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AVALIAÇÃO DO POTENCIAL EROSIVO DE CHÁS COMERCIALMENTE DISPONÍVEIS

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RESUMO

LUNKES, Letícia Bello Flores. **Avaliação do Potencial Erosivo de Chás Comercialmente Disponíveis**. 2015. 41 f. Trabalho de Conclusão de Curso (Graduação de Odontologia) – Faculdade de Odontologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2015.

O presente estudo teve como objetivo avaliar o potencial erosivo dos chás comercialmente disponíveis. O estudo foi dividido em duas etapas. Na primeira etapa foram avaliados os valores de pH e titrabilidade ácida de 12 chás prontos para beber, 6 chás em saquinho e 1 erva mate comercializada na região metropolitana de Porto Alegre. Na segunda etapa, foi feito desafio erosivo *in vitro* com blocos de esmalte e dentina humanos com um chá pronto para beber e uma água mineral sem gás (controle). A dureza superficial dos blocos foi avaliada antes e depois dos desafios erosivos. A porcentagem de perda de dureza superficial (%PDS) foi submetida ao test *t* de Student. As concentrações de flúor, cálcio e fosfato também foram analisadas. Os valores de pH encontrados variaram de 2,89 à 4,03 para os chás prontos para beber e de 6,75 à 7,89 para os chás em saquinho, havendo um diferença significativa entre os dois grupos ($p < 0,05$). Os chás em saquinho e a erva mate não foram submetidos à análise de titrabilidade ácida, pois seus pH eram neutros. O valor da titrabilidade dos chás prontos para beber variou de 3,77mL a 12,68 mL. Em relação à perda de dureza superficial, houve uma diferença significativa entre o chá pronto para beber e a água mineral tanto para esmalte quanto para dentina. A concentração de cálcio foi maior na água mineral do que no chá pronto para beber. Entretanto, em relação ao fluoreto e ao fosfato, foram encontradas maiores concentrações no chá pronto para beber. A partir do presente estudo conclui-se que os chás prontos para beber podem apresentar potencial erosivo em esmalte e dentina.

Palavras-chave: Erosão Dentária. Esmalte. Dentina. Chá.

ABSTRACT

LUNKES, Letícia Bello Flores. **Evaluation of Erosive Potential of Commercially Available Teas**. 2015. 41 f. Final Paper (Graduation in Dentistry) – Faculdade de Odontologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2015.

The aim of this study was analyze the erosive potential of commercially available teas. The study was divided in two phases. In the first phase were analyzed the pH and titratable acidity values of 12 ready to drink tea, 6 brewed tea and 1 yerba mate sold in the Porto Alegre metropolitan area. In the second phase it was made an erosive challenge *in vitro* with human enamel and dentin specimens with one commercial ready to drink tea and one bottled mineral water (control). Specimen's superficial hardness was analyzed before and after the erosive challenge. The percentage of superficial hardness loss (%SHL) was submitted to Student *t* test. Fluoride, calcium and phosphate concentrations were also analyzed. The pH value ranged between 2.89 and 4.03 for ready to drink teas and from 6.75 to 7.89 for brewed teas, there is a significant difference among the two groups ($p < 0.05$). Brewed teas and yerba mate weren't submitted to titratable acidity analysis because their pH was neutral. The titratable acidity of ready to drink teas ranged from 3.77mL to 12.68mL. On relation to superficial hardness loss, there was a significant difference between the commercial ready to drink tea and the mineral water for enamel and dentin. Calcium concentration was greater in the mineral water than commercial ready to drink tea. However on relation to phosphate and fluoride were observed superior concentrations on commercial ready to drink tea. It's concluded from the present study that commercial ready to drink teas could have erosive potential on enamel and dentin

Keywords: Tooth erosion. Dental enamel. Dentin. Tea.

SUMÁRIO

1 INTRODUÇÃO E REVISÃO DE LITERATURA

Nos últimos anos, ocorreram muitas mudanças nos hábitos alimentares da população brasileira, nas quais há destaque para um aumento da presença de alimentos industrializados na dieta dos brasileiros (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2010). Concomitantemente há uma preocupação da população com seu corpo e com estilo de vida mais saudável (NIELSEN, 2012). Neste contexto existe a oferta dos chás prontos para beber.

A prevalência das doenças bucais também está sofrendo uma transição. O decréscimo na incidência de cárie nas faixas etárias de 5,12, 15-19 e 35-44 anos observado na comparação dos estudos SB Brasil de 2003 e 2010 mostra uma tendência dos brasileiros envelhecerem com mais dentes em boca (BRASIL, 2010). Estes dentes estão susceptíveis a outras doenças dentre elas a erosão. Estudos que avaliaram brasileiros nas faixas etárias de 12, 12-16 e 2-20 anos obtiveram prevalência de erosão de 13%, 20% e 25,43%, respectivamente (PERES et al., 2005; GURGEL et al., 2011; CORRÊA et al., 2011).

Outro aspecto relevante em relação à saúde bucal é a recessão gengival que consiste na migração apical dos tecidos gengivais marginais levando a exposição da superfície radicular. Existem várias causas para esta condição dentre elas escovação agressiva, doença periodontal e uso de fio dental de forma inadequada (PRADEEP et al., 2012). Os estudos com a população brasileira que avaliaram indivíduos a partir de 20 anos e o de 35 anos obtiveram prevalência de cerca 89% e 99,7% (MARINI et al., 2004; RIOS et al., 2014).

1.1 EROSÃO DENTÁRIA

A erosão é caracterizada como uma perda irreversível dos tecidos dentários mineralizados decorrente de um processo químico de dissolução ácida, sem que haja envolvimento bacteriano. Os ácidos podem ter origem intrínseca ou extrínseca. Os ácidos endógenos são de origem gástrica e eles entram em contato com os dentes em decorrência de vômito, refluxo gastroesofágico ou ruminação. Enquanto os ácidos de origem extrínseca são provenientes da:

- dieta (alimentos industrializados ácidos, suco de frutas cítricas, etc);
- estilo de vida (alto consumo de vegetais e frutas ácidas devido a um estilo de vida saudável);
- medicação (aspirina, ácido ascórbico etc);
- ambiente (trabalhadores de fábrica de bateria e galvanização).

(O'SULLIVAN; MILOSEVIC, 2008; ZERO,1996).

