encontrados oito estudos com a presença de I. paraguariensis na formulação de alimentos e outros três envolvendo o uso do seu extrato na ração administrada em frangos e aplicação direta em carne de frango assada/armazenada/reaquecida e mecanicamente separada. As pesquisas indicam que o uso de erva-mate em alimentos é viável, podendo ser utilizada também como corante e conservante natural. O uso do extrato em carnes mostrou ação contra a oxidação lipídica.


Abstract: Given the increase in consumption of yerba mate (Ilex paraguariensis A.St.-Hil.) and the demand for more nutritious food, this work intended to assemble studies published in the last eight years, in which leaves or extracts of the plant have been used for producing food. The bibliographical survey was conducted in scientific journals and databases (PubMed, Medline, Lilacs, and Scielo), and as a criterion for their inclusion, we adopted articles that indicate the use of yerba mate in the formulation of foods and its influence on the composition of ready-to-eat foods. We found eight studies with the presence of I. paraguariensis in the formulation of foods and three others that involved the use of its extract in chicken feed and direct application in roasted/stored/reheated and mechanically separated poultry meat. The researches indicate that the use of yerba mate in food is feasible, and it can also be used as a natural dye and preservative. The use of its extract in meat showed effectiveness against lipid oxidation.

Keywords: Functional Foods. Natural Antioxidant. Aquifoliaceae. Yerba Mate Extract. Lipid Oxidation.

INTRODUCTION

The demand for ever more nutritious food and the preservation of the environment are trends of the new millennium that drive the food industry to seek alternatives to adapt to this new phase (BILCK, 2009).

¹ Mestre em Biotecnologia pelo Centro Universitário UNIVATES.
² Graduanda de Ciências Biológicas, Licenciatura, pelo Centro Universitário UNIVATES.
³ Programas de Pós-graduação em Biotecnologia e Ensino, Laboratório de Propagação de Plantas.
In this context, a species native of Brazil, *Ilex paraguariensis* A.St.-Hil., popularly known as yerba mate, occurring in the states of Paraná, Santa Catarina, Rio Grande do Sul (RS) and Mato Grosso do Sul (DICKEL; RITTER; BARROS, 2011), has been highlighted for its high concentrations of methylxanthines, phenolic acids, tannins and alkaloids, such as caffeine (VIEIRA et al., 2008). These substances found in the extracts of yerba mate leaves act as stimulants to the central nervous system, muscles and circulatory system and favor the digestion and have diuretic effects (DICKEL; RITTER; BARROS, 2011). Besides, yerba mate can be considered a functional raw material that shows basic nutritional functions and beneficial effects to health when consumed as a part of a normal diet (DAMODARAN; FENNEMA; PARKIN, 2010).

Considering the increasing consumption of yerba mate, the cultural importance of the plant in the State of RS and the properties that make it beneficial to people’s health and food, this work aims to gather studies involving this plant in the composition of food products.

**MATERIAL AND METHODS**

We conducted a bibliographical survey of published studies in the last eight years in national and international literature, such as scientific journals, technical books and the databases PubMed, Medline, Lilacs and Scielo. As an inclusion criterion, we considered the papers discussing the use of yerba mate and its influence in the composition of ready-to-eat foods, using, for this search, the terms “yerba mate in food”, “products with yerba mate” and “yerba mate foods”.

**RESULTS AND DISCUSSION**

Eight articles reporting the use of yerba mate in the development of food products were found in the databases: cereal bar, yogurt with fibers, yogurt with probiotics, gelatin, cheese, candies, carbonated beverage and beverage with fibers (TABLE 1). Furthermore, other three studies were found involving the use of the extract in feed provided to chicken and the direct application of the extract in roasted/stored/reheated and mechanically separated chicken meat (MRM).

