Research, Society and Development, v. 9, n. 11, e44191110004, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i11.10004

Analysis of the potential for dental wear of acidic diet: Literature review

Análise do potencial de desgaste dentário de dieta ácida: Revisão de literatura

Análisis del potencial de desgaste dental de una dieta ácida: Revisión de la literatura

Received: 11/06/2020 | Reviewed: 11/09/2020 | Accept: 11/16/2020 | Published: 11/21/2020

Ana Laura Rezende Vilela
ORCID: https://orcid.org/0000-0002-1020-8273
Federal University of Uberlândia. Brazil
E-mail: analaurarvilela@ufu.br
Alexandre Coelho Machado
ORCID: https://orcid.org/0000-0003-0160-5688
Federal University of Uberlândia. Brazil
E-mail: alexandrecoelhomachado@ufu.br
Sofia de Oliveira Rangel
ORCID: https://orcid.org/0000-0002-2485-8592
Catholic University of Brasilia. Brazil
E-mail: sofiarangel0203@gmail.com
Gabriela Resende Allig
ORCID: https://orcid.org/0000-0002-4881-7162
Federal University of Uberlândia. Brazil
E-mail: alliggabriela@gmail.com
Paola Gomes Souza
ORCID: https://orcid.org/0000-0002-3544-1223
University of São Paulo. Brazil
E-mail: paolagomessouza@gmail.com
Bruno Rodrigueis Reis
ORCID: https://orcid.org/0000-0002-3394-0010
Federal University of Uberlândia. Brazil
E-mail: reisbrunor@gmail.com
Paulo Vinicius Soares
ORCID: https://orcid.org/0000-0001-7071-826X
Federal University of Uberlândia. Brazil
E-mail: paulovsoares@yahoo.com.br

Murilo de Sousa Menezes

ORCID: http://orcid.org/0000-0001-5912-310X

Federal University of Uberlândia. Brazil

E-mail: murilomenezes@ufu.br

Abstract

Objective: The aim of this study was to perform an acid wear properties review (pH, entitlement and buffering effect) of diets that can influence dental and restorative aging. Methodology: Manuscripts from the Pubmed database were collected. The search terms were: “Dental erosion”, “Erosion”, “Food habits”, “acidity”, “tooth enamel solubility”, “carbonated drinks”, “hydroxyapatite” and “alcoholic beverage consumption” between the years of 1995 and 2020. Result: 755 manuscripts were initially obtained, but after analyzing the inclusion and exclusion criteria, 15 manuscripts were selected at the end. After analyzing the 15 manuscripts included in the literature review, the results of the study showed that most of the diets evaluated had a pH lower than 5.5, except for coffee and mineral water. The soft drinks and Kombucha had lower pH values and therefore more corrosive potential. Conclusion: Based on the results of this study, it may be concluded that most of the diets evaluated present a corrosive potential for dental structure and restorative materials.

Keywords: Erosion; Acids; Tooth erosion; Composite resins.

Resumo

Objetivo: O objetivo deste trabalho foi realizar uma revisão sobre as propriedades de desgate ácido (pH, titularidade e efeito tamponante) de vários alimentos que podem influenciar no envelhecimento dentário e restaurador. Metodologia: Foram coletados artigos oriundos da base de dados Pubmed. Os termos de busca foram: “Erosão dentária”, “Erosão”, “Hábitos alimentares”, “acidez”, “solubilidade do esmalte dentário”, “bebidas gasificadas”, “hidroxiapatita” e “consumo de bebidas alcoólicas” Resultado: . Foram obtidos inicialmente 755 artigos mas após as análises dos critérios de inclusão e exclusão foram selecionados ao final 15 artigos. Após a análise dos 15 artigos incluidos na revisão de literatura, os resultados do estudo apontaram que a maioria das bebidas avaliadas apresentaram pH menor do que 5.5, exceto para café e água mineiral. Os refrigerantes e Kombucha apresentaram menores valores de pH e com isso maior potencial corrosivo. Conclusão: Podemos concluir que a maioria dos alimentos avaliados possuem potencial corrosivo a estrutura dentária e aos materiais restauradores.

Palavras-chave: Erosão; Ácidos; Erosão dentária; Resinas compostas.

Resumen

Objetivo: El objetivo de este trabajo fue realizar una revisión de las propiedades potencial de desgaste ácido (pH, derecho y efecto amortiguador) de varios alimentos que pueden influir en el envejecimiento dental y restaurador. Metodología: Se recolectaron artículos de la base de datos Pubmed. Los términos de búsqueda fueron: "Erosión dental", "Erosión", "Hábitos alimentarios", "acidez", "solubilidad del esmalte dental", "bebidas carbonatadas", "hidroxiapatita" y "consumo de bebidas alcohólicas" entre los años de 1995 y 2020. Resultado: Se obtuvieron inicialmente 755 artículos, pero luego de analizar los criterios de inclusión y exclusión, se seleccionaron 15 artículos al final. Luego de analizar los 15 artículos incluidos en la revisión de la literatura, los resultados del estudio mostraron que la mayoría de las bebidas evaluadas tenían un pH menor a 5.5, a excepción del café y el agua mineral. Los refrescos y la Kombucha tenían valores de pH más bajos y por lo tanto más poder corrosivo. Conclusión: Podemos concluir que la mayoría de los alimentos evaluados tienen potencial de corrosivo de la estructura dental y los materiales restauradores.

Palabras clave: Erosion; Ácidos; Erosión de los dientes; Resinas compuestas.

1. Introduction

Acid foods are part of routine diet of most people nowadays. They are included on healthy and unhealthy diet. That is because most of the fruits, healthy and unhealthy snacks, carbonated drinks, energy drinks, syrups, wine, sweets, candies and lots of other foods that are part of people's meal have low pH (Aidi, Bronkhorst, Huysmans, & Truin, 2011; Gurgel, Rios, de Oliveira, Tessarolli, Carvalho & Machado, 2011; Jensdottir, Nauntofte, Buchwald, & Bardow, 2005; Okunseri, Okunseri, Gonzalez, Visotcky, & Szabo, 2011). Regardless of lifestyle, people are consuming more foods with low pH than higher pH such as milk (Salas, Vargas-Ferreira, Tarquinio, Huysmans & Demarco, 2015). This behavior generates consequences for people's body including oral health (Bartlett, Lussi, West, Bouchard, Sanz & Bourgeois, 2013; O'Toole, Bernabe, Moazzez, & Bartlett, 2017).