1.1.1 Processo químico da erosão Dental

Em água os íons dos ácidos se dissociam, o íon hidrogênio ataca os cristais de hidroxiapatita e os dissolve se combinando com o íon carbonato ou fosfato. Além disso, alguns ácidos em água também se dissociam em ânions ácidos os quais interagem com o cálcio removendo-o da superfície do cristal (FEATHERSTONE; LUSSI, 2006).

A força da dissolução ácida é direcionada pelo grau de saturação do ácido em relação ao conteúdo mineral do dente. O grau de saturação dos alimentos e bebidas é determinado pelos valores de pH, concentrações de cálcio, fosfato e fluoreto (LUSSI; JAEGI, 2006). Quando a solução for subsaturada, irá ocorrer dissolução do mineral até que a solução se tornar supersaturada. Importante considerar que independente do pH, se a solução tem altas concentrações de cálcio e/ou fosfato que a tornem supersaturadas em relação ao mineral, a dissolução não irá ocorrer (FEATHERSTONE; LUSSI, 2006). Para o processo de remineralização a saliva, por ser supersaturada em relação aos minerais do dente, atua como fonte de fosfato, fluoreto e cálcio (BUZALAF; HANNAS; KATO, 2012). Na presença do fluoreto pode ser formada a fluorapatita que é menos solúvel frente exposição a ácido (FEATHERSTONE; LUSSI, 2006). A saliva ainda forma a película adquirida que atua como uma barreira para a difusão protegendo o dente do ataque ácido (FEATHERSTONE; LUSSI, 2006), promove uma remoção gradual dos ácidos da boca através da deglutição e possui a capacidade tampão gerando a neutralização e tamponamento dos ácidos (BUZALAF; HANNAS; KATO, 2012).

1.1.2 Erosão por ácidos extrínsecos

Existem diversos estudos na literatura que relacionam a erosão dentária com consumo de diferentes bebidas. O estudo de Borjian et al. (2010) avaliou através de microscopia eletrônica o efeito da exposição de terceiro molares à ácidos de seis refrigerantes de cola após 30s, 60s e escovação. Observou-se que a exposição a refrigerantes de cola leva ao desenvolvimento de falhas na superfície e facilita o desenvolvimento de abrasão. Fushida e Cury (1999) avaliaram o efeito erosivo da Coca-Cola relacionado com sua frequência e a capacidade de reversão da saliva através de um estudo *in situ* com blocos de esmalte e dentina bovinos. Em ambos os tecidos houve um aumento da dureza 24 horas após a última ingestão de Coca-cola, mas que não foi suficiente para retornar a dureza inicial, de forma que a frequência da ingestão de Coca-cola causa perdas irreversíveis na dureza superficial tanto de esmalte quando de dentina radicular.

Canappele et al. (2012) avaliaram o efeito erosivo de uma marca comercial de bebida isotônica, suco de laranja, energético e vinho branco em dentina através de um estudo *in vitro* com raízes de incisivos bovinos. Os autores observaram que todas as bebidas testadas promoveram erosão sendo o energético com maior potencial erosivo e que não houve relação entre o pH das bebidas e seu potencial erosivo.

Gonçalves et al. (2012) avaliaram o efeito erosivo de sucos de uva em esmalte bovino *in vitro* e observou que independente da apresentação comercial este tipo de bebida possui potencial erosivo.

Em relação às bebidas, também é relevante a titrabilidade ácida corresponde a quantidade de base necessária para tornar o pH da solução neutro (EHLEN et al., 2008). Logo quanto maior for a titrabilidade ácida, maior será o potencial erosivo. O estudo de Willershausen et al. (2009) avaliou *in vitro* o efeito erosivo de vinhos brancos e tintos em esmalte humano feitos a partir de molares e pré-molares extraídos por doenças periodontais. Primeiramente foi feita avaliação de pH de 100 vinhos, 50 de cada tipo, na qual foram encontrados valores de pH entre 3,25 e 4,11 para o tinto e entre 2,95 e 3,9 para o branco. Na outra fase do estudo, foi avaliada a titrabilidade ácida de 4 vinhos de cada tipo que tinham valores de pH diferente e a partir desta análise foram escolhidos os que tinham maior e menor titrabilidade ácida para avaliar a liberação de cálcio *in vitro*. Para todos os vinhos, houve um aumento liberação de cálcio com aumento do período de incubação e tanto para o vinho tinto quanto para o branco a maior liberação de cálcio ocorreu nas amostras com maior titrabilidade ácida, sendo que o vinho branco obteve a maior liberação de cálcio.

1.1.3 Chás e a erosão

Dentre as bebidas comercialmente disponíveis no mercado estão os chás. O consumo de chá é associado a um estilo de vida saudável, pois o mesmo tem propriedades antioxidantes e anticancerígenas (HAYAT et al., 2013). Muitas pessoas consideram o chá uma bebida saudável e optam por emprega-lo como substituto de bebidas industrializadas que são consideradas prejudiciais a saúde.

Amoras et al. (2012) avaliaram o efeito de refrigerante, leite UHT, leite de soja, água e chá pronto para beber em esmalte bovino exposto previamente a desafio erosivo com ácido clorídrico simulando um ácido de origem intrínseca. A perda de microdureza ocasionada pelo refrigerante e pelo chá pronto foi significativamente maior em relação às demais bebidas.

Existem estudos na literatura sobre o efeito protetor do chá verde para erosão em dentina. Kato et al. (2009) realizaram um estudo *in situ* com espécimes de dente bovino no qual após o desafio erosivo com refrigerante era realizado bochecho com chá verde seguido de escovação. Observou-se que o bochecho com chá verde reduziu significativamente o desgaste da dentina diante de desafios erosivos/ abrasivos. Mirkarimi e Toomarian (2012) realizaram um estudo *in vitro* com pré-molares humanos no qual os espécimes foram imersos em Coca Cola durante 05 minutos e depois imersos durante 01 minuto em solução de chá verde. Os valores de microdureza superficial obtidos após cada etapa foram diferentes significativamente caracterizando que o chá verde levou a um aumento na microdureza superficial da dentina que sofreu erosão. O estudo *in vitro* de Fujii et al. (2011) avaliou as alterações na rugosidade superficial e no pH da superfície de esmalte bovino após desafio erosivo por cola, suco de laranja e chá verde. O chá verde não alterou significativamente a rugosidade superficial, nem o pH como ocorreu com as demais bebidas. O chá verde utilizado tinha valor de pH 6,3, enquanto a cola e o suco de laranja tinham valores de 2,2 e 4,0, respectivamente. Na composição do chá havia chá verde, vitamina C e aromatizante.