According to the articles found, the first record of the use of yerba mate in the formulation of foods dates to 2006. Barboza (2006) developed a distinguished drink using the extract obtained from crushed yerba in a ratio of 1:50 to water. During the first phase of the study, the author developed a drink using the plant extract, sucrose, sodium benzoate, potassium sorbate, citric acid, ascorbic acid, caramel coloring and mineral water. From this formulation, with 7% sucrose, another formulation of the beverage was developed using the sweetener sucralose to replace sucrose, thus defining
the necessary concentration of sucralose to achieve the same sweetness intensity obtained with sucrose. In the last phase of the study, polydextrose dietary fiber was added to the sucralose formulation. The results showed that more than 50% of tasters would probably buy the yerba mate beverage. The judges classified the beverage as slightly bitter and with a flavor resembling mate. Physical and chemical analyses showed that the drink was developed in accordance with Brazilian legislation and the microbiological parameter for yerba mate-based drinks and identity and quality patterns were respected (BRASIL, 2001; BRASIL, 1998a). Moreover, it contributes to the consumption of dietary fiber and polyphenol, which are both antioxidants.

Table 1 - List of works carried out in the last eight years (2006-2013) which indicate the use of *Ilex paraguariensis* A.St.-Hil. (yerba mate) in production and improvement of food quality

<table>
<thead>
<tr>
<th>Year</th>
<th>Paper/Thesis</th>
<th>Authors</th>
<th>Journal or Thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Desenvolvimento de bebida à base de erva-mate (<em>Ilex paraguariensis</em> Saint Hilaire) adicionada de fibra alimentar. [Development of yerba mate-based beverage (<em>Ilex paraguariensis</em> Saint Hilaire) with added dietary fiber].</td>
<td>Barboza, L. M. V.</td>
<td>Doctoral dissertation</td>
</tr>
<tr>
<td>2007</td>
<td>Antioxidante natural de erva-mate na conservação da carne de frango <em>in vivo</em>. (Natural yerba mate Antioxidant on the conservation of <em>in vivo</em> chicken meat).</td>
<td>Padilha, A. D. G</td>
<td>Master Thesis in Food Science and Technology</td>
</tr>
<tr>
<td>2009</td>
<td>Bebida gaseificada de erva-mate verde. (Green yerba mate carbonated beverage).</td>
<td>Mello, A. C. B.; De Freitas, R. J. S; Wasyczynski, N; Koehler, H. S.; Wille, G. M. F. C.; Berté, K. A. S.</td>
<td>Boletim Centro de Pesquisa de Processamento de Alimentos</td>
</tr>
<tr>
<td>2009</td>
<td>Aplicação de antioxidantes naturais em carne mecanicamente separada (CMS) de ave. (Application of natural antioxidants in mechanically separated poultry meat - MRM).</td>
<td>Pereira, M. G.</td>
<td>Master Thesis of Food Science and Technology Postgraduate Program</td>
</tr>
<tr>
<td>Year</td>
<td>Paper/Thesis</td>
<td>Authors</td>
<td>Journal or Thesis</td>
</tr>
<tr>
<td>------</td>
<td>--------------</td>
<td>---------</td>
<td>-------------------</td>
</tr>
<tr>
<td>2010</td>
<td>Influência da adição de extrato de erva-mate (Ilex paraguariensis St. Hil) e culturas adjuntas (Lactococcus lactis ssp. Lactis e Lactococcus lactis ssp. Cremor) em queijo prato. ([Influence of the addition of yerba mate extract (Ilex paraguariensis St. Hil) and adjunct cultures (Lactococcus lactis ssp. Lactis and Lactococcus lactis ssp. Cremor) to prato cheese].)</td>
<td>Faion, A.</td>
<td>Master Thesis in Food Engineering</td>
</tr>
<tr>
<td>2012</td>
<td>Influência do potencial antioxidante do extrato de erva-mate (Ilex paraguariensis St. Hil) em frango assado, armazenado e reaquecido. ([Influence of the antioxidant potential of yerba mate extract (Ilex paraguariensis St. Hil) in roasted, stored and reheated chicken])</td>
<td>Camel, M.; Becegatto, M. G.; Valduga, A. T.; Cichoski, A. J.; Toniazzo, G.; Valduga, E.; Cansian, R. L.; Oliveira, D.</td>
<td>Alimentos e Nutrição</td>
</tr>
</tbody>
</table>