Frequent and prolonged contact of teeth or restorative materials with acidic foods promote erosion or biocorrosion. This is a complex process that happens in a chemical reaction and the potential of acids aggression for the teeth depends on some chemical properties of these food (Shellis, Featherstone, & Lussi, 2014). Properties as the analysis of

(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i11.10004

pH shows the amount of H^+ released during the chemical reaction (Grippo, Simring, & Coleman, 2012). Also, another characteristic that helps to understand the potential of aggression is pKa because it is related to the ability that some substance to release the H^+ ions by measuring the pH when 50% of substance is dissociated (Shellis et al., 2014). Moreover, it is important to understand titration to determine the time that acids take to be buffered when it reacts with titrating substances (Grippo et al., 2012).

All those properties are related to the surface degradation caused by biocorrosion and it can be the reason for appearance of non-carious cervical lesions (NCCL), dentin hypersensitivity (DH) and tooth wear. However, they are not caused by isolated factors (Teixeira, Zeola, Machado, Gomes, Souza, Mendes & Soares et al., 2018). There are factors such as stress and friction that have a complex interaction between them causing these lesions. During the diagnosis is important to consider all modifying and etiologic factors to initiate the treatment and determinate the correct diagnosis (Grippo et al., 2012). Some factors act more intensely according to different lifestyle and some of them affect more than others (Peumans, Politano, & Van Meerbeek, 2020).

Biocorrosion is one of the most intense potential to development of DH and NCCL and it has a mechanism of degradation that involves chemical reactions between acid contained on food sources and mineral tissues (Shellis et al., 2014). Thus, the ions H^+ are liberated from these foods when they are on an aqueous solution and they react with hydroxyapatite molecules contained on enamel and dentin. The H^+ ions react mainly with OH^- and PO_4^{3-}. Thereby, it breaks down the hydroxyapatite molecule, consequently the mineral crystals and degraded it (Shellis et al., 2014).

Resin-based composites (RBC) are also affected by acid foods and beverage. The surface degradation of restorations cause discoloration, increase surface roughness and decrease surface microhardness (Silva, Sales, Pucci, Borges, & Torres, 2017; Tanthanuch, Kukiattrakoon, Eiam, Pokawattana, Pamanee, Thongkamkaew & Kochatung, 2018). The reason why all these changes happen is that the acidity increases in dissolving and soften the polymer matrix. Thus, filler particles are dislodged resulting a decrease in the load resistance and worsen physical and mechanical properties of RBC (Santos, Clarke, Braden, Guitian, & Davy, 2002). Therefore, the aim of this study is to understand and evaluate the impact of pH and the titration of acidic foods for the appearance of non-carious lesions and degradation of tooth surface and restorative materials.

The objective of this study was to perform a biocorrosion properties review (Potential of Hydrogen- pH, Titratable acid and buffer effect) of various foods that can influence dental and restorative aging.

2. Methodology

This is an integrative review carried out through the following steps: establishing the research question, searching the literature, extracting and organizing information, evaluating the included studies, interpreting the results and presenting the review (Souza, Silva & Carvalho, 2010). The review was conducted to answer the following research question: What are the biocorrosive potential of foods present in the population's diet? The search for the manuscripts was carried out in June 2020 in the PubMed / MEDLINE database consulted in the Health Science Descriptors (DeCS): “tooth erosion”, “erosion”, “feeding behavior”, “acidity”, “Dental Enamel Solubility”, “Carbonated Beverages”, “Hydroxyapatites”, “alcoholic beverages”; “dentistry”, “tooth” and “dental wear”.

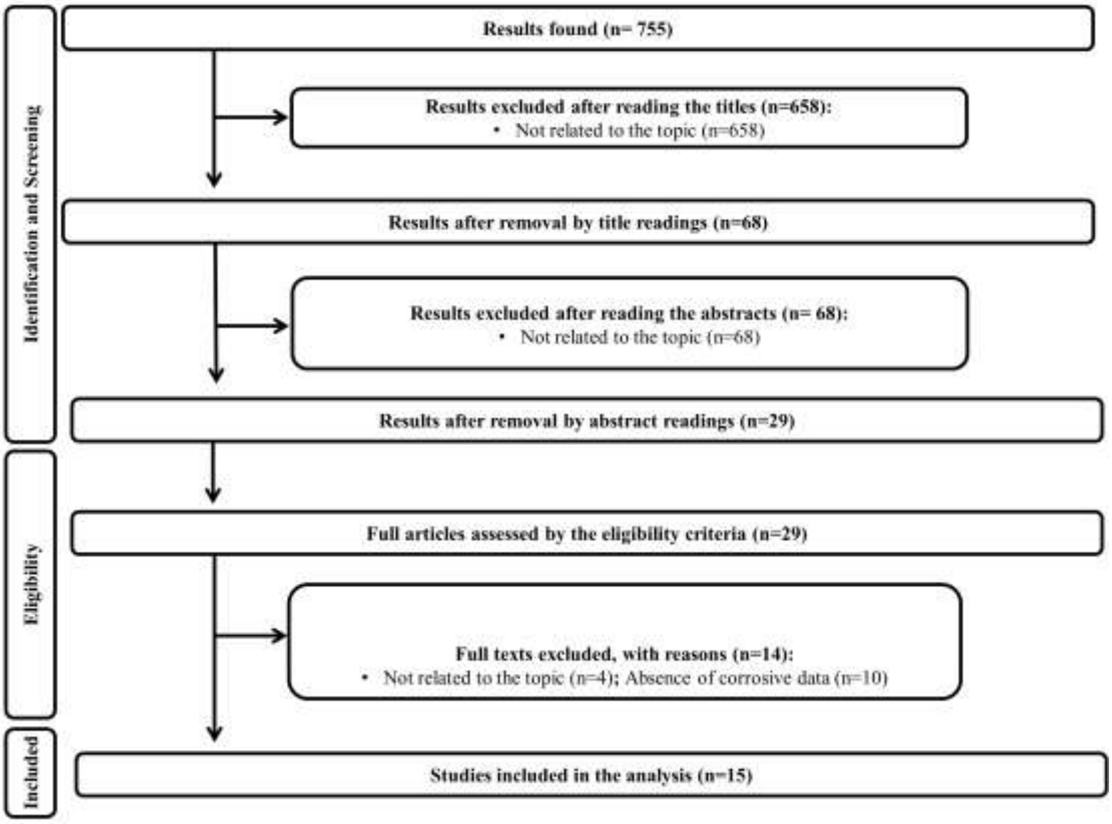
The Inclusion criteria were: English manuscripts that performed experimental design in laboratory (in vitro) and observational studies that included information about dental biocorrosion/erosion and acidic diet. The exclusion criterion was: manuscripts that did not analyze the effects of the dental wear and acidic diet components. Initially, the individual search for descriptors was carried out, and then crossings were carried out in pairs or trios, interconnected by the Boolean operator *and*. After this stage, the titles and abstracts of the selected studies were thoroughly read.