O estudo de Brunton e Hussain (2001) avaliou o efeito erosivo em esmalte de dois chás de saquinho, um chá preto e um chá herbal, usando água como controle. Os blocos de esmalte humano foram imersos na bebida durante 14 dias sendo que a cada 02 dias a bebida era trocada e a cada 7 dias eram escovados para remover detritos da superfície. O período de 14 dias foi escolhido, pois simula 18,4 anos de ingestão do chá no caso de uma pessoa que bebe 4 xícaras por dia com 15 goles durando 3s. O pH das bebidas foi mensurado antes de seu uso e os valores médios foram 4,8 para o chá preto, 3,2 para o chá herbal e 7,0 para água. Ambos os chás causaram erosão do esmalte sendo que o efeito do chá herbal foi 5 vezes mais severo. No entanto, o estudo de Simpson, Shaw e Smith (2001) que avaliou a mudança no pH da superfície palatina na região dos dentes anteriores superiores e molares inferiores após beberem chá preto com valor de pH de 4,9 encontrou apenas uma pequena queda no pH sendo que a média do pH mínimo encontrado foi de 5,45 e que o tempo médio para o pH retornar foi de 2 minutos. De forma que recomendaram o chá como uma alternativa segura para bebidas ácidas.

O estudo de Lussi et al. (2000) avaliou o potencial erosivo de bebidas no esmalte de dentes decíduos e permanentes. Dentre as bebidas estava um chá pronto para beber de valor de pH 3,00 que causou perda significativa da dureza Knoop em ambas dentições.

Em relação aos estudos sobre potencial erosivo dos chás há divergência sobre os resultados. Além disso, a maioria dos estudos limita-se ao esmalte dentário de forma que existem poucos estudos que avaliam o potencial erosivo dos chás comercialmente disponíveis em esmalte e dentina.

2 OBJETIVOS

Os objetivos do presente estudo foram divididos em objetivo geral e objetivo específico.

2.1 OBJETIVO GERAL

Avaliar o potencial erosivo de chás comercialmente disponíveis.

2.2 OBJETIVOS ESPECÍFICOS

a) Avaliar o potencial erosivo de chás comercialmente disponíveis no mercado através da mensuração de pH e titrabilidade ácida.
b) Avaliar o potencial erosivo de um chá comercial pronto para beber sobre esmalte e dentina.

3 ARTIGOS

O presente trabalho será apresentado na forma de dois artigos científicos.

3.1 ARTIGO 1

Evaluation of the pH and titratable acidity of teas commercially available in Brazilian market

Letícia Bello Flores Lunkes, Lina Naomi Hashizume

ABSTRACT

Objective: Tea has been considered a healthy alternative to other industrialized beverages. The objective of this study was to assess the erosive potential of teas commercially available in Brazil by pH and titratable acidity measures.

Methods: Eighteen teas available in Brazilian market were selected for this study (read to drink and teabag), and a brand of yerba mate (*Ilex paraguariensis*). Each product was analyzed for pH and titratable acidity. For comparison between different kinds of teas, the Student t test was used.

Results: The mean pH values for ready to drink teas ranged between 2.89 and 4.03, while for the brewed teas and yerba mate the values ranged between 6.75 and 7.89. The difference between the two groups was significant ($p < 0.05$). Regarding titratable acidity, the ready to drink teas showed mean values ranging between 3.77 mL and 12.68 mL. Brewed teas (including yerba mate) were not tested for titratable acidity because their pH values were greater than 7.0.

Conclusion: Among the teas commercially available, ready to drink teas have lower pH values and higher titratable acidity compared to other teas. It suggests that they have an erosive potential.

INTRODUCTION

In recent years, significant changes happened in the eating behavior of the Brazilian population, mainly in relation to replacement of homemade and natural food by industrialized food[1,2]. Along with that has been also a wide diversity on the beverages consumption behavior as well on the offer of ready to drink beverages in the Brazilian market[3,4].

Following this change in the eating behavior, an increase on prevalence of tooth erosion cases among children and teenagers[5] has been observed. The tooth erosion is characterized by a chemical wear of dental mineralized tissues without bacterial involvement[6,7]. Previous studies have shown a significant relationship between dental erosion and dietary behavior[8,9]. The majority have associated this problem with beverages present in the modern diet, for example wine[10,11], sport beverages[12,13], soft drinks [14,15,16] and juices[13,14,17].

Teas are among the industrialized beverages commercially available on the Brazilian market. Tea consumption is associated with great benefits to health as it has been shown to have antioxidant properties[18,19]. Many people consume tea as replacement to other industrialized beverages that are considered harmful, due to the belief that tea is a healthier option. However, the literature is scarce in relation to studies that evaluate the erosive potential of teas commercially available in the Brazilian market through assessment of pH values and titratable acidity.

METHODS

Eighteen commercial brands of teas available in the city of Porto Alegre, RS, Brazil were analyzed in the present study. Of these, 12 were in the ready to drink form and 6 in the teabag form. Furthermore, a commercial brand of yerba mate (*Ilex paraguariensis*) that is widely used as *chimarrão* by the local population was also evaluated. Three units of each tea or yerba mate were bought in different stores in the metropolitan region of Porto Alegre, RS. Tables 1 and 2 show the composition of tested teas.

Table 1. Composition of the ready to drink teas tested in this study, Porto Alegre, RS, 2011.

