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Is homemade hibiscus drink dental lesions risk factors? Analysis of physicochemical parameters after oral cavity contact

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ABSTRACT

Aim: This study aimed to analyze the physicochemical parameters variation of the homemade hibiscus drink (Hibiscus sabdariffa) after contact with the oral cavity.
Methods and materials : The study took place from October 2010 to March 2012 at the Félix Houphouët Boigny University in Cocody, Côte d'Ivoire. The procedures were carried out at the Laboratory of Analytical Chemistry and Bromatology of the Training and Research Unit in Pharmaceutical and Biological Sciences, the Biochemistry Laboratory of the Emergency Medical Aid Service and the National Laboratory of Public Health (LNSP). Potential hydrogen (pH), acidity, calcium, phosphorus and sugar were the analyzed variables.
Results: The pH in drink discharges does not vary over time. Drink discharges have, over time, lower calcium and higher phosphorus content than the starting drink.
Conclusion: Hibiscus drink would have an acid generating effect on the tooth, but its high concentration of calcium and phosphorus would counterbalance this effect and could protect teeth against demineralization.

1. Introduction

The significant increase in industrial sweetened drinks consumption, such as sodas, carbonated drinks/soft drinks, non-carbonated fruit juice and energy drinks can be tied to health problems experienced by an increasing number of people.[1–3] There is also a clear correlation between the consumption of sweetened drinks and caries.[4] Several parameters, including the high acidity of most of these drinks, lead to tooth surface erosion.[3] Besides industrial sweetened drinks, there are homemade drinks whose consumption is growing among African populations, especially in Côte d'Ivoire. These are drinks made from locally produced raw materials such as guinea sorrel (hibiscus),[5] ginger, passion fruit, tamarind, etc. All socio-professional sectors and groups of the population consume them.[6] However, although industrial drinks are linked to metabolic, cardiovascular and oral cavity diseases,[1,3,7] it is difficult to comment on homemade drinks, of which very few studies link their consumption to the occurrence of any pathology. Yet, these drinks contain added sugar and have a more or less sour taste suggesting their acidity. Furthermore, a study on eating habits and oral hygiene in a population of 249 people in southern Côte d'Ivoire showed that76% of the population usually consume sweetened drinks daily, mostly homemade drinks. Dental caries within this population was 52.50%.[8] It seems appropriate, thereupon, to analyze the chemical composition of one among the most consumed drinks, the hibiscus (Hibiscus sabdariffa) particularly after contact with the oral cavity. This study aimed to analyze the

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physicochemical properties of the hibiscus drink to study the variation of certain parameters, following their contact with the oral cavity.

2. Materials and Methods

This study was carried out jointly in the Department of Endodontic Conservative Odontology of the Odonto-Stomatology Training and Research Unit and the Department of Analytical Chemistry, Bromatology, General and Mineral Chemistry of the Pharmaceutical and Biological Sciences Training and Research Unit of Félix Houphouët-Boigny University of Abidjan. It took place between October 2010 and March 2012. The practical tests were carried out at the Laboratory of Analytical Chemistry and Bromatology of the UFR Sciences Pharmaceutical and Biological, at the Laboratory of Biochemistry of the Emergency Medical Aid Service (EMAS) and the National Public Health Laboratory (NPHL). The potential hydrogen (pH), acidity, calcium, phosphorus and sugars variables were analyzed.

2.1. Study population and participation criteria

The study population was based on their age: between 18 and 35 years, absence of ongoing tretment, oral health disease-free and willingness to participate in the study.

2.2. Study material

The study was about the homemade hibiscus drink. The discharged drink is the beverage spited out by the subject after 30 sec in the oral cavity. The amount of drink introduced into the oral cavity before discharge is 25 ml.

2.3. Contact procedure for prepared beverages-oral cavity

The drink is used as a mouthwash as follows:

-the subjects are given25 mL of the drink to introduce in the mouth. After about 30 sec, they spit it out in a disposable glass. The operation is repeated every 15 mn for 60 mn with a new volume of the beverage. Discharges at T0, T15, T30, T45 and T60are analyzed for each drink.

2.4. Measuring parameters in drinks

Five parameters of the drink before consumption are analyzed: calcium, phosphorus, pH, acidity and sugar content. The analyzed discharges' parameters are pH, calcium, phosphorus.