3. Literature Review and Results

The literature review sought a total of 755. After excluding manuscripts by title (658) and abstract (68), the search resulted in a total of 29 manuscripts but had some requirements assessed in which it restricted the number of manuscripts to 15. On these 15 manuscripts, there are information about foods and beverage pH, titratable acid and buffer effect on different experimental tests (Figure 1). The pH, titratable acid and buffer effect are described in tables 1 (alcoholic beverages); 2 (energy and sport drinks); 3 (coffee and tea); 4 (mineral water and sparkling water); 5 (milk products, fruit and miscellaneous); 6 (soft drinks); 7 (fruit juices) and 8 (Kombucha tea with 14 days of fermentation).

(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i11.10004

Figure 1. Flowchart of the articles selected in the database.



Source: Authors.

Table 1. Values of pH, acid titratable, buffering capacity and alcohol content of alcoholic beverages.

Alcoholic beverages		**Potential of hydrogen**	**Titratable Acid**			**Buffer effect**			**ABV**
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol /l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**	**%**
Beer	Antárctica (Nogueira, Souza & Nicolau, 2000)	3.92	9.15*	-	-	-	-	-	-
	Bavária (Nogueira et al., 2000)	4.63	6.40*	-	-	-	-	-	-
	Brahma (Nogueira et al., 2000; Zanatta, Esper, Valera, Melo & Bresciani, 2016)	3.87	9.15*	-	-	-	-	-	-
		4.34	-	-	-	-	-	-	4.8
	Mean of Brahma	4.10	-	-	-	-	-	-	4.8
	Budweiser (Seow & Thong, 2005; Zanatta et al., 2016)	4.26	-	-	-	-	-	-	5.0
		3.90	-	-	-	-	-	-	_
	Mean of Budweiser	8.08	-	-	-	-	-	-	5.0
	Carlsberg (Lussi et al., 2004; Lussi et al., 2012; Seow & Thong, 2005)	3.90	-	-	-	-	-	-	-
		4.40	-	9.6	40.0	-	-	-	-
		4.20	-	-	-	17.5	8.3		5.0
	Mean of Carlsberg	4.16	-	9.6	40.0	17.5	8.3	-	-
	Corona (Lussi et al., 2004)	4.20	-	4.6	8.2			-	-
	Heineken (MA et al., 2016; Nogueira et al., 2000; Seow & Thong, 2005; Zanatta et al., 2016)	4.80	7.20*	-	-	-	-	-	-
		4.10	-	-	-	-	-	-	5.0
		4.35	-	-	-	-	-	-	5.0
		3.80	-	-	-	-	-	-	
	Mean of Heineken	4.26	7.20						5.0
	Kaiser (Nogueira, et al., 2000)	4.45	7.20*	-	-	-	-	-	-
	Schincariol (Nogueira, et al., 2000)	3.79	9.02*	-	-	-	-	-	-
	Skol (Nogueira, et al., 2000)	4.11	9.52*	-	-	-	-	-	-
Mean of beer		**4.17**	**8.23**	**7.1**	**24.1**	**17.5**	**8.3**	**--**	**4.96**

Red Wine	Collivo (Lussi et al., 2012)	3.43	-	-	76.0	-	-	-	13.0
	Montagne (Lussi et al., 2012)	3.68	-	-	63.0	-	-	-	11.7
	Not specified (Lussi et al., 2004)	3.40	-	66.4	-	-	-	-	-
Mean of red wine		**3.50**	**-**	**66.4**	**69.5**	**-**	**-**	**-**	**12.3**
White Wine	La côte (Lussi et al., 2012)	3.60	-	-	-	-	-	-	12.1
	Not specified (Lussi et al., 2004)	3.7	-	44.0	70.0	-	-	-	-
Mean of white wine		**3.65**	**-**	**44.0**	**70.0**	**-**	**-**	**-**	**12.1**
Vodka	Absolut (MA et al., 2016)	7.0	-	-	-	-	-	-	40.0
Vodka with flavor	Smirnoff ice lemon flavour (Lussi et al., 2012)	3.07	-	-	50.0	-	-	-	40.0
Champagne	Freixenet (Lussi et al., 2012)	2.99	-	-	78.0	-	-	-	12.0
Whisky	Red Label (MA et al., 2016)	3.76	-	-	-	-	-	-	40.0

*The amount of base needed to raise the pH to 7.
▲ The buffering capacity at the pH value of the product.
Source: Authors.

Table 2. Values of pH, acid titratable and buffering capacity of energy and sport drinks.

ENERGY AND SPORT DRINKS		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Energy Drink	Red Bull (Carvalho, Schmid, Baumann, & Lussi, 2017; Kitchens & Owens, 2007; Lussi & Carvalho, 2015; Lussi et al., 2004; Lussi et al., 2012; Seow & Thong, 2005)	3.10	-	-	-	-	-	-
		3.4	-	73.2	91.6	-	-	-
		3.30	-	-	98.0	45.5	-	-
		3.24	51.9	-	-	-	-	-
		3.35	-	67.76	-	-	-	-
		3.35	-	67.76	-	-	-	-
	Mean of Red Bull	3.29	51.9	69.57	94.8	45.5	-	-
	Monster (Carvalho et al., 2017; Lussi et al., 2015)	3.35	-	62.39	-	-	-	-
		3.35	-	62.39	-	-	-	-
	Mean of monster	3.35	-	62.39	-	-	-	-
Mean of energy drinks		**3.30**	**51.9**	**66.7**	**94.8**	**45.5**	**-**	**-**
Sport Drink	Gatorade (Lussi et al., 2015; Lussi et al., 2012; Seow et al., 2005)	2.90	-	-	-	-	-	-
		3.17	-	-	46.0	21.8	-	-
		2.89	-	37.38	-	-	-	-
	Mean of Gatorade	2.98	-	37.38	46.0	21.8	-	-
	Gatorade flavour lemon lime (Cochrane et al., 2012; Kitchens et al., 2007)	3.28	-	30.82	48.57	-	-	-
		2.93	14.8	-	-	-	-	-
	Mean of Gatorade flavour lemon lime	3.10	14.8	30.82	48.57	-	-	-
	Powerade (Lussi et al., 2012; Seow & Thong, 2005)	3.10	-	-	-	-	-	-
		3.74	-	-	43.0	18.0	-	-
	Mean of Powerade	3.42	-	-	43.0	18.0	-	-
	Powerade flavour blackcurrant (Cochrane et al., 2012)	3.24	-	24.15	35.81	-	-	-
Mean of Sport drinks		**3.15**	**14.8**	**30.78**	**43.34**	**19.9**	**-**	**-**

▲ The buffering capacity at the pH value of the product.
Source: Authors.

Research, Society and Development, v. 9, n. 11, e44191110004, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i11.10004

Table 3. Values of pH, acid titratable and buffering capacity of coffee and tea.