Tea's commercial brand (manufacturer)	Composition
Black Tea lemon flavor zero (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, synthetic aroma identical to natural, preservatives sodium benzoate and potassium sorbate, artificial sweetener sodium cyclamate (45 mgs) and sodium saccharin (6,5 mgs) per 100 mL, sequestrant sodium hexametaphosphate and dimethylpolysiloxane antifoam.
Black tea peach flavor (Nestea, Nestlé, São Paulo, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, sequestrant sodium hexametaphosphate, preservatives sodium benzoate and potassium sorbate, flavoring, caramel color and dimethylpolysiloxane antifoam.
Black tea peach flavor (Lipton®, Ambev, Jaguariúna, Brazil)	Water, sugar, acidulant citric acid INS 330, black tea extract, concentrated peach juice, flavoring (aroma identical to natural peach), antioxidant ascorbic acid INS 300
Black tea peach zero flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, synthetic aroma identical to natural, preservatives sodium benzoate and potassium sorbate, artificial sweetener sodium cyclamate (45 mgs) and sodium saccharin (6,5 mgs) per 100 mL, sequestrant sodium hexametaphosphate and dimethylpolysiloxane antifoam.
Black tea lemon light flavor (Lipton®, Ambev, Jaguariúna, Brazil)	Water, acidulant malic acid INS 296, acidulant citric acid INS 330, black tea extract, concentrated lemon juice, flavoring (aroma identical to natural peach), acidity regulator: sodium citrate INS 331 iii, antioxidant ascorbic acid INS 300, artificial sweetener: aspartame INS 951 (10 mgs/100 mL) and acesulfame K INS 950 (8 mgs/100 mL) and sodium cyclamate INS 952 (22 mgs/100 mL)
Black tea lemon flavor (Lipton®, Ambev, Jaguariúna, Brazil)	Water, sugar, acidulant citric acid INS 330, black tea extract, concentrated lemon juice, flavoring (aroma identical to natural peach), acidity regulator: sodium citrate INS 331 iii, antioxidant ascorbic acid INS 330.
Black tea lemon flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, flavoring identical to natural, acidity regulator sodium citrate, preservative sodium benzoate and potassium sorbate, sequestrant sodium hexametaphosphate and dimethylpolysiloxane antifoam.
Black tea peach flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, synthetic aroma identical to natural, acidity regulator sodium citrate, preservative sodium benzoate and potassium sorbate, sequestrant sodium hexametaphosphate and dimethylpolysiloxane antifoam.
Green tea (Feel Good, Wow Nutrition, São Bernardo do Campo, Brazil)	Water, green tea powder (*Camellia sinensis*), stabilizing sodium citrate, acidulant citric acid, antioxidant ascorbic acid (vitamin C), aroma identical to lemon natural, concentrated lemon juice and artificial sweetener sodium cyclamate (40 mgs/100 mL), sucralose (6 mgs/100 mL) and sodium saccharin (4 mgs /100 mL)
Black tea lemon flavor (Nestea, Nestlé, São Paulo, Brazil)	Water, sugar, black tea extract, acidulant citric and ascorbic acid, sequestrant sodium hexametaphosphate, preservative sodium benzoate and potassium sorbate, flavoring, caramel color and dimethylpolysiloxane antifoam
Black tea peach light flavor (Lipton®, Ambev, Jaguariúna, Brazil)	Water, acidulant malic acid INS 296, black tea extract, concentrated peach juice, flavoring (aroma identical to peach natural), preservative potassium sorbate INS 202, acidity regulator: sodium citrate INS331 iii, antioxidant ascorbic acid INS 300, artificial sweetener: aspartame INS 951 (22 mgs/100 mL) and acesulfame K INS 950 (7,2 mgs/100 mL).
Natural mate tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Water, mate extract, sugar, acidulant citric acid, antioxidante ascorbic acid, preservatives sodium benzoate and potassium sorbate.

Table 2. Composition of the brewed teas and yerba mate tested in this study, Porto Alegre, RS, 2011.

Tea's commercial brand (manufacturer)	Composition
Green tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Leaves and stalks of green tea (*Camellia sinensis, L. kuntze*)
Chamomile (Dr. Oetker Brasil, São Paulo, Brazil)	Chamomile (*Matricaria recutita*), floral chapters
Lemongrass (Prenda, Senador Salgado Filho, Brazil)	Leaves of lemongrass (*Cymbopogon citratus*)
Black tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Leaves and stalks of black tea (*Camellia sinensis* L. kuntze)
Natural mate tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	Leaves and stalks of yerba mate toasted (*Ilex paraguariensis*)
Boldo (Prenda, Senador Salgado Filho, Brazil)	Leaves of boldo (*Pneumus boldus*, Molina)
Yerba mate (Seiva Pura®, Ijuí, Brazil)	Leaves and stalks of yerba mate (*Ilex paraguariensis*)

Tea and yerba mate samples preparation

Samples of ready to drink tea (canned or bottled) were collected directly from the product package immediately after its opening. Brewed teas were prepared using a standard method by which the tea bag was allowed to infuse in 200 mL of distilled water at 100°C for 4 minutes. The yerba mate was prepared by putting it inside a *cuia* (cup for the preparation and consumption of *chimarrão*) with a volume of 2/3 of the cup. The rest (1/3 of the *cuia*) was filled with distilled water at 100°C. After the water was added, the prepared yerba mate brew was removed from the *cuia* and filtered using a filter paper.

Evaluation of beverages pH values

The measurement of the beverages' pH values were made at 25°C through a pH electrode connected to an ion analyze (DM-23, Digimed, São Paulo, SP, Brazil). Previously to the measurements the equipment was calibrated with standard solutions of pH 4.01 and 6.86. The readings were performed in triplicate for each sample.

Titratable Acidity of Beverages

In the sequence of pH measurements, the samples which showed a pH value below 7.0 were submitted to titratable acidity analysis. Increments of 0.5 mL of 0.1M NaOH solution were added, in a tea volume of 25 mL, until pH 7 was reached. The volume of 0.1M NaOH solution (in milliliters) necessary to achieve a neutral solution was recorded and it corresponded to titratable acidity of each beverage[20]. The procedure was also conducted in triplicate for each sample.

Statistic Analysis

Mean and standard deviations of all samples were calculated with Excel software (Microsoft, Redmond, WA, USA). The pH values of ready to drink teas were compared with brewed tea and yerba mate through Student t test, with significance level of 0.05, using the Statistical Package for Social Sciences version 17.0 for Windows (SPSS Inc., Chicago, Ill., USA).

RESULTS

Table 3 shows the results of pH values and titratable acidity of ready to drink teas. Mean values of pH of ready to drink teas (canned and bottled) varied between 2.89 and 4.03. The smallest pH value (2.89) was found for a commercial brand of canned black tea with a lemon flavor. In regard to titratable acidity, ready to drink teas showed mean values varying between 3.77 mL and 12.68 mL. The tea which required the highest volume of NaOH solution to neutralize its pH was also a commercial brand of canned black tea with a lemon flavor.