The pH was determined by the semi-quantitative colorimetric.

The acidity can be determined by titrimetric with a colored indicator.[9]

The calcium, the titrimetric was the simplest and easiest method to determine it.[10]

The phosphorus by absorption spectrometric visible at 700 nm reacts with the molybdate ion in an acid area to give a phospho-molybdic complex which is then reduced by ascorbic acid to form a molybdenum complex colored blue whose absorbance can be measured in the visible at 700 nm.[11]

Determination of total sugars

The method Dubois et al.[12] was used for the determination of total sugars.

3. Results

3.1. Study subject

Only one subject out of ten was selected for this study. A 20 years old female with a healthy oral cavity and no particular ailment following an odontostomatology consultation.

3.2. The prepared beverage physicochemical parameters

Analysis of the prepared beverage's parameters yielded the following values: pH=1, total acidity of 67 mmol/L, calcium content of 205 mg/L, phosphorus content of 45.5mg/L and total sugars of 1343.31 mg/L.

3.3. Discharges' physicochemical parameters

The discharges, over time, have constant pH, lower calcium and higher phosphorus content than the starting drink (Table 1).

Table 1: Physicochemical parameters in beverage discharges

	T0	T15	T30	T45	T60
oral pH	7	4	7	4	6
pH of the discharge	2	2	2	2	2
Calcium content mg/L	175	170	160	165	165
Phosphorus content mg/L	72	71.6	74.2	71	69.6

4. Discussion

The study was useful in understanding how homemade hibiscus drink affects teeth. The five physicochemical parameters, which are pH, acidity, sugars, calcium and phosphorus were analyzed using straightforward and easy-to-implement methods. These hibiscus drinks have a very acidic pH that could cause dental enamel demineralization, given the critical threshold of demineralization pH is a pH below 5.5 (Cavalcanti et al. 2008; Fraunhofer and Roger, 2004).[13,14] Nevertheless, it is rich in calcium and phosphorus, which would be beneficial for preventing demineralization of the tooth, as they strengthen the tooth enamel.[15] Added sugar lowers the calcium and phosphorus concentrations; its only value is that it renders these beverages more attractive to consumers. Large amounts

of sugars combined with poor handling and/or storage conditions can promote the growth of microorganisms.[16] Acid-containing bacteria (Leuconostoc and Lactobacillus) or heat-resistant bacteria can affect the drink.[5] These bacteria issues were raised in the study "Endodontic Infections by Kaboré et al. (2016),[17] Burkina Faso,"

Furthermore, added sugar can lead to changes in calcium and phosphorus mineral levels, which mineral may promote re-mineralization by binding on enamel (Fatima et al., 2010).[18] Improving consumer information is needed to minimize repeated use which is a common dental caries and obesity risk factor, both of which affect the quality of life.[19] An analysis of the drink after contact with the oral cavity showed that the subject's oral pH varies between 7 and 4 after 60 mn. On the other hand, there is a decline in the calcium content of 205mg/L of the starting drink and an increase in the phosphorus content of 45.5mg/L with variations over time. This may indicate that a drink with an acidic pH below the critical pH threshold of5.5 leads to a decrease in the subject's oral pH and thus the demineralization of the tooth's hard tissue.

However, being a very calcium-rich drink it leads to a calcium-rich salivary area. Thus, a re-mineralization would reverse the tooth demineralization with binding calcium on the tooth, whether combined or not with other elements than the phosphorus such as sodium or fluorides.[15] Given the hibiscus drink acid-generating on the tooth; its calcium and phosphorus high concentration would protect the tooth from demineralization. Today, dental erosion is a pathology highly linked to the consumption of acidic beverages.

5. Conclusion

This study has been carried out to assess the impact of homemade drinks in the mouth. The hibiscus drink physicochemical parameters were analyzed to determine their possible variations after contact with a disease-free oral cavity. It has an acid-generating effect on the tooth, however, its high concentration of calcium and phosphorus would counterbalance it and protect the teeth from demineralization. Conducting such a study on a larger population of subjects with different types of oral cavity (with or without conditions) would allow a better understanding of the analyzed physicochemical parameters. Furthermore, microbiological monitoring should be considered, since the required good manufacturing and monitoring practices are not systematically followed.

6. Source of Funding

None.

7. Conflict of Interest

None.

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