COFFE AND TEA		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Coffee	Expresso brewed Vict. coffe (Seow & Thong, 2005)	5.6	-	-	-	-	-	-
	Espresso nestlé (Lussi et al., 2012)	5.82	-	-	3.0	-	-	-
	Starbucks frapuccino coffee (Kitchens et al., 2007)	6.59	4.73	-	-	-	-	-
Mean of Coffee		**6.00**	**4.73**	**-**	**3.0**	**-**	**-**	**-**
Tea	Lipton´s (Seow & Thong, 2005)	6.80	-	-	-	-	-	-
	Ice tea (Lussi & Carvalho, 2015; Lussi et al., 2004)	3.0	-	18.4	26.4	-	-	-
		2.43	-	24.36	-	-	-	-
	Mean of Ice tea	2.71	-	21.38	26.4	-	-	-
	Ice tea classic (Lussi et al., 2012)	2.94	-	-	26.50	15.0	-	-
	Lipton Ice Tea lemon (Lussi et al., 2012; Phelan & Rees, 2003)	3.03	-	-	24.0	9.4	-	-
		3.26	60.3*	-	-	-	-	-
	Mean of Lipton Ice tea lemon	3.14	60.3	-	24.0	9.4	-	-
	Lipton ice tea peach (Lussi & Carvalho, 2015; Lussi et al., 2012)	2.94	-	-	21.5	8.5	-	-
		2.65	-	25.15	-	-	-	-
	Mean of lipton Ice tea peach	2.79	-	25.15	21.5	8.5	-	-
	Black tea (Lussi et al., 2012)	6.59	-	-	1.5	-	-	-
	Lipton wild berries (Lussi et al., 2012)	6.78	-	-	1.0	-	-	-
	Camomile (Phelan & Rees, 2003)	7.08	-	-	-	-	-	-
	Traditional lemon (Phelan & Rees, 2003)	3.69	19.86*	-	-	-	-	-
Mean of tea		**4.26**	**40.08**	**22.63**	**16.81**	**10.96**	**-**	**-**

*The amount of base needed to raise the pH to 7.
▲ The buffering capacity at the pH value of the product.
Source: Authors.

Table 4. Values of pH, acid titratable and buffering capacity of mineral water and sparkling water.

MINERAL WATER AND SPARKLING WATER		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Mineral water	Henniez (Lussi et al., 2012)	7.68	-	-	-	2.0	-	-
	Valser (Carvalho et al., 2017; Lussi & Carvalho, 2015; Lussi et al., 2012)	5.63	-	-	12.5	10.9	-	-
		6.70	-	-	-	-	-	-
		6.53	-	-	-	-	-	-
	Mean of Valser	5.95	-	-	-	-	-	-
Mean of mineral water		**6.63**	**-**	**-**	**12.5**	**6.45**	**-**	**-**
Mineral water with flavour	Valser lemon flavour (Lussi et al., 2012)	3.51	-	-	40.0	21.1	-	-
	(Not specified) lemon flavour (Jensdottir, Bardow, et al., 2005)	4.17	-	0.54	1.54	-	-	-
	Valser lemon and herbs (Carvalho et al., 2017)	3.31	-	30.0	-	-	-	-
Mean of mineral water with flavour		**3.66**	**-**	**15.27**	**20.77**	**21.1**	**-**	**-**
Sparkling water	(Not specified) Mineral water sparklet (Lussi et al., 2004)	5.3	-	1.6	24.0	-	-	-
Sparkling water with flavour	(Not specified) Lemon and lime flavour (Brown et al., 2007)	2.74	0.663*	-	-	-	-	-
	(Not specified) Peach flavour (Brown et al., 2007)	2.83	0.518*	-	-	-	-	-
	(Not specified) Grapefruit flavour (Brown et al., 2007)	2.74	0.597*	-	-	-	-	-
	(Not specified) Apple and cherry (Brown et al., 2007)	3.03	0.511*	-	-	-	-	-
	(Not specified) Orange and mango (Brown et al., 2007)	2.97	0.497*	-	-	-	-	-
Mean of sparkling water with flavour		**2.86**	**0.557**	**-**	**-**	**-**	**-**	**-**

* The amount of base needed to raise the pH to 7.
▲ The buffering capacity at the pH value of the product.

Source: Authors.

Table 5. Values of pH, acid titratable and buffering capacity of milk products, fruit and miscellaneous.

MILK PRODUCTS, FRUIT AND MISCELLANEOUS		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Milk	Not specified (Lussi et al., 2004)	6.7	-	-	4.0	-	-	-
Drinking Whey	Not specified (Lussi et al., 2004)	4.7	-	12.0	32.0	-	-	-
Yogurt nature	Not specified (Lussi et al., 2012)	3.91	-	-	120.0	-	-	-
Yoghurt with flavour	Not specified Forest berries flavor (Lussi & Carvalho, 2015)	4.13	-	62.86	-	-	-	-
Milk derived lactic acid	Not specified (Jensdottir, Bardow, et al., 2005)	3.46	-	8.40	10.33	-	-	-
Kiwi	Not specified (Lussi & Carvalho, 2015; Lussi et al., 2012)	3.25	-	-	206.5	-	-	-
		3.24	-	159.81	-	-	-	-
	Mean of kiwi	3.24	-	159.81	206.5	-	-	-
Orange	Not specified (Lussi & Carvalho, 2015; Lussi et al., 2012)	3.60	-	-	113.0	-	-	-
		3.93	-	71.93	-	-	-	-
	Mean of orange	3.76	-	71.93	113.0	-	-	-
Vinegar	Not specified (Lussi et al., 2004)	3.2	-	648.4	740.8	-	-	-

▲ The buffering capacity at the pH value of the product.
Source: Authors.

Table 6. Values of pH, acid titratable and buffering capacity of soft drinks.