Table 3. pH and titratable acidity values (mean ± standard deviation) of each ready to drink tea analyzed in this study, Porto Alegre, RS, 2011.

Tea's commercial brand (manufacturer)	pH	Titratable acidity (mL)
Black tea lemon flavor zero (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	2.89 ± 0.02	11.05 ± 0.47
Black tea peach flavor (Nestea, Nestlé, São Paulo, Brazil)	2.99 ± 0.04	8.59 ± 0.32
Black tea peach flavor (Lipton®, Ambev, Jaguariúna, Brazil)	2.96 ± 0.04	8.73 ± 0.24
Black tea peach zero flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	3.04 ± 0.04	7.99 ± 0.13
Black tea lemon light flavor (Lipton®, Ambev, Jaguariúna, Brazil)	3.41 ± 0.05	6.11 ± 0.29
Black tea lemon flavor (Lipton®, Ambev, Jaguariúna, Brazil)	3.13 ± 0.04	9.68 ± 0.39
Black tea lemon flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	3.05 ± 0.02	11.85 ± 0.13
Black tea peach flavor (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	3.18 ± 0.03	7.54 ± 0.07
Green tea (Feel Good, Wow Nutrition, São Bernardo do Campo, Brazil)	3.60 ± 0.02	7.73 ± 0.09
Black tea lemon flavor (Nestea, Nestlé, São Paulo, Brazil)	2.90 ± 0.07	12.68 ± 0.40
Black tea peach light flavor (Lipton®, Ambev, Jaguariúna, Brazil)	3.39 ± 0.03	8.74 ± 0.05
Natural mate tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	4.03 ± 0.01	3.78 ± 0.06

Table 4 shows the pH values (mean and standard deviation) for the brewed teas and yerba mate. Mean values of pH for these teas varied between 6.75 and 7.89. The yerba mate prepared for *chimarrão* showed a mean value of 7.10. Since brewed tea and yerba mate showed pH neutral values (approximately pH 7.0), it was not possible measure their values for titratable acidity.

Table 4. pH values (mean ± standard deviation) of each brewed tea and yerba mate analyzed in this study, Porto Alegre (RS), 2011.

Tea's commercial brand (manufacturer)	pH
Green tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	7.02 ± 0.05
Chamomile (Dr. Oetker Brasil, São Paulo, Brazil)	7.89 ± 0.03
Lemongrass (Prenda, Senador Salgado Filho, Brazil)	7.45 ± 0.09
Black tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	6.75 ± 0.11
Natural mate tea (Matte Leão, Coca Cola® Brasil, Rio de Janeiro, Brazil)	7.37 ± 0.01
Boldo (Prenda, Senador Salgado Filho, Brazil)	7.29 ± 0.08
Yerba mate (Seiva Pura®, Ijuí, Brazil)	7.10 ± 0.01

When comparing the type of tea, ready to drink teas showed a mean pH values significantly lower than brewed teas and yerba mate ($p < 0.05$).

DISCUSSION

Erosion lesions on enamel surface happen due to demineralization caused by subsaturated solutions in relation to hydroxyapatite and fluorapatite considering that the dissolution kinetic is associated to reactions controlled by the diffusivity degree of acids in solution[21]. One of the most important extrinsic factors in dental erosion is the high consumption of acidic beverages and foods. The consumed amount and the frequency of consumption of products containing acids have increased due to changes in life style[22].

All brewed teas and yerba mate presented pH values close to neutrality, showing no erosive potential to teeth. This finding can be explained through the Stephan report[23], which did not observe loss of superficial hardness of teeth when they were in contact with teas without an acid component. In the present study, the water used to prepare the brewed teas and yerba mate showed a pH = 7.0. After beverage preparation, little variation in pH value was observed. This finding indicates that the water utilized for the preparation of brewed tea and yerba mate can be determinant for the final pH of these beverages.

The yerba mate (*Ilex paraguariensis*) is a natural product widely known and consumed in the southern region of Brazil, similarly in Paraguay, Uruguay and Argentina. In the southern region of Brazil it is consumed by the infusion of leaves, in a way called *chimarrão*, characterized as one of the region's main cultural habits[24] which justify its inclusion in the study.

In relation to ready to drink teas, it was verified, in the present study, that they showed lower pH values, and higher values of titratable acidity compared to brewed teas and yerba mate. Ready to drink tea is submitted to an industrialization process in which other components are added to the tea. Among them there are acidulants. The addition of acidulants to the product causes a significant reduction of the beverage pH value. All pH values observed for ready to drink teas tested in this study were below 4.03.

When evaluating the erosive potential of a beverage there are other variables which can be considered such as calcium, fluoride and phosphorus concentrations and the type and concentration of acids present in the beverage. However, the major factor when analyzing the action of erosive beverages remains the pH value[25,26].

The titratable acidity measurement has also been used to assess beverages' erosive potential. This method considers the type and concentration of the present acid. The majority of erosive beverages have weak acids and the concentration of these acids determines not only the pH value but also the buffering properties. Many authors have found a strong association between titratable acidity and erosive potential of beverages[27,28,29]. All ready to drink teas evaluated in this study showed the high titratable acidity values.

Analyzing the composition of ready to drink teas tested in the present study, it was found that most of them contained citric acid as the acidulant, be it associated or not to phosphoric acid. Citric acid has a high erosive potencial due to its acidic nature and chelating properties[30,31]. This finding can justify the reduced pH values and high titratable acidity values found in ready to drink teas.

In the present study the green tea was analyzed in both forms ready to drink and brewed. The literature has reported many different properties of this tea against dental caries due to presence of their catechins[32,33]. Furthermore, green tea has components which can inhibit matrix metalloproteinase that are present on saliva and on mineralized dental tissues[34] decreasing the dental erosion/abrasion *in situ*[35].

To determine the erosive potential of a beverage it is necessary to consider aspects other then pH and titratable acidity values, although results from these two factors can be used as indicators for this issue. Others studies are being conducting to evaluate the erosive potential of these teas on mineralized dental tissues, considering other variables involved.

