



The Antibacterial Effect of Three Mouthwashes on Common Microbial Flora of the Oral Cavity

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was based on determining the efficacy of three different mouthwashes, containing different classes of chemical agents. A random collection of 30 samples were obtained from Bingham University students in which three specific organisms were isolated. The isolated organisms studied were *Staphylococcus aureus*, *Streptococcus mutans* and *Candida albicans*. The mouthwashes used were assayed for their inhibitory effect on these isolates. The antibacterial activities of the mouthwashes were determined by using the antimicrobial susceptibility testing method. Data obtained from the study indicated that the three mouthwashes 001, 002, and 003 had inhibitory effects on *S. mutans* (143.15 mm, 31.18 mm, 118.84 mm), *S. aureus* (113.11 mm, 3.14 mm, 50.27 mm) and *C. albicans* (56.75 mm, 15.91 mm, 9.62 mm). Different active components of these mouthwashes may account for their various areas of inhibition on these isolates as each active component has its own designated efficacy. The results revealed that mouthwash 001 and 003 had more active antimicrobial properties on the bacteria isolates whereas mouthwash 002 had little antimicrobial properties on the bacterial isolates but more on the fungal isolate.

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1. INTRODUCTION

The World Health Organization estimates that, 60-90% of school children and approximately 100% of adults have dental problems globally [1].

The oral cavity is inhabited by a diverse microflora that may include bacteria, fungi, mycoplasma, protozoa and possibly viral flora of which bacteria are the predominant group. The oral cavity houses various habitats for microorganisms like, the mucosal surfaces and teeth which support the growth of microbial communities [2].

Poor oral hygiene causes accumulation of metabolites from this oral flora, through which dental caries, gingivitis, and periodontitis will be induced [3,4].

The development of preventive methods, treatments and products which are safe, effective and economical is necessary to improve the oral health which can influence the life and quality of people.

Mouthwash solutions assist good oral hygiene. They are used for reducing oral bacteria, cleaning food remnants and for decreasing oral malodour [5,6]. Mouthwashes can be used for various preventative and therapeutic purposes which include the treatment of oral infections, reducing inflammation, decrease halitosis and to deliver fluoride locally for preventing caries.

There is a wide range of mouthwash commercially available that differ in their taste analgesic or astringent property and antimicrobial effectiveness. This study evaluates the antibacterial effect of three mouthwashes on microbial flora of the oral cavity.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Bingham University, AutaBalefi, Karu, Nasarawa State, Nigeria. This community is situated in the middle belt of Nigeria at longitude 8°32'N 8°18'E and Latitude 8.533°N 8.300°E and is characterised by a tropical sub-humid climate with two distinct seasons; wet and dry seasons. Monthly temperature ranges from 20°C to 34°C and annual rainfall ranges from 1100 mm to about

2000 mm. It occupies a land mass of over 200m², away from Abuja [7].

2.2 Sample Collection

Samples were collected randomly from 30 University students. Sterile swab sticks were labelled accompanied with a questionnaire and were randomly given to consenting students. Sterile swab stick was aseptically used for the collection of samples by rubbing gently around the gums, teeth, tongue and crevices of the mouth and transported immediately to the laboratory for microbiological analyses.

Three types of mouthwashes were used for this study and were designated as 001(Colgate plax), 002 (Listerine) and 003 (Dentiplus). All of these mouthwashes were chosen as a result of the active ingredients in them and also because they are easily available in supermarkets in Nigeria. All three brands of mouthwashes are advertised as having antibacterial agents.

2.3 Sample Processing

Each sample was inoculated by the streaking method unto four different media containing MacConkey agar, Blood agar, Potato Dextrose agar and Nutrient agar. They were then incubated at 37°C for 24 hours.

Biochemical analyses were carried out to determine the bacterial isolates. Identification of isolates on potato dextrose agar was done by using permanent direct mount and observed microscopically for the presence of budding yeast cells. The antibiotic susceptibility pattern of isolates was determined by using the Kirby-Bauer disc diffusion method and measured according to Clinical and Laboratory Standard Institute's manual [8]. To ensure quality control, each streaked media plate was independently examined by two laboratory technicians. A third laboratory technician was employed to read the petridishes to resolve any discrepancies.

3. RESULTS

The organisms isolated from the mouth were *Candida albicans*, *Streptococcus mutans*, and *Staphylococcus aureus*. Table 1 shows the frequency of the isolated organisms ranging from the most common isolates to the least common isolate. The most common isolate was

Staphylococcus aureus (40.67%), followed by *Streptococcus mutans* (32.20%) and *Candida albicans* (27.11%).