In another food developed with yerba mate, the processing residues of yerba mate (small fragments of the plant resulting of the crushing process) were used on 0.4%, 0.8% and 1.2% concentrations in the manufacture of a candy prepared with sugar, water, pectin and ascorbic acid (VIEIRA et al., 2008). The total level of dietary fiber in yerba mate candies ranged from 5.7 to 6.29 based on dry matter (levels that are within the range considered for high fiber foods) (BRASIL, 1998b). The research pointed out that there was a significant increase in polyphenol and mineral levels. The candy well-accepted and presented a purchase intent above 60% for notes 4 and 5, that corresponds to “Would possibly buy” and “Would certainly buy”, respectively. Therefore, the candy with yerba mate residues acts as a supplement to diets and as a functional ingredient. The use of the residues in food is important because it adds value to the residues that are generated in yerba mate processing.

Preci et al. (2008) developed a low-calorie yogurt with yerba mate extract and the addition of probiotics, aiming to assess the potential of the plant extract as an antioxidant in a light yogurt. The yerba mate extract was used on concentrations 0% (control);
0.125% and 0.25%. It was elaborated six formulas. Three of the formulations were developed with *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, plus concentrations of 0% (control), 0.1% and 0.25% of yerba mate extract. The other three formulations were composed of *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, probiotic cultures (*Lactobacillus acidophilus* and *Bifidobacterium* ssp.), plus concentrations of 0.0%, 0.1% and 0.25% of yerba mate extract. The yogurt formulations were evaluated after 60 days of storage, refrigerated at a temperature of 8°C. The authors noted that although the yerba mate presents an antimicrobial activity, these concentrations can be used without causing damage to the manufactured product. The presence of yerba mate extract in the product showed an antioxidant action for lipids and do not influenced significantly the protein oxidation.

Another project with yogurt was conducted by Rilb et al. (2011). The authors analyzed the lipid, glycemic, hepatic and renal profile of rats fed on yogurts containing yerba mate extract. Forty-two rats were divided into three groups that were fed, during a period of 30 days, on yogurt without yerba mate extract (group I) and yogurt with 0.1% of yerba mate extract, with probiotic cultures (group II) or without probiotic cultures (group III). At the end of the experiment, the rats were given an anesthesia and the blood was collected by the abdominal aorta for analysis of biochemical parameters. The authors found no significant effects of yerba mate extract on total cholesterol, HDL cholesterol, triglycerides, urea, uric acid, creatine and glucose, showing that the extract of yerba mate in the yogurt on 0.1% concentration did not affect the metabolism of rats. However, Morais et al. (2009) found that the consumption of mate during a period of two months improved the lipid profile, compared to control subjects. This and other literature data indicate the use of yerba mate extract as a protective factor in dyslipidemias and, according to the authors, the yerba mate yogurt can represent a promising functional food.

The authors Mello et al. (2009) elaborated a carbonated beverage with addition of 35%, 42.5%, 50% e 57.5% (v/v) of yerba mate extract and refined sugar (syrup), citric acid, sodium benzoate, potassium sorbate, caramel coloring, drinking water, and carbon dioxide for the carbonation. After the sensory evaluation, the authors observed that the carbonated beverage elaborated with a smaller quantity of yerba mate extract (35%) was the favorite of judges. It also had a good acceptance among the judges (average 6.88) in a hedonic scale with the maximum of nine points. The typical bitter taste of yerba mate is directly related to the quantity of yerba mate extract present in the beverage. The formulation with the highest concentration of extract was considered the one with the most intense bitterness. The results showed a smooth and distinctive taste of yerba mate, which enables the possibility to produce carbonated beverages from the extract of the mentioned plant, treated as an alternative ingredient in the composition of new food products.