CONCLUSION

The present study demonstrated that, among teas commercially available on the Brazilian market, ready to drink teas show lowest pH values and highest titratable acidity values compared to brewed teas tested. These findings suggest an erosive potential for this kind of tea.

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3.2 ARTIGO 2

Erosive potential of a commercial ready to drink tea

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ABSTRACT

Background: Prevalence of tooth erosion is increasing and one reason for this is the increase of beverages with high erosive potential. The aim of this study was to evaluate the erosive potential of a commercial ready to drink tea on human enamel and dentin, using an *in vitro* experiment.

Methods: Human enamel and dentin were exposed to one commercial ready to drink tea and one bottled mineral water (control). For each beverage 10 specimens were submitted to 5 days of 6 erosion-remineralization cycles. The superficial hardness was measured before and after the erosive challenge to determine superficial hardness loss. Titratable acidity, pH value, fluoride, calcium and phosphate concentrations of each beverage were also analyzed.

Results: The commercial ready to drink tea resulted in a higher percentage of superficial hardness loss on relation to mineral water($p < 0.001$) on both enamel and dentin specimens. Commercial ready to drink tea showed lower values of pH and calcium concentration in relation to mineral water. For titratable acidity, phosphate and fluoride concentration, the commercial ready to drink values were higher than mineral water.

Conclusion: The commercial ready to drink tea used in the present study showed erosive potential on enamel and dentin.

Keywords: dentin, enamel, erosion, ready to drink tea.

INTRODUCTION

An increase of industrialized food in Brazilian population diet has been observed[1]. Due to modern life style, people are choosing more practical food[2]. At the same time there is a trend of population adopt a healthier life style[2]. On this context, had an increase of health and practical products between them the ready to drink tea[3]. This is a trend observed in others countries, like United States where this beverage had an increase of more than 15 fold[4]. Tea consumption is increasing so much that in 2012 happened the Fifth International Scientific Symposium on Tea and Human Health in which were discussed tea benefits on health promotion and on decrease of chronic diseases[5].

On the last years there was a significate increase on national population income which lead to an increase of food with added value[6], including ready to drink tea. Bezerra *et al.*[7] compared eating habits of Brazilians and Americans adult's between 20 and 60 years and concluded that Brazilians consume more tea than Americans.

Incidence of tooth decay decreased on age group of 5, 12, 15-19 and 35-44 years in Brazil according with comparison of two Brazilian epidemiological studies[8]. So the Brazilian population trend is getting old with more teeth in the mouth. This will create need of treatment for others oral diseases including tooth erosion. Tooth erosion has an impact on patient lifelong who can be submitted to a repetitive restorative cycle with rising complexity[9]. Studies that analyzed Brazilians on age group 12 years, 12-16 years and 2-20 years got tooth erosion prevalence of 13%, 20% and 25.43% respectively[10-12].

Tooth erosion is a chemistry loss due to acid action from intrinsic or extrinsic origin[13]. Solutions lead or not to mineral loss according with their saturation degree on relation to tooth mineral. Subsatured solutions lead to demineralization until the moment that, due to saliva buffer capacity, the solution became oversaturated and remineralization occurs. Calcium and/or phosphate concentrations could increase the saturation degree of a solution. If fluoride is present while the remineralization process is happening occurs fluorapatite formation which is less soluble than hydroxyapatite[14]. So the beverages saturation degree is dependent of pH and calcium, phosphate and fluoride concentrations[15]. The period that saliva will take to neutralize the acid is directly proportional to beverages titratable acidity[16].

There are many studies on the literature which analyze the relation of tooth erosion with soft drinks, sport drinks, juices, milk and yogurt consumption[17]. However there are few studies about tea potential erosion. The studies related to tea analyze just chemistry aspects[18-20] or analyze hardness loss just on enamel[21, 22]. So there is need studies that evaluate tea erosive potential on human enamel and dentin substrates.

The purpose of this study was to evaluate the erosive potential of a commercial brand of commercial ready to drink tea on human enamel and dentin.

MATERIALS AND METHODS

Experimental Design

This study was approved by the Ethics in Research Committee of UFRGS (process 18678/2010). Enamel and root dentin specimens (3x3x2mm) were prepared from third human molars extracted for therapeutics reasons and storage in 2% formol solution (pH 7.0)[23]. The teeth was sectioned with the aim of obtain enamel and dentin specimens. Specimens were ground flat with water-cooled discs (320, 600 and 1200 granulation) and polished with felt paper and diamond suspension (1/4 µ, Arotec, Cotia, Brazil). For hardness determination were made first a reference indentation on specimen middle with 100g load for enamel and 50g load for dentin during 10s (HMV-2T, Shimadzu, Kyoto, Japan). Then to determinate the baseline surface hardness (SH_B) were made five indentations since reference indentation with distance of 100 µm between them with 50g load for enamel and 25g load for dentin for 10s. Twenty specimens of enamel and dentin with mean SH_B 15% above or below average were randomly allocated into 2 groups, mineral water and commercial ready to drink tea.

After the determination of the $SH_{B,}$ specimens were submitted to an in vitro erosion cycling model, according with protocol of Scaramucci et al[24]. In one day of the experiment was performed 6 times the erosive challenge followed by the remineralization process and during overnight was also made the remineralization process. First the specimens were exposed to beverage for 5 minutes (10mL/ specimen), then 60 minutes (10mL/specimen) in artificial saliva solution (calcium 1.5 mmol L^{-1}, phosphate 0.9mmol L^{-1}, KCL 150 mmol L^{-1} in TRIS buffer 0.1 mol L^{-1}, pH 7.0, containing 0.03 µg/mL fluoride)[25], 10mL/specimen under agitation. Between erosive and remineralization challenge, specimens were rinsed with deionized water and dried with paper towels. This phase of the study was conducted during 5 days, leading to a total of 30 cycles.

Tested beverages

For this study, one of the most popular commercial ready to drink tea (Black Tea Zero Lemon Flavor®, Matte Leão, Coca Cola Brasil, Rio de Janeiro, Brazil) and one bottled mineral water (Floresta®, Sarandi Ltda, Brazil) were chosen. Components of tested drinks are on Table 1.

