

# SODIUM BICARBONATE TOOTHPASTES REDUCE METALLOPROTEINASE-8 AND INTERLEUKIN-1B LEVELS IN SMOKERS AND IMPROVE IMPORTANT SALIVARY INDEXES

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**Abstract.** Background: Saliva is an important body fluid that aids in digestion and contains a repertoire of important biomarkers. This research aimed to investigate the role of sodium bicarbonate toothpaste in regulating salivary indexes. Materials and Methods: The study involved taking saliva samples from healthy and fasting adult, male volunteers, aged between 20 to 45 years old. The samples were taken randomly and stratified, from 50 smokers and 50 non-smokers. The levels of metalloproteinase-8, interleukin-1 $\beta$ , pH, salivary flow rate, and  $\alpha$ -amylase were measured, and the effects of sodium bicarbonate toothpaste application were investigated. Results: The levels of metalloproteinase-8 and interleukin-1 $\beta$  in smokers were significantly elevated, with more acidic saliva but reduced salivary flow rate and  $\alpha$ -amylase. With the application of sodium bicarbonate, there were significant reductions in metalloproteinase-8 and interleukin-1 $\beta$ , with substantial improvement in pH, salivary flow rate, and  $\alpha$ -amylase in both smokers and non-smokers. Conclusion: This study confirmed the negative effects of smoking. The use of sodium bicarbonate toothpaste enhanced oral health by reducing the pro-inflammatory biomarkers while improving the pH, salivary flow rate, and  $\alpha$ -amylase.

**Keywords:** metalloproteinase-8, interleukin-1 $\beta$ , salivary indexes,  $\alpha$ -amylase, sodium bicarbonate, smoking habit.

## List of Abbreviations

SB – sodium bicarbonate

MMP-8 – metalloproteinase-8

IL1 $\beta$  – interleukin-1 $\beta$

SFR – salivary flow rate

$\alpha$ -amylase – alpha-amylase

## Introduction

Saliva, a clear, watery, viscous, heterogeneous, and complex biofluid, is an essential oral cavity component, secreted from salivary glands (Ebersole *et al.*, 2024). It is important in maintaining oral health as it contains proteins and peptides that have roles in defence and protection against viruses and germs, maintenance, lubricating food, remineralizing teeth, and for buffering capacity and balancing oral pH (Hasan *et al.*, 2024). There are many salivary biomarkers such as MMP-8 and interleukins, which are vital for immune response, controlling inflammation, boosting antigen representation, and regulating adaptive immunity (Al-Qahtani *et al.*, 2024).

MMP-8 enzyme is produced by granulocytes in saliva in response to collagen damage, particularly in periodontitis, and is an important in-

dicator of periodontitis. Salivary MMP-8 and IL-1 $\beta$  levels are important indicators of periodontal health, especially in evaluating the impact of smoking (Noh *et al.*, 2022). Smokers with chronic periodontitis tend to exhibit higher salivary MMP-8 and IL-1 $\beta$  levels. Monitoring salivary MMP8 and IL-1 $\beta$  could therefore identify individuals at risk of developing periodontitis (Hamza *et al.*, 2020; Do *et al.*, 2023). Smoking also affects pH levels, SFR, and buffering capacity (Beklen *et al.*, 2021). Smokers have shown lower salivary pH levels than non-smokers (Bhavsar, 2023). An inverse correlation between smoking frequency and the effects on salivary pH and flow rate is well-established (Azuma & Matsui, 2022).

One of the effective ways to promote oral health and to moisturize the mouth is to apply SB mouthwash (Mohammadi *et al.*, 2022). SB could increase salivary pH and improve SFR, and IL-1 $\beta$  levels, especially in smokers ((Hamza *et al.*, 2020; Ariani *et al.*, 2023). However, the use of SB toothpaste has not often been promoted for oral health of both smokers and non-smokers and to prevent dental caries especially in children although it is easier to implement.