SOFT DRINKS		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Cola	Coca-Cola (Carvalho et al., 2017; Cochrane et al., 2012; Jensdottir, Bardow, et al., 2005; Kitchens et al., 2007; Larsen & Nyvad, 1999; Lussi & Carvalho, 2015; Lussi et al., 2004; Lussi et al., 2012; Seow & Thong, 2005; Zanatta et al.,	2.36	-	-	-	-	-	-
		2.30	-	-	-	-	-	-
		2.60	-	14.0	34.0	-	-	-
		2.45	-	-	17.5	9.6	-	-
		2.45	-	8.25	23.36	-	-	-
		2.49	18.3	-	-	-	-	-
		2.55	-	9.32	-	-	-	-
		2.55	-	9.32	-	-	-	-
		2.59	-	0.76	2.31	-	-	-
		2.40	-	-	-	-	9	25

	2016)							
	Mean of Coca-Cola	2.47	18.3	8.33	19.29	9.6	9	25
	Coca-Cola Light (Lussi et al., 2012)	2.60	-	-	19.0	7.3	-	-
	Pepsi (Larsen & Nyvad, 1999; Lussi & Carvalho, 2015; Lussi et al., 2012; Seow & Thong, 2005)	2.30	-	-	-	-	-	-
		2.39	-	-	19.0	11.7	-	-
		2.51	-	8.30	-	-	-	-
		2.53	-	-	-	-	8	18
	Mean of Pepsi	2.43	-	8.30	19.0	11.7	8	18
	Pepsi Light (Lussi et al., 2004; Lussi et al., 2012)	3.10	-	9.6	34.6	-	-	-
		2.77	-	-	15.0	7.4	-	-
	Mean of Pepsi Light	2.93	-	9.6	24.8	7.4	-	-
	Diet Coke (Kitchens et al., 2007)	3.12	20.1	-	-	-	-	-
Mean of Cola soft drinks		**2.55**	**19.2**	**8.50**	**20.59**	**9**	**8.5**	**10**
Orange	Fanta (Larsen & Nyvad, 1999; Lussi & Carvalho, 2015; Lussi et al., 2004; Lussi et al., 2012)	2.90	-	40.0	83.6	-	-	-
		2.67	-	-	52.5	-	-	-
		2.59	-	36.19	-	-	-	-
		2.86	-	-	-	-	32	51
	Mean of Fanta	2.75	-	38.09	68.05	-	32	51
Tonic	Schweppes (Lussi et al., 2004)	2.50	-	51.0	88.6	-	-	-
	Schweppes Indian (Larsen & Nyvad, 1999)	2.48	-	-	-	-	47	68
	Sprite (Lussi et al., 2012)	2.54	-	-	39.0	-	-	-
	Sprite light (Larsen & Nyvad, 1999; Lussi et al., 2004)	2.90	-	30.0	62.0	-	-	-
		2.98	-	-	-	-	16	31
	Mean of Sprite light	2.94	-	30.0	62.0	-	16	31
Mean of tonic soft drink		**2.68**	**-**	**40.50**	**63.2**	**-**	**31.5**	**49.5**
Tonic with flavour	Sprite Flavour lemon (Lussi & Carvalho, 2015)	2.57	-	31.56	-	-	-	-
	Schweppes dry grape (Larsen & Nyvad, 1999)	2.76	-	-	-	-	47	66
Mean of tonic soft drink with flavour		**2.66**	**-**	**31.56**	**-**	**-**	**47**	**66**

Guaraná	Antártica (Lussi & Carvalho, 2015)	2.62	-	15.55	-	-	-	-

▲ The buffering capacity at the pH value of the product.
Source: Authors.

Table 7. Values of pH, acid titratable and buffering capacity of fruit juices.

FRUIT JUICES		**POTENTIAL OF HYDROGEN**	**TITRATABLE ACID**			**BUFFER EFFECT**		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Apple	Not specified (Jensdottir, Bardow, et al., 2005; Lussi et al., 2004; Seow & Thong, 2005)	3.60	-	-	-	-	-	-
		3.40	-	70.0	82.0	-	-	-
		3.59	-	2.43	2.79	-	-	-
	Mean of not specified apple juice	3.53	-	36.21	42.39	-	-	-
	Ramseier (Carvalho et al., 2017; Lussi & Carvalho, 2015; Lussi et al., 2012)	3.41	-	-	72.0	-	-	-
		3.24	-	70.30	-	-	-	-
		3.24	-	70.30	-	-	-	-
	Mean of Ramseier	3.29	-	70.30	72.0	-	-	-
Mean of apple juice		**3.41**	**-**	**53.25**	**52.26**	**-**	**-**	**-**
Orange	Not specified (Jensdottir, Bardow, et al., 2005; Lussi et al., 2004; Lussi et al., 2012; Seow & Thong, 2005)	3.70	-	-	-	-	-	-
		3.70	-	82.4	109.4	-	-	-
		3.74	-	-	108.0	-	-	-
		3.83	-	3.75	5.05	-	-	-
	Mean of not specified orange juice	3.74	-	43.07	74.15	-	-	-
	Hohes C (Carvalho et al., 2017; Lussi & Carvalho, 2015; Lussi et al., 2012)	3.56	-	-	121.0	-	-	-
		3.56	-	83.56	-	-	-	-
		3.63	-	83.56	-	-	-	-
	Mean of Hohes C	3.58	-	83.56	121.0	-	-	-
Mean of orange juice		**3.67**	**-**	**63.31**	**85.86**	**-**	**-**	**-**
Grape	Not specified (Jensdottir, Bardow, et al., 2005; Lussi et al., 2004; Lussi et al., 2012)	3.2	-	185.0	218.0	-	-	-
		3.15	-	-	168.5	-	-	-
		3.36	-	5.92	7.73	-	-	-
	Mean of not	3.23	-	95.46	131.41	-	-	-

	specified grape juice							

▲ The buffering capacity at the pH value of the product. Source: Authors.

Table 8. Values of pH, acid titratable and buffering capacity of Kombucha tea with 14 days of fermentation.

KOMBUCHA TEA		POTENTIAL OF HYDROGEN	TITRATABLE ACID			BUFFER EFFECT		
TYPE	**BRAND**	**pH**	**NaOH 0.1 N (ml)**	**mmol/l OH – to pH 5.5**	**mmol/l OH to pH 7.0**	**b (mmol/l X pH)▲**	**mmol/l to pH 5.5**	**mmol/l to pH 7.0**
Green tea Kombucha	Not specified (Jakubczyk, Kaldunska, Kochman, & Janda, 2020)	2.49	-	-	-	-	-	-
Black tea Kombucha	Not specified (Jakubczyk et al., 2020)	2.53	-	-	-	-	-	-
White tea Kombucha	Not specified (Jakubczyk et al., 2020)	2.37	-	-	-	-	-	-
Red tea Kombucha	Not specified (Jakubczyk et al., 2020)	2.32	-	-	-	-	-	-
Mean of Kombucha tea		2.42	-	-	-	-	-	-

▲ The buffering capacity at the pH value of the product.
Source: Authors.