Table 1- Composition of commercial ready to drink tea and water tested in this study

Beverage	Composition
Black Tea Zero Lemon Flavor® (Matte Leão, Coca Cola, Rio de Janeiro, Brazil)	Water, sugar, black tea extract, acidulant citric and phosphoric acid, synthetic aroma identical to natural, preservatives sodium benzoate and potassium sorbate, artificial sweetener sodium cyclamate (45 mgs) and sodium saccharin (6.5 mgs) per 100 mL, sequestrant sodium hexametaphosphate and dimethylpolysiloxane antifoam
Floresta® Mineral Water (Sarandi Ltda., Barra Funda, Brazil)	Calcium (41.06mg/L), magnesium (1.21mg/L), potassium (4.00 mg/L), sodium (16.00 mg/L), sulfate (7.2 mg/L), bicarbonate (155.73 mg/L), fluoride (0.12 mg/L), nitrate (5.8 mg/L) e chloride (5.16 mg/L)

Percentage of superficial hardness loss

After the erosive challenge were performed five new indentations since reference indentation with distance of 100 µm between them with 50g load for enamel and 25g load for dentin for 10s. The average was used to determinate the superficial hardness after *in vitro* test (SH_A). The percentage of superficial hardness loss (%SHL) was calculated by the formula: $\%SHL = (SH_B – SH_A) \times 100 / SH_B$[26].

Chemical analysis of beverages

The pH value of each beverage was determinate through a pH electrode connected to an ion analyzer (DM-23, Digimed®, São Paulo, Brazil). The titratable acidity was determinate by the addition of 0.1M NaOH solution in 25mL of each beverage until pH 7 was reached. The analyses of pH values and titratable acidity were made in triplicate.

Each beverage was analyzed for calcium, phosphate and fluoride concentrations, those analyses were made in duplicate. Calcium and phosphate concentrations determination was made through a spectrophotometer. Calcium concentration was made with colorimetric method with Arsenazo III reagent[27] and phosphate concentration was made with direct method with fosmolibdato reagent[28]. The fluoride determination was made using an ion specific electrode (96-09 combination fluoride electrode, Orion, Cambridge, USA) after adding the same volume of TISAB II to the sample[29].

Statistical analysis

For the data normality verification was used the Shapiro-Wilks test. Since the results were satisfactory, Student t test was used for %SHL comparison between mineral water and commercial ready to drink tea. For analysis was used SPSS (Statistical Package for Social Sciences) version 18.0 for Windows, with significance level of 5%.

RESULTS

Table 2 shows the %SHL for the different treatments. The commercial ready to drink tea resulted in a higher %SHL on relation to mineral water ($p < 0.001$) on both enamel and dentin specimens

The chemical properties are showed on table 3. Commercial ready to drink tea showed lower values of pH and calcium concentration in relation to mineral water. For the others properties analyzed, titratable acidity, phosphate and fluoride concentration, the commercial ready to drink values were higher than mineral water.

Table 2- Baseline surface hardness (SH_B), superficial hardness after *in vitro* test (SH_A) and percentage of superficial hardness loss (%SHL) (mean ± standard deviation) for enamel and dentin submitted to mineral water and commercial ready to drink tea treatment

Group	Enamel			Dentin		
	SH_B	SH_A	% SHL	SH_B	SH_A	%SHL
Mineral water	328.86±16.88	270.92±26.92	17.52±8.27[a]	58.21±5.32	48.36±8.69	16.75±13.57[a]
Tea	337.32±14.79	64.18±9.48	80.92±3.06[b]	61.56±5.18	10.62±2.07	82.51±4.21[b]

Distinct lower case indicates statistical significance (p <0.001)

Table 3- Values (mean ± standard deviation) of chemical factors of mineral water and commercial ready to drink tea analyzed

Group	pH	Titratable acidity (mL)	Calcium concentration (mM Ca)	Phosphate concentration (µg P)	Fluoride concentration (ppm)
Mineral water	6.91±0.31	n.a.	5.93±1.75	3.03±1.17	0.18±0.00
Tea	2.72±0.01	11.05±0.47	0.81±0.42	17.16±1.75	1.22±0.19

n.a.= not analyzed

DISCUSSION

Ready to drink tea is considered by the Brazilian population as a healthy and practical option to others industrialized beverages. The present study had as aim evaluate the chemical factors related to erosive potential of a commercial ready to drink tea, beyond the effects of this beverage on enamel and dentin substrates.

Were obtained low pH value and high titratable acidity value for commercial ready to drink tea according with Beherendt *et al.*[19], Lussi *et al*.[22] and Phelan *et al*.[30] Wherein Lussi *et al*.[22] founded similar results for ready to drink tea and soft drink. Ready to drink tea is submitted to an industrialization process in which others chemistry components are added to formula and this can result in change of these beverage properties. Commercial ready to drink tea components are listed on table 1. The acidulant is responsible for a significate reduction on beverages pH. On Lunkes *et al*.[31] all ready to drink teas tested showed pH below 4.03, while brewed tea pH ranged from 6.75 to 7.89. Commercial ready to drink has two others components, flavoring and preservative, that were related on others studies[18,32] with high titratable acidity, which can justify the result founded in the present study.

Acid dissolution force is dependent of acid saturation degree on relation to tooth mineral. Beverages saturation degree is determined by pH, calcium, phosphate and fluoride concentrations[33]. Thus analysis of those ions concentrations is important for erosive potential determination.

The calcium concentration value was similar with the values on Lussi *et al.*[22] Calcium concentration is a very important factor to be considered on relation to demineralization and there are studies which observed that the addition of calcium decrease the erosive potential of acid beverages[34-35].

Only Lussi *et al.*[22] analyzed the phosphate concentration and the results were similar to the present study. Another study[36] showed wide variation on phosphate concentration of acid beverages soft drink type which could be due to acid phosphoric presence on composition. Phosphate contents present on commercial ready to drink tea evaluated could be from phosphoric acid also present on composition and water utilized on its manufacture.

Fluoride high concentrations founded in the present study agree with Behrendt *et al.*[19], Hayacibara *et al.*[20], Lussi *et al.*[22]. Including on Lussi *et al.*[22] the black tea had the higher fluoride concentration on relation to others substances studied between them soft drink, yogurt, juice and alcoholic drink. Tea is prepared from the leaves which are where plants accumulate the fluoride absorbed from the soil. Ruan *et al.*[37] observed a higher concentration of fluoride on mature leaves than on young leaves and considered plant maturity how being the main determinant for fluoride concentration. Fluoride concentration can also range according with this ion concentration on the water utilized on ready to drink tea manufacture[38]. Fluoride presence is important on remineralization process to form fluorapatite which has lower solubility than hydroxyapatite.[14] On the other hand, teas can be a systemic source of fluoride. The frequent consumption of tea with high concentration of fluoride by children could contribute to an increase of dental fluorosis[19].

