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# Impact of Soft Drinks Consumption on Salivary pH Levels

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## Abstract

**Objective:** The goal of current investigation was to determine the impact of some drinks on saliva pH values.

**Methodology:** The study included 20 healthy individuals (15 females and 5 males) with different ages. Measurements after 0, 10, 20, 30, 40, 50, and 60 minutes of drinking Cola, Pepsi, Seven Up, Shani, and Mirinda on saliva pH were determined.

**Results:** Very similar pH value changes happened for all drinks, with a decrease in pH within 10 minutes after drinking that return to original values after 60 minutes.

**Conclusion:** The studied drinks cause a decrease in salivary pH that returns to original values within 60 minutes.

**Keywords:** Diet; Dental Caries; Risk

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## Introduction

Dental decay is one of the most common oral health problems in the world, which arise from the interactions between bacteria and fermentable carbohydrate and could guide to destruct the hard part of tooth [1]. Although it is preventable, but dental decay remains prevalent, it assuming about 3.5 billion individuals, where 40% from those cases remain untreated [2]. It commonly leads to discomfort and pain [3]. Tooth decay is a chronic disorder and it is of interest identifying the individuals at higher risk of decay in advance as well as taken precautions [4,5].

Saliva has crucial roles in the sustenance of mouth health. It is an important factor in oral shielding mechanisms. In a salutary mouth, saliva encloses antimicrobial enzymes, glycoproteins as well the primary electrolytes that protect the mucosa of mouth. Saliva is essential for digestion, tasting and forming the bolus, preservation of teeth, in addition to antimicrobial impacts [6,7].

Principal factors to consider when evaluating the roles of saliva in decay risks involve: Organic and inorganic constituents, buffering capacity, pH, viscosity and saliva amount [8,9].

Saliva plays an essential role in modulating remineralization as well as demineralization of teeth [10]. Previous work attempted to assess the interplay between salivary pH, flow and alterations of plaque pH[11].

*Streptococcus mutans* and *Streptococcus sobrinus* are known as prime contributors to initiate of tooth decay for their potential to metabolize sugars into acids, which act to demineralize enamel. On the other hand, lactobacilli have a crucial role in the progress of dental decay. These bacterial species prosper in acidic environment, making them especially efficient in sustain and

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advance carious lesions after the initial enamel damages had taken placed [12,13].

Usually, human's mouth is exposed to foods have pH levels deviate from natural saliva's pH (6.5-7.5), where those deviations could lead to tooth damage or mucosal surfaces [14]. Sweet soft drinks alter salivary pH and prompt bacterial propagation and are correlated with decay progression [15]. Information on the impacts of consuming soft drinks is limited, so the current investigation aimed to determine the impacts of some drinks on saliva pH values.

## Material and Methods

### Participants

The present investigation included 20 volunteers (15 females, 5 males), with ages between 18 and 60 years. All participants provided written informed consent. Participants were non-smokers and without oral, dental or any systemic diseases, in addition to not getting any medications potentially intervening with saliva releasing.

### Collection of samples

350 ml cans of soft drink (Pepsi, Cola, Seven, Up Mirinda and Shani) from a Baghdad Company were used. A sample of saliva was placed in a urine collection cup or any available container similar in size and shape. Then the can of soft drink was consumed by rinsing the mouth first, then drinking and collecting saliva in several periods (after drinking immediately and then after 10, 20, 30, 40, 50 and 60 minutes). pH measurements were subsequently obtained.

### Evaluation of salivary pH

A pH meter (ISOLAB Laborgerate GmbH pH Meter, Wertheim, Germany) was used to estimate salivary pH.

### Statistical Analysis

pH readings were expressed as means and standard deviations (SD), and then they were compared by ANOVA.

## Results

The mean saliva pH and SD for all drinks are displayed in Table 1. The current study indicated that the lowest pH detected was after 10 minutes for all the drinks included in the study, and that the lowest pH (5.12± 0.12) was for the Shani drink. However, the study showed that the pH values began to rise over time, returning to normal limits within 60 min for all drinks. Time-dependent pH changes for all groups are shown in Figure 1.