4. Discussion

The extrinsic factor that can influence dental corrosion include the consumption of acidity foods and beverages (MA et al., 2016; Nogueira et al., 2000; Zanatta, Esper, Valera, Melo, & Bresciani, 2016). This biocorrosion can be related to pH of those foods and beverages since the critical pH for enamel dissolution is 5.5. Below this value the degree of minerals saturation contain in the saliva is not enough to control mineral loss (Lussi, Jaeggi, & Zero, 2004; Lussi, Megert, Shellis, & Wang, 2012; Seow & Thong, 2005). A healthy tooth surface is composed mainly of hydroxyapatite which are calcium phosphate crystals. When this element is immersed in a solution which has a low pH the hydroxyapatite ions dissolve and then re-associate with ions H^+ from the medium. This exchange occurs in a state of equilibrium between the substances (Shellis et al., 2014). However, this ions loss collaborates to demineralization of tooth and consequently favor biocorrosion (Lussi et al., 2004; Lussi et al., 2012; Seow & Thong, 2005). Another factor that influence on teeth acid wear is the degree of dissociation of acid. This happens due to the existence of variation between solutions and the fact that it is not all acid that dissociates completely. The pkA constant indicates this degree of dissociation of acid and this is another important value to be considered (Lussi et al., 2004; Shellis et al., 2014). Therefore, the amount of H+ ions present in the solution leads to a lower or moderate pH and consequently influences the corrosive potential. Not only the pH but other factors that are still to be discussed contribute to this potential (Cochrane et al., 2012). This behavior can explain the reasons to beverages such as citric juices, soft drinks kombucha, guarana soft drinks, tonics, flavored sparkling water and some teas are potentially harmful as it is seen on tables.

Other properties that are related to the corrosive potential of foods and beverages are buffering capacity and titratable acidity (Lussi et al., 2012; Zero, 1996). Buffering is the ability of a product not to vary or to vary its pH not too much in a given situation(Shellis et al., 2014). The better the buffering capacity of a solution, the longer it will take for the pH to be neutralized by saliva. Thus, the dissolution of the minerals surface in the tooth will take longer to crease, increasing the biocorrosive potential (Barbour, Parker, Allen, & Jandt, 2003; Lussi, Jaeggi, & Jaeggi-Scharer, 1995; Lussi et al., 2012; Zero, 1996). The buffering capacity can change according to the acid and pH of the solution. However, it is important to consider that factors such as volume and contact time to tooth surface with the solution directly influence the buffering effect (Larsen & Nyvad, 1999; Shellis, Barbour, Jones, & Addy, 2010; Shellis et al., 2014).

In addition, titratable acidity is an important property to be analyzed. It is related with the concentration of undissociated acids in the solution and this factor plays an important role on dental corrosion (Larsen & Nyvad, 1999). Titratable is measured by the H+ concentration between an initial pH and a determinate final pH value and generally is calculated in pH 5.5 and 7.0 (Larsen & Nyvad, 1999; Lussi et al., 2012; Shellis et al., 2014). These undissociated acids pin and diffuse more easily on the enamel surface and the release of these ions keep the pH low and the dissolution of minerals continues to occur (Barbour et al., 2003; Lussi & Carvalho, 2015). Resuming, titratable acidity is a good indicator to study the corrosive potential of acidic food and beverages once it shows the amount of H^+ ions that are available to interact with the tooth surface (Brown, Smith, Shaw, Parry, & Smith, 2007; Jensdottir, Bardow, & Holbrook, 2005).

As it can be seen on tables, some beverages and foods have higher titratable acidity and buffering capacity than others. Fruit juices, tonic drinks, vinegar, orange, yogurt, energy drinks and champagne have shown higher values of these properties and consequentially have an aggressive corrosion potential.

The consumption of acid foods and beverages do not only degraded tooth surface but also composite resin restorations (Jaeggi, Gruninger, & Lussi, 2006; Peutzfeldt, Jaeggi, & Lussi, 2014; Wu & McKinney, 1982). Composite materials are constituted by organic matrix, inorganic particles, a coupling agent and an initiator system (Soares, Peres, Wobido & Machado, 2019). Applying a correct technique, all those factors contribute to adequate properties of the material. However, an acid diet could create a critical pH environment which can degrade composite resin. This mechanism occurs due to the deranged of the composite polymers by broking its chemical bonds between molecules. This result generated an alteration on physical and mechanical properties, such as hardness, surface roughness and color variation (Münchow, Machado, Ramos & Rodrigues-Junior, 2014).

The increased surface roughness creates an environment to accumulation of biofilm, making it more susceptible to secondary caries and periodontal diseases (Garcia-Godoy, Garcia-Godoy, & Garcia-Godoy, 2003). The absorption of pigments is also increased by the modifications of restorations surfaces caused by an acid diet. The pigments contained on food and beverages are more easily absorbed on composite resin surface. Thus, eating habits and food diet have a direct correlation to composite resin restoration longevity (Bagheri, Burrow, & Tyas, 2005).

Moreover, beverages that contain alcohol in its composition could produce corrosive damage to composite restorations even if the pH is neutral or close to it (MA et al., 2016). The reason why this damage happen is that the alcohol diffuses into the polymer matrix of the composite material causing hydrolysis. In this process are created gaps between the linear chains of the polymers and the chemical bond present between filler particles and the resin matrix loss straight (Santos et al., 2002). Due to filler particles are dislodge from the outer surface of the material, there is a reduction of hardness and increase of roughness surface (Ablal et al., 2009; MA et al., 2016). The polymer matrix suffers a plasticizer effect and consequently its degradation (Ablal et al., 2009).

It is important to remain that the corrosive potential of foods and beverages is also influenced by the factors association that help to remove hard tooth tissue. The oral cavity is in a constant change and friction, mechanical efforts and tension also corroborates and intensify the damage caused by acid foods and beverages. The tooth tissue affect by a critical pH is more easily removed by friction factors and it intensifies tissue loss (West et al., 2013; Shitsuka, Palma, Pedron, Polotow, Barros, Leite & Corrêa, 2020).

Since most people daily routine is surrounded by an acid diet it is important to give orientations to patients about how to decrease damage to teeth. Intensifying the salivary flux by chewing sugar-free candies and gums could benefit soft and hard tissues for being able to increase saliva amount able to achieve its buffering effect (Dawes, 2008). It is also recommended to rinse the mouth carefully before brush the teeth when the cavity was exposed to acid food and beverages. Furthermore, a collaboration between dentists and nutritionists could bring good results. Explaining to these professionals about the patients' oral disease, nutritionists can adapt routine diet switching acid foods to the one's with higher pH. When it is not possible to change beverages belong to the diet, drink it with a straw could decrease its contact to teeth surface (Amaechi & Higham, 2005; Carvalho et al., 2016; Zero, 1996). By following some of these recommendations, corrosion can be controlled and prevented on population (Maltarollo, Pedron, Medeiros & Shitsuka, 2020).

5. Conclusion

The results of this study revealed the importance of knowledge about biocorrosive potential of the food consumed in routine and the influence on oral health. It is concluded that most of the foods analyzed in this study had a pH below the critical to generate changes in the tooth structure and composite resins. It is noteworthy that more studies are needed about biocorrosive potential in the tooth and composite resins degradation and related to contemporary lifestyle diet.

