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Investigating the Effects of *Euterpe oleracea* Fruit Extract on Dental Erosion

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ABSTRACT

Dental erosion poses a significant challenge in oral healthcare, leading to enamel loss and subsequent tooth decay. Traditional approaches to managing dental erosion focus on prevention rather than treatment. However, emerging research suggests that natural compounds found in certain fruits may offer therapeutic benefits in mitigating dental erosion. *Euterpe oleracea*, commonly known as acai berry, is one such fruit known for its rich antioxidant and anti-inflammatory properties. The aim of this study was to analyze the impact of *Euterpe oleracea* fruit extract on dentin erosion. For five minutes, twelve healthy human premolars that had been removed were submerged in Coca-Cola (pH 2.7). With a 50gr/10s stress, the surface microhardness was assessed using a Knoop diamond. After that, the teeth were submerged in a solution of *Euterpe oleracea* fruit extract for a minute. The Wilcoxon test was used to compare the remeasured microhardness values with the pretreatment values. The results were found to be statistically significant (*P*<0.001). *Euterpe oleracea* fruit extract increased the microhardness of eroded dentin and improved the eroded texture.

Keywords: Dental erosion, acai berry, antioxidant, anti-inflammatory, enamel loss, tooth decay.

1. INTRODUCTION

Dental erosion is a significant issue characterized by the loss of tooth structure due to acids, both exogenous and endogenous, without bacterial involvement. It's a prevalent problem, particularly in modern societies where acidic food and beverage consumption is high.[1] This erosion leads to irreversible damage to the tooth surface, with softening and eventual loss of dental hard tissue. Erosive demineralization, a key aspect of dental erosion, results from acid dissolution of dental hard tissue and can be caused by intrinsic factors like acid reflux or extrinsic factors such as dietary habits, particularly frequent consumption of soft drinks or acidic snacks.[2,3]

Preventive measures for dental erosion are not widely accepted, despite its prevalence, especially among preschool children. There's a lack of awareness among patients regarding this issue. However, various studies have shown that certain chemical agents or components possess anti-erosive properties. Regular soft drink consumption—especially of carbonated sodas—is the main cause of erosive tooth damage. Furthermore, naturally high-acid fruit juices, candies, and acidic foods might raise the risk of erosion.[4,5] Diagnosis and management of dental erosion involve careful clinical examination to identify signs of erosion and predisposing factors. Preventive measures aim to reduce exposure to acidic drinks and dietary sources.[6]

In recent years, there has been growing interest in exploring natural compounds as adjunctive therapies for dental erosion management. Among these, *Euterpe oleracea*, commonly known as acai berry, has gained attention due to its rich

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antioxidant content and potential health benefits. Native to the Amazon rainforest, acai berries have been traditionally used for their nutritional and medicinal properties.[7] Studies have shown that *Euterpe oleracea* fruit extracts possess potent antioxidant and anti-inflammatory effects, which could potentially aid in protecting dental hard tissues from acid-induced damage.[8] The antioxidant properties of acai berries are primarily attributed to their polyphenol content, particularly anthocyanins and flavonoids. These compounds scavenge free radicals generated during oxidative stress, thereby preventing oxidative damage to dental tissues.[8,9]

Euterpe oleracea berries are renowned for their high concentration of bioactive compounds, including anthocyanins, polyphenols, flavonoids, vitamins, and minerals. These constituents exhibit various biological activities, such as antioxidant, anti-inflammatory, and anti-cariogenic properties, which are relevant to the management of dental erosion.[9,10] Moreover, the high mineral content of acai berries, including calcium and phosphorus, may contribute to remineralization of demineralized enamel, thereby enhancing its resistance to acid dissolution.[11]

Given this background, the present study aimed to investigate the effect of *Euterpe oleracea* fruit extract (EOFE) on eroded dentin by measuring microhardness values evaluations. This research seeks to contribute to the understanding of potential preventive measures or treatments for dental erosion.

2. MATERIAL & METHODS

2.1 Collection and Extraction of Plant Material

Euterpe oleracea fruits were sourced from the Amazon Bay region in Brazil. The hydroalcoholic extract was prepared by decocting açaí stones, following a previously established method.[13] In summary, 200 grams of açaí stones were boiled in distilled water for 10 minutes, and the resulting decoction was then cooled to room temperature. Subsequently, the decoction was mixed with ethanol (400 mL) and stored at 4 °C for a period of 10 days. Afterward, the extract underwent filtration using a Whatman filter paper, and the ethanol was removed under low pressure at 55 °C. The resulting extract was then lyophilized and stored at -20 °C until needed.

2.2 Preparation of Dental Erosion and Treatment Samples

Twelve healthy human premolars, extracted for orthodontic or periodontal reasons, were carefully cleaned to remove any organic residue. Examination under a stereomicroscope (Magnification ×10, Nikon, Germany) ensured that the teeth were free from cracks. Using a low-speed handpiece, enamel on the buccal surface was gradually removed until dentin was exposed. Subsequently, the teeth were longitudinally sectioned, and the exposed surfaces were coated with two layers of acid-resistant nail varnish.