| Soft drink name | pH value Mean ± SD | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | After | | | | | | |
| | Before | 0 mins | 10 mins | 20 mins | 30 mins | 40 mins | 50 mins | 60 mins |
| Pepsi | 7.08± 0.12$^{b}$ | 6.81± 0.16$^{b}$ | 5.17± 0.11$^{b}$ | 5.33± 0.04$^{a}$ | 5.81± 0.15$^{b}$ | 6.23± 0.19$^{c}$ | 6.77± 0.03$^{b}$ | 7.13± 0.10$^{a}$ |
| Cola | 7.09± 0.09$^{b}$ | 6.77± 0.11 | 5.15± 0.17$^{b}$ | 5.28± 0.08$^{ab}$ | 5.79± 0.16$^{b}$ | 6.15± 0.09$^{ab}$ | 6.71± 0.05$^{a}$ | 7.12± 0.17$^{a}$ |
| Seven Up | 7.18± 0.15$^{c}$ | 6.69± 0.12$^{a}$ | 5.21± 0.07$^{c}$ | 5.31± 0.13c | 5.69± 0.28$^{a}$ | 6.09± 0.15$^{a}$ | 6.69± 0.09$^{a}$ | 7.14± 0.19$^{a}$ |
| Mirinda | 7.19± 0.14$^{c}$ | 6.83± 0.22$^{ab}$ | 5.16± 0.10$^{b}$ | 5.25± 0.05$^{a}$ | 5.83± 0.12$^{b}$ | 6.18± 0.08$^{b}$ | 6.80± 0.14$^{bc}$ | 7.15± 0.22$^{a}$ |
| Shani | 7.02± 0.22$^{a}$ | 6.80± 0.07$^{b}$ | 5.12± 0.04$^{a}$ | 5.27± 0.18$^{ab}$ | 5.87± 0.14$^{c}$ | 6.71± 0.17$^{d}$ | 6.82± 0.12$^{c}$ | 7.19± 0.17$^{a}$ |

Different letters indicate significant differences by ANOVA analysis.

**Table 1. pH values obtained in the study.**

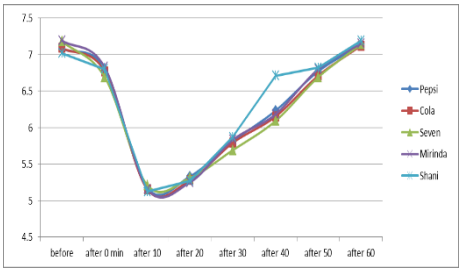


**Figure 1. Graphic representation of results.**

## Discussion

The main factors that control stabilizing of enamel hydroxyapatite include the active concentration free of Ca, phosphate, as well as fluoride in solution, in addition to pH of saliva[16].

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Generally, dental enamel erosion developed from acidic condition of the mouth. Diets and beverages have faint pH values, like citrus fruit, soft drinks, as well as some sport drinks can participate to this acidity state. The continuous exposure of enamel to those acidic conditions could disband the minerals, and lead to diminution of hardness and weakened structure [8,17]. The standard pH of saliva is between 6 to 7 [16]. When food is ingested, pH of plaque remains under the critical pH for round about fifteen to twenty mins and does not return to usual value until approximately forty minutes rinse [18].

Given the importance of pH, this study aimed to evaluate the pH levels of saliva after consuming soft drinks, to highlight the negative effects of excessive consumption of these drinks.

The current study indicated that the lowest pH was seen after 10 minutes for all the drinks included in the study, and that the lowest pH within this group was for the Shani drink. However, the study demonstrated that pH value begins to rise over time, returning to normal limits within 60 minutes in all drink groups.

The current findings are supported by a previous study conducted by Tenuta et al, which showed that salivary pH reduced after consumption carbonated soft drinks due to their highest acids content, like phosphoric acid as well as citric acid; the recovery time for saliva to return to its normal pH is affected by acidity of the beverage. Investigations have reported that the salivary pH can return to baseline within 30 seconds to 90 seconds after expectoration of the drink, depending on the type and acidity of the beverage [19].

The findings of the present research are consistent with previous one of Hans et al., that indicated that consuming soft drinks lead to reduced pH of saliva, and the authors stated that while fluids leak rapidly from oral cavity, they have serious cariogenic and erosive potency [20].

The current study aligns with a previous investigation conducted by Demir et al., [14], that highlighted the value of controlled consumption of drinks to avoid tooth decay, as some drinks could significantly lower salivary pH. Acidic conditions can lead to dental erosion, tooth decay, in addition to bad breath [21].

Consuming soft drinks, particularly carbonated ones, can have significant erosive impacts on dental enamel [22]. Drops in pH levels as well the high acidity in these drinks cause enamel demineralization as well as escalated roughness of tooth surface [23]; consequently, these events could cause dental hypersensitivity and augmented risk of caries [22].

The buffering capacity of saliva is a key determinant in dental decay resistance. The buffered system withstands the variations in pH levels that happen

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with producing of acidic as well basic ions; if this capacity is defeated, and the balance of mineralization is undermined, pH levels reduce, which boosts escalated demineralization and progression of cavities [6]. Proper diet selection is prerequisite to maintain oral health, highlighting the significance of buffering impact of saliva in pH maintenance [24]. Accordingly, it is crucial to include anti-caries foods in the diet for preventing tooth decay.

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