References

Ablal, M. A., Kaur, J. S., Cooper, L., Jarad, F. D., Milosevic, A., Higham, S. M., & Preston, A. J. (2009). The erosive potential of some alcopops using bovine enamel: an in vitro study. *J Dent, 37*(11), 835-839. doi:10.1016/j.jdent.2009.06.016

Aidi, H. E., Bronkhorst, E. M., Huysmans, M. C., & Truin, G. J. (2011). Factors associated with the incidence of erosive wear in upper incisors and lower first molars: a multifactorial approach. *J Dent, 39*(8), 558-563. doi:10.1016/j.jdent.2011.06.001

Amaechi, B. T., & Higham, S. M. (2005). Dental erosion: possible approaches to prevention and control. *J Dent, 33*(3), 243-252. doi:10.1016/j.jdent.2004.10.014

Bagheri, R., Burrow, M. F., & Tyas, M. (2005). Influence of food-simulating solutions and surface finish on susceptibility to staining of aesthetic restorative materials. *J Dent, 33*(5), 389-398. doi:10.1016/j.jdent.2004.10.018

Barbour, M. E., Parker, D. M., Allen, G. C., & Jandt, K. D. (2003). Enamel dissolution in citric acid as a function of calcium and phosphate concentrations and degree of saturation with respect to hydroxyapatite. *Eur J Oral Sci, 111*(5), 428-433. doi:10.1034/j.1600-0722.2003.00059.x

Bartlett, D. W., Lussi, A., West, N. X., Bouchard, P., Sanz, M., & Bourgeois, D. (2013). Prevalence of tooth wear on buccal and lingual surfaces and possible risk factors in young European adults. *J Dent, 41*(11), 1007-1013. doi:10.1016/j.jdent.2013.08.018

Brown, C. J., Smith, G., Shaw, L., Parry, J., & Smith, A. J. (2007). The erosive potential of flavoured sparkling water drinks. *Int J Paediatr Dent, 17*(2), 86-91. doi:10.1111/j.1365-263X.2006.00784.x

Carvalho, T. S., Colon, P., Ganss, C., Huysmans, M. C., Lussi, A., Schlueter, N., . . . Wiegand, A. (2016). Consensus Report of the European Federation of Conservative Dentistry: Erosive tooth wear diagnosis and management. *Swiss Dent J, 126*(4), 342-346.

Carvalho, T. S., Schmid, T. M., Baumann, T., & Lussi, A. (2017). Erosive effect of different dietary substances on deciduous and permanent teeth. *Clin Oral Investig, 21*(5), 1519-1526. doi:10.1007/s00784-016-1915-z

Cochrane, N. J., Yuan, Y., Walker, G. D., Shen, P., Chang, C. H., Reynolds, C., & Reynolds, E. C. (2012). Erosive potential of sports beverages. *Aust Dent J, 57*(3), 359-364; quiz 398. doi:10.1111/j.1834-7819.2012.01708.x

Dawes, C. (2008). Salivary flow patterns and the health of hard and soft oral tissues. *J Am Dent Assoc, 139 Suppl*, 18S-24S. doi: 10.14219/jada.archive.2008.0351.

Garcia-Godoy, F., Garcia-Godoy, A., & Garcia-Godoy, F. (2003). Effect of APF Minute-Foam on the surface roughness, hardness, and micromorphology of high-viscosity glass ionomers. *J Dent Child (Chic), 70*(1), 19-23.

Grippo, J. O., Simring, M., & Coleman, T. A. (2012). Abfraction, abrasion, biocorrosion, and the enigma of noncarious cervical lesions: a 20-year perspective. *J Esthet Restor Dent, 24*(1), 10-23. doi:10.1111/j.1708-8240.2011.00487.x

Gurgel, C. V., Rios, D., de Oliveira, T. M., Tessarolli, V., Carvalho, F. P., & Machado, M. A. (2011). Risk factors for dental erosion in a group of 12- and 16-year-old Brazilian schoolchildren. *Int J Paediatr Dent, 21*(1), 50-57. doi:10.1111/j.1365-263X.2010.01090.x

Jaeggi, T., Gruninger, A., & Lussi, A. (2006). Restorative therapy of erosion. *Monogr Oral Sci, 20*, 200-214. doi:10.1159/000093364

Jakubczyk, K., Kaldunska, J., Kochman, J., & Janda, K. (2020). Chemical Profile and Antioxidant Activity of the Kombucha Beverage Derived from White, Green, Black and Red Tea. *Antioxidants (Basel), 9*(5). doi:10.3390/antiox9050447

Jensdottir, T., Bardow, A., & Holbrook, P. (2005). Properties and modification of soft drinks in relation to their erosive potential in vitro. *J Dent, 33*(7), 569-575. doi:10.1016/j.jdent.2004.12.002

Jensdottir, T., Nauntofte, B., Buchwald, C., & Bardow, A. (2005). Effects of sucking acidic candy on whole-mouth saliva composition. *Caries Res, 39*(6), 468-474. doi:10.1159/000088181

Kitchens, M., & Owens, B. M. (2007). Effect of carbonated beverages, coffee, sports and high energy drinks, and bottled water on the in vitro erosion characteristics of dental enamel. *J Clin Pediatr Dent, 31*(3), 153-159. doi:10.17796/jcpd.31.3.1157l653t8206100

Larsen, M. J., & Nyvad, B. (1999). Enamel erosion by some soft drinks and orange juices relative to their pH, buffering effect and contents of calcium phosphate. *Caries Res, 33*(1), 81-87. doi:10.1159/000016499

Lussi, A., & Carvalho, T. S. (2015). Analyses of the Erosive Effect of Dietary Substances and Medications on Deciduous Teeth. *PLoS One, 10*(12), e0143957. doi:10.1371/journal.pone.0143957

Lussi, A., Jaeggi, T., & Jaeggi-Scharer, S. (1995). Prediction of the erosive potential of some beverages. *Caries Res, 29*(5), 349-354. doi:10.1159/000262091

Lussi, A., Jaeggi, T., & Zero, D. (2004). The role of diet in the aetiology of dental erosion. *Caries Res, 38 Suppl 1*, 34-44. doi:10.1159/000074360

Lussi, A., Megert, B., Shellis, R. P., & Wang, X. (2012). Analysis of the erosive effect of different dietary substances and medications. *Br J Nutr, 107*(2), 252-262. doi:10.1017/S0007114511002820

MA, D. A. S., Vitti, R. P., Sinhoreti, M. A., Consani, R. L., Silva-Junior, J. G., & Tonholo, J. (2016). Effect of alcoholic beverages on surface roughness and microhardness of dental composites. *Dent Mater J, 35*(4), 621-626. doi:10.4012/dmj.2015-383

Maltarollo T. H , Pedron I. G., Medeiros J. M. F.& Shitsuka C., (2020). A erosão detinária é um problema!. Research Society and Development 9(3), e168932723. doi: 10.33448/rsd-v9i3.2723

Münchow, E. A., Ferreira, A.C.A., Machado, R.M.M., Ramos, T.S., Rodrigues-Júnior, S.A., Zanchi, C.H. (2014). Effect of Acidic Solutions on the Surface Degradation of a Micro-Hybrid Composite Resin. . *Brazilian Dental Journal*, *25*(4), 321-6. doi: 10.1590/0103-6440201300058.