Mouthwash 001 had the highest inhibitory effect on all the organisms (*S. mutans*, *S. aureus*, and *C. albicans*) with the values of 143.5 mm, 113.11 mm and 56.75 mm, respectively when compared to mouthwashes 002 and 003 (Fig. 1). Mouthwash 002 exhibited the lowest area of inhibition on *S. aureus* and *S. mutans* whereas a high area of inhibition on *S. mutans*. Mouthwash 003 had the second largest area of inhibition against *S. aureus* (50.27 mm), *S. mutans* (118.4 mm) and *C. albicans* (9.62 mm).

Table 1. Frequency of isolated microorganisms

Microorganisms	Frequency (%)
<i>Candida albicans</i>	27.11
<i>Streptococcus mutans</i>	32.20
<i>Staphylococcus aureus</i>	40.67
Total	100

4. DISCUSSION

The organisms *S. mutans*, *C. albicans*, and *S. aureus* were isolated from the collected samples. According to Jenkinson and Lamont [9,10], the microflora present in the mouth of healthy individuals include these three organisms [11].

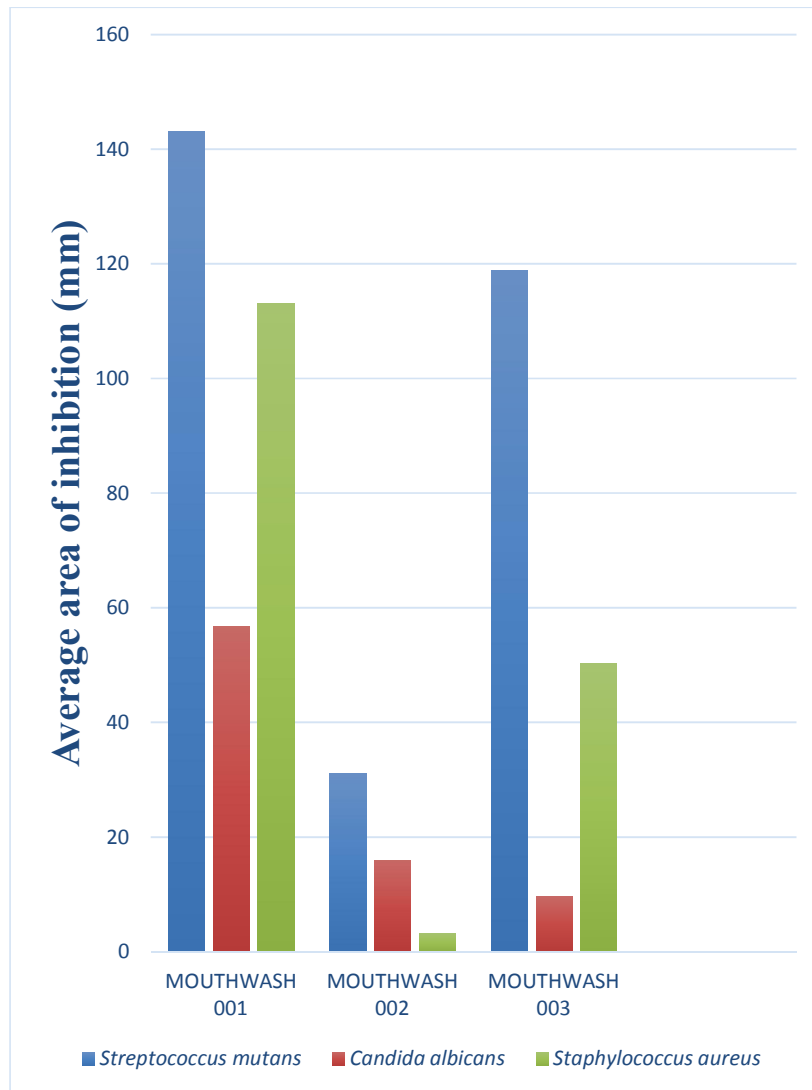


Fig. 1. Antimicrobial susceptibility of isolated organisms to the different mouthwashes

Mouthwash 001 had the highest inhibitory effect on the organisms with the following zones of inhibition; 143.5 mm, 113.11 mm and 56.75 mm, respectively. This might be due to its active ingredient, 0.05% sodium fluoride that is effective in bacterial inhibition. It is alcohol free.

Mouthwash 003 also had a large area of inhibition against *S. aureus* (50.27 mm), *S. mutans* (118.4 mm) and *C. albicans* (9.62 mm) which could be the effect of its active ingredient, 0.05% sodium fluoride, as recorded for mouthwash 001. It is also alcohol free. Mouthwash 002 composed of active ingredients such as thymol and alcohol. The product tested does not contain sodium fluoride. It had the lowest area of inhibition on *S. aureus* and *S. mutans* while high area of inhibition on *S. mutans* when compared to mouthwash 003. The alcohol does not seem to have apparent effect on rest of the isolates. However, the contribution of it cannot be ignored completely.

5. CONCLUSION

It is concluded that the organisms isolated from the mouth of Bingham University students are *S. mutans*, *S. aureus* and *C. albicans*, which are known to be present in the mouth of healthy individuals and cause dental