In the study of Chiesa et al. (2010), the powdered yerba mate was added to the cereal bars formulation. In preliminary tests, the product was developed in a traditional
way, without any addition of yerba mate, using granulated cashew nut, flaked rice, grated coconut, flaked oat, honey, soybean oil, raisin, lemon juice and maize glucose. After that, the authors elaborated three formulations, reducing the quantity of flaked oat, grated coconut and water and adding, in substitution of these ingredients and in the same proportion, powdered yerba mate on concentrations of 5%; 10% and 20% (m/m). The sensory analysis showed that the taste was the attribute that most influenced the preference of the tasters, given that the formulations with lower concentrations of yerba mate (5 and 10%) had a better acceptability (80.7% and 71.6%, respectively). The purchase intent of the cereal bar containing yerba mate was evaluated as well. It was found that there was a decrease of the purchase preference of the product as the quantity of yerba mate used increased. The physical and chemical analyses of formulations showed that the bars with a higher concentration of the plant obtained a reduction of 51% in lipid level, becoming favorable for the consumption due to the lower level of fat.

Faion (2010) developed a prato cheese with yerba mate extract (0.1 and 0.2%) and mixed cultures of *Lactococcus lactis* ssp. *lactis* and *Lactococcus lactis* ssp. *cremoris*. Six treatments were prepared: without extract and without culture; with addition of culture and without extract; with mixed cultures and 0.1% of extract; with mixed cultures and 0.2% of extract; without mixed culture and 0.1% of extract and without mixed cultures and with addition of 0.2% of extract. Sensory analyses were performed at the 30th, 45th and 60th days of maturation of the formulations at 15°C and 85% of RH. It was observed for the attribute overall acceptability that treatment 5 (without culture and with 0.1% of extract) at 30 and 45 days of maturation showed notes 81.44 and 80.77%, respectively, which correspond to “I liked very much” in the rating scale. In the “taste” attribute, at the 45th day there was a decrease in the mean values for all treatments, except the treatments that did not contain yerba mate extract in its formulation. The author considers the yerba mate bitterness a reason for the decrease of the rating attributed to the topic cheese taste. The presence of yerba mate extract added to the cultures of *Lactococcus* had a marked influence in the protein oxidation. At the concentration of 0.2% of extract, there was a decrease of carbonyl concentration, indicating that at this concentration the extract may have antioxidant action toward protein oxidation. The study found that the antioxidant activity can be considered good as well as the applicability of yerba mate is considered viable in dairy food.

Berté (2011) elaborated a functional gelatin with yerba mate extract and soluble fibers [inulin (IN), fructo-oligosaccharides (FOS) and polydextrose (PD)], then they evaluated the effect of these ingredients in sensory properties of the gelatin developed. At first, it was elaborated a standard formulation with addition of yerba mate extract and, based on this formulation, they developed seven formulations, all of them with the same concentration of yerba mate of the reference formulation, containing several types and proportions of fibers. The research evidenced that the attribute taste of a food can be modified by the type of dietary fiber in the formulation, even that this dietary fiber do not give taste to the final product. The functional gelatin with IN obtained
the highest index for taste and purchase preference above 70%, values that are above the average. The formulations with fibers and yerba mate extracts showed a low caloric value, which makes this food a dietetic one and it can be consumed by diabetics and consumers who use functional foods.

Padilha (2007) verified that the influence of hydroethanolic extract of yerba mate on lipid oxidation, and cholesterol content of fatty acid profile of broiler chicken meat when these animals were put on a diet based in a food with natural antioxidant. The treatments were divided into control (without any addition of extract) and on concentrations 0.3%; 0.5% and 0.7% of yerba mate extract. The food was administered in a period ranging from 1 to 42 days, when the chicken was slaughtered. The broiler chicken breast and legs stored in a refrigerated place (5°C) and frozen (-18°C) for twenty-one days and four months in order to be analyzed, respectively. The results revealed that on concentration 0.3% of extract, the unsaturated fatty acids content was higher than the other treatments, demonstrating the antioxidant effect on fatty acids. The study pointed out that the natural antioxidant provided a reduction of cholesterol in chicken meat, with the use of yerba mate extract in animal food, which is an alternative for obtaining meat and meat products with functional properties for human health and effective in protection against lipid oxidation.