Nogueira, F. N., Souza, D. N., & Nicolau, J. (2000). In vitro approach to evaluate potential harmful effects of beer on teeth. *J Dent, 28*(4), 271-276. doi:10.1016/s0300-5712(99)00072-x

O'Toole, S., Bernabe, E., Moazzez, R., & Bartlett, D. (2017). Timing of dietary acid intake and erosive tooth wear: A case-control study. *J Dent, 56*, 99-104. doi:10.1016/j.jdent.2016.11.005

Okunseri, C., Okunseri, E., Gonzalez, C., Visotcky, A., & Szabo, A. (2011). Erosive tooth wear and consumption of beverages among children in the United States. *Caries Res, 45*(2), 130-135. doi:10.1159/000324109

Peumans, M., Politano, G., & Van Meerbeek, B. (2020). Treatment of noncarious cervical lesions: when, why, and how. *Int J Esthet Dent, 15*(1), 16-42.

Peutzfeldt, A., Jaeggi, T., & Lussi, A. (2014). Restorative therapy of erosive lesions. *Monogr Oral Sci*, *25*, 253-261. doi:10.1159/000360562

Phelan, J., & Rees, J. (2003). The erosive potential of some herbal teas. *J Dent, 31*(4), 241-246. doi:10.1016/s0300-5712(03)00048-4

Salas, M. M., Nascimento, G. G., Vargas-Ferreira, F., Tarquinio, S. B., Huysmans, M. C., & Demarco, F. F. (2015). Diet influenced tooth erosion prevalence in children and adolescents: Results of a meta-analysis and meta-regression. *J Dent*, *43*(8), 865-875. doi:10.1016/j.jdent.2015.05.012

Santos, C., Clarke, R. L., Braden, M., Guitian, F., & Davy, K. W. (2002). Water absorption characteristics of dental composites incorporating hydroxyapatite filler. *Biomaterials*, *23*(8), 1897-1904. doi:10.1016/s0142-9612(01)00331-3

Seow, W. K., & Thong, K. M. (2005). Erosive effects of common beverages on extracted premolar teeth. *Aust Dent J, 50*(3), 173-178; quiz 211. doi:10.1111/j.1834-7819.2005.tb00357.x

Shellis, R. P., Barbour, M. E., Jones, S. B., & Addy, M. (2010). Effects of pH and acid concentration on erosive dissolution of enamel, dentine, and compressed hydroxyapatite. *Eur J Oral Sci, 118*(5), 475-482. doi:10.1111/j.1600-0722.2010.00763.x

Shellis, R. P., Featherstone, J. D., & Lussi, A. (2014). Understanding the chemistry of dental erosion. *Monogr Oral Sci, 25*, 163-179. doi:10.1159/000359943

Shitsuka, C., Palma, L. F., Pedron, I. G., Polotow, T. G., Barros, M. P. De, Leite, M. F, & Corrêa, M. S. N. P. (2020). Salivary profile of children with erosive tooth wear: a transversal study. *Brazilian Oral Research, 34*, e115 . doi: https://doi.org/10.1590/1807-3107bor-2020.vol34.0115.

Silva, T. M. D., Sales, A., Pucci, C. R., Borges, A. B., & Torres, C. R. G. (2017). The combined effect of food-simulating solutions, brushing and staining on color stability of composite resins. *Acta Biomater Odontol Scand, 3*(1), 1-7. doi:10.1080/23337931.2016.1276838

Soares, P.V., Peres, T. S., Wobido, A. R., Machado, A. C. (2019). Resinas Compostas nos últimos 10 anos - Revisão da Literatura. Parte 1: composição química. *Journal Of Clinical Dentistry And Research*, 16(1), 45-56. doi: 10.14436/2447-911x.16.1.045-056.oar

Souza, M. T., Silva, M. D., Carvalho, R. (2010). Integrative review: what is it? How to do it?. Einstein (São Paulo, 8(1), 102-106. doi: 10.1590/s1679-45082010rw1134

Tanthanuch, S., Kukiattrakoon, B., Eiam, O. P. K., Pokawattana, K., Pamanee, N., Thongkamkaew, W., & Kochatung, A. (2018). Surface changes of various bulk-fill resin-based composites after exposure to different food-simulating liquid and beverages. *J Esthet Restor Dent*, *30*(2), 126-135. doi:10.1111/jerd.12349

Teixeira, D. N. R., Zeola, L. F., Machado, A. C., Gomes, R. R., Souza, P. G., Mendes, D. C., & Soares, P. V. (2018). Relationship between noncarious cervical lesions, cervical dentin hypersensitivity, gingival recession, and associated risk factors: A cross-sectional study. *J Dent, 76*, 93-97. doi:10.1016/j.jdent.2018.06.017

West, N. X., Sanz, M., Lussi, A., Bartlett, D., Bouchard, P., & Bourgeois, D. (2013). Prevalence of dentine hypersensitivity and study of associated factors: a European population-based cross-sectional study. *J Dent, 41*(10), 841-851. doi:10.1016/j.jdent.2013.07.017

Wu, W., & McKinney, J. E. (1982). Influence of chemicals on wear of dental composites. *J Dent Res, 61*(10), 1180-1183. doi:10.1177/00220345820610101501

Zanatta, R. F., Esper, M. A., Valera, M. C., Melo, R. M., & Bresciani, E. (2016). Harmful Effect of Beer on Bovine Enamel Microhardness - In Vitro Study. *PLoS One*, *11*(10), e0163440. doi:10.1371/journal.pone.0163440

Zero, D. T. (1996). Etiology of dental erosion--extrinsic factors. *Eur J Oral Sci*, *104*(2 (Pt 2)), 162-177. Doi: 10.1111/j.1600-0722.1996.tb00065.x

Percentage of contribution of each author in the manuscript

Ana Laura Rezende Vilela– 25%

Alexandre Coelho Machado – 15%

Sofia de Oliveira Rangel – 20%

Gabriela Resende Allig – 15%

Paola Gomes Souza – 5%

Bruno Rodrigueis Reis – 5%

Paulo Vinicius Soares – 5%

Murilo de Sousa Menezes – 10%