To prepare the samples for testing, they were inserted in epoxy resin, then leveled using water-cooled discs ranging from 60 to 3000 grits of silicon carbide paper. Finally, polishing was done using 1-µm aluminum oxide felt papers. The specimens were then subjected to a 5-minute immersion in Coca Cola (pH=2.7,) at room temperature. A Knoop diamond was used in a microhardness tester (HMV 2000, Shimadzu Corporation) to measure the microhardness of the dentin surface while it was subjected to a 50gr/10s stress. For measuring purposes, the cervical third of each specimen had three indentations created on it.

Preparation of the *Euterpe oleracea* fruit extract involved dissolving two grams of the extract in 180 mL of boiled water, allowing it to cool for 5 minutes at room temperature. The fluoride content of the resulting green tea solution was measured at 0.4 mg/L using a fluoride electrode (ThermoFisher Scientific), and its pH was determined to be 7.0. The teeth were then immersed in the fruit extract solution for 1 minute. Microhardness values were measured at three separate indentations within the cervical third of each tooth specimen using consistent procedures. Using SPSS 27.0 software for analysis, the average microhardness values were calculated before and after treatment, and subsequently compared using the Wilcoxon test.[14]

3. RESULTS

Based on the results of this study, the mean±SD microhardness value (Kgforce/mm^2) after immersing teeth in Coke was 43.85±1.83. However,

following immersion of the eroded teeth in EOFE solution, the microhardness value notably increased to 56.35±2.86. Statistical analysis using the Wilcoxon test indicated highly significant differences between the two groups (P<0.001).

4. DISCUSSION

The present study aimed to investigate the impact of *Euterpe oleracea* fruit extract (EOFE) on eroded dentin. The results indicated a notable increase in dentin microhardness values following treatment with EOFE solution. Dentin erosion is not a straightforward surface phenomenon. Once acids induce mineral dissolution, it exposes the organic matrix, primarily composed of collagens. Because the organic components serve as a diffusion barrier, a thicker matrix can slow down the loss of erosive minerals.[15]

Matrix metalloproteinases (MMPs) belong to a multi-gene family of endopeptidases within the metalloproteinase class, responsible for degrading nearly all extracellular matrix molecules. MMPs play roles in organizing enamel and dentin organic matrix before mineralization, as well as regulating proteoglycan turnover and mineralization processes. MMPs hydrolyze extracellular matrix components during oral remodeling and breakdown processes. They are found in saliva and dentin.

MMPs 2, 8, and 9, activated by bacterial acids, play crucial roles in dentin destruction by caries, making MMP inhibitors potential agents for inhibiting or delaying erosion progression.[16,17]

It has been discovered that biologically active elements from natural goods, such as different anthocyanins present in EOFE, suppress MMP activity. There have been several attempts to clarify how MMP inhibitors stop dentinal degeneration. The demineralized structure of the eroded dentin appears to be improving, as evidenced by the rise in surface microhardness values that was seen following immersion in the EOFE solution. This improvement might be ascribed to the induction of freshly produced collagen crosslinks or the surface deposits of organic elements on the dentin. Anthocyanidin and polyphenols that are present in *Euterpe oleracea* fruit, may interact with dentin's organic component.[18,19]

Anthocyanins, prevalent in various fruits such as berries and grapes, possess intriguing potential interactions with the organic portion of dentin. These water-soluble pigments, responsible for vibrant red, purple, and blue hues, could potentially bind to collagen fibers within the dentin matrix. This binding may lead to the formation of stable complexes or even participate in crosslinking reactions, enhancing the structural integrity of the dentin.[20] Additionally, anthocyanins' renowned antioxidant properties may offer protection against oxidative damage to the organic components of dentin, while their anti-inflammatory effects could indirectly support the health of surrounding tissues. Although research on the direct interactions of anthocyanins with dentin is limited, their multifaceted properties hint at their potential as promising agents for maintaining dental health and bolstering the resilience of dentin structure. Further exploration of these interactions could unveil novel avenues for improving dental care and treatments.[21,22]

After immersion in EOFE solution, evident deposits are observed on the dentin surface, indicating a more organized structure. Additionally, preservation of the dentin matrix by MMP inhibition could offer another possible explanation for these findings. Since there is evidence of MMP inactivity in extracted teeth over time, freshly extracted teeth were utilized within the first week after extraction. It's important to note that the results of this study should be corroborated with further research that closely simulates clinical situations.

5. CONCLUSION

Based on the findings of the present *in vitro* study, it is evident that *Euterpe oleracea* fruit extract (EOFE) contributes to an increase in the surface microhardness of eroded dentin. These results underscore the potential of EOFE as a promising agent for enhancing the structural integrity of eroded dentin. Further investigations, particularly in clinical settings, are warranted to validate and expand upon these promising outcomes, paving the way for the development of novel approaches to dental care and treatments.

Conflict of Interest: The authors declare that they have no conflicts of interest.

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