Pereira (2009) evaluated the action of the following natural extracts: yerba mate, marcela (*Achyrocline satureioides*), alcohol-free propolis, green tea and a mixture of yerba mate with marcela in relation to its antioxidant activity in chicken mechanically recovered meat (MRM). All extracts were applied separately in different and equal portions in MRM. After the extracts application, the mechanically recovered meat was kept refrigerated for 10 days and then evaluated during this storage period. The results showed that the yerba mate had a higher level of flavonoids than all the other extracts used in the study and also have inhibited the lipid oxidation in MRM. This shows the importance of the natural antioxidants use in meat and the benefits that yerba mate can bring in relation to inhibition of microbial population of this food.

Another application of yerba mate in chicken meat was performed by Camel et al. (2012) in order to verify the influence of the antioxidant potential on meat under the following conditions: raw, roasted, after storage with refrigeration, and reheated. Seven kinds of treatments for the piece of meat were elaborated: only leg quarter; formulations of leg quarter with salt; salt and dried salvia; salt and dried salvia plus yerba mate extract (0.125%); salt and yerba mate extract (0.125%); salt, dried salvia and yerba mate extract (0.25%); and salt and yerba mate extract (0.25%). After these treatments, the meat was analyzed in three forms: raw, roasted and reheated. The obtained results have demonstrated that the antioxidant percentage increased proportionally to the added extract concentration. The addition of the plant extract to roasted chicken leg quarters, when stored and after the reheating, significantly reduced the lipid oxidation.
Ramilho e Jorge (2006) considers it important to conduct further studies in order to evaluate the antioxidant potential of the other compounds, since the lipid oxidation products are related to a large number of diseases.

FINAL CONSIDERATIONS

The use of yerba mate as a food ingredient is still incipient. However, it is important to develop new foods with yerba mate (*Ilex paraguariensis*), regarding the possibility of providing the consumer with healthier products. It is noticeable that the 11 works found, using the yerba mate in food had a good acceptability by consumers, which is inversely proportional to the yerba mate concentration. Furthermore, the yerba mate shows an oxidant potential and can be used as a coloring and natural preservative. This question should be encouraged in order to increase the consumption of yerba mate, with sensory quality and maintenance of bioactive compounds appropriately to the health promotion.

ACKNOWLEDGEMENTS

To the owners of yerba mate factories Putinguense e Ximango, in Rio Grande do Sul, Brazil, by allowing us to collect the leaves of *Ilex paraguariensis* in their holdings. To CAPES, the financing entity of Prosup research grant.

REFERENCES


BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. Aprova os Regulamentos Técnicos para Fixação dos Padrões de Identidade e Qualidade, para refresco, refrigerante, preparado ou concentrado líquido para refresco ou refrigerante, preparado sólido para refresco, xarope e chá pronto para o consumo. In: *Portaria 544*, de 16 de
APPLICATION OF YERBA MATE (ILEX PARAGUARIENSIS A.ST.-HIL.) IN FOOD...


PRECI, Daiane; CICHOSKI, Alexandre José; VALDUGA, Alice Teresa; OLIVEIRA, Débora de; VALDUGA, Eunice; TREICHEL, Helen; TONIAZZO, Geciane; CANSIAN, Rogério Luís. Desenvolvimento de iogurte light com extrato de erva-mate (*Ilex paraguariensis* St. Hil) e adição de probióticos. *Alimentos e Nutrição*, v.22, n.1, p.27-38, 2008.