On dental enamel the superficial hardness loss founded in the present study agree with previous studies of Lussi *et al.*[22] e Phelan *et al.*[30]. Lussi *et al.*[22] realized an *in vitro* study with human premolars and analyzed the change on enamel superficial hardness after challenge with many dietary substances and medications, between them the ready to drink tea. Significant superficial hardness loss for commercial ready to drink tea was observed. However the superficial hardness loss observed by the authors was less than in present study which is probably due to superior number of erosive challenge performed in the present study. Phelan *et al.*[30] performed an *in vitro* study with human tooth and measured the enamel amount removed after 1 hour immersion in herbal teas, including ready to drink tea. Ready to drink obtained high levels of erosion and this is probably a reflex of high citric and ascorbic acid content on this beverage.

On dentin was observed high superficial hardness loss. This data couldn't be compared due to absence of ready to drink tea erosion studies on radicular dentin. The study *in vitro* of Canappele *et al.*[39] observed radicular dentin erosion when submitted to erosive challenge with white wine, sport drink, soft drink, orange juice and energy drink. The present study is pioneer on this analysis that has high relevance due to high prevalence of gum recession in adults[40]. Gum recession is characterized by the displacement of the marginal gum on the apical way of cementoenamel junction leading to tooth root exposure[41]. With root exposure, the cementum could be easily lost leading to root dentin exposure and increasing the risk of erosive lesions.

In the present study, despite the high concentrations of phosphate and fluoride in commercial ready to drink tea there was a significant superficial hardness loss by high titratatble acidity value and low pH value and calcium concentration showing the importance of those factors to determinate the erosive potential. Furthermore, the acid type present on the beverage is very relevant, the citric and phosphoric acid beyond having hydrogen atoms, they have acid anions which bind with calcium and remove them from the surface[14].

Among relevant biological factors to tooth erosion stands out the saliva because it has characteristics like buffer capacity, oversaturation on relation to tooth minerals, acquired pellicle[42]. Acquired pellicle works as a diffusion barrier, protecting the tooth surface from acid attacks[14]. So for erosive effect study is essential that saliva is included. A limitation of the present study was to not form acquired pellicle before the erosive challenge.

Mineral water was used as control because it is beverage with neutral pH value then was not expected that would cause any erosive effect, however on both enamel and dentin was observed a superficial hardness loss around 17%. Lussi *et al.* and Parry *et al.* studies[22,43] evaluated erosive potential of mineral waters and observed an insignificant erosive effect, in Parry *et al.* study[43] there were brands that had non-detectable dissolution. In the present study, the superficial hardness loss observed could be result from composition of the analyzed mineral water which could be subsaturated in relation to hydroxiapatite. Another hypothesis could be the insufficient number of changes of the artificial saliva solution which on the present study was once a day.

The reason for the Black tea zero lemon flavor of Matte Leão have been chosen was because it is a very popular commercial ready to drink tea in Brazil. However is a limitation of the study just analyzed one commercial brand of ready to drink in a way that results need be analyzed with caution, but with clinical relevance once represents commercial presentation of ready to drink tea. The commercial ready to drink tea analyzed showed erosive potential in enamel and dentin, however those results should not been extrapolated completely to others commercial brands of ready to drink tea. Others studies are been conducted with more commercial brands of ready to drink and brewed tea to verify their erosive potential.

In conclusion, the commercial ready to drink tea analyzed in the present study showed erosive potential on enamel and dentin.

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4 CONSIDERAÇÕES FINAIS

a) A erosão pode afetar indivíduos de todas as idades tendo um efeito cumulativo ao longo da vida.
b) O chá é considerado uma bebida saudável, todavia o processo de industrialização acaba por produzir efeito deletério no chá comercial pronto para beber devido à adição de produtos químicos dentre eles os acidulantes.
c) Os chás prontos para beber apresentam valores de pH e titrabilidade sugestivos de possuírem efeito erosivo sobre os tecidos dentários mineralizados em relação aos chás de saquinho.
d) O chá comercial pronto para beber apresenta características químicas que o tornam erosivo tanto para esmalte quanto para dentina. Portanto não é recomendado o consumo frequente deste tipo de bebida.
e) Sugere-se que mais estudos sejam realizados com outras marcas comerciais de chás prontos para beber e chás de saquinho.

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APÊNDICE- TERMO DE DOAÇÃO

TERMO DE DOAÇÃO DE MATERIAL BIOLÓGICO
Avaliação do potencial erosivo de chás prontos para beber sobre o esmalte e dentina humanos

Pesquisadora responsável: Profa.Dra Lina Naomi Hashizume
Telefones para contato: (51) 3308-5193

A erosão dental está relacionada com os efeitos físicos de uma perda localizada, crônica e patológica de tecido mineral dentário, removido quimicamente por meio de ácidos, muitos deles presentes em bebidas de nossa dieta.

Objetivo do estudo: Avaliar o potencial erosivo de chás prontos para beber sobre o esmalte e dentina humanos.

Procedimento: Serão coletados dentes permanentes que foram extraídos por motivos terapêuticos e foram doados pelos pacientes ou responsáveis. Os dentes doados farão parte de um estudo sobre a avaliação de chás prontos para beber como fator causador de erosão dentária.

Acompanhamento e assistência: o doador do dente estará em atendimento na Faculdade de Odontologia e será acompanhado durante o pós-operatório.

Sigilo: Todas as informações obtidas neste estudo poderão ser publicadas com finalidade científica, sem divulgação dos nomes das pessoas envolvidas.

Consentimento: Declaro ter lido e compreendido integralmente as informações acima antes de assinar este termo, não restando dúvidas quanto ao conteúdo deste documento. Assim, livre de qualquer forma de constrangimento e/ou coação faço a doação de meu dente ou de meu filho, em casos de menores de idade, neste estudo.

Nome do Participante:____

Assinatura do participante ou responsável:______________________________

Assinatura da Pesquisadora:___________________________________

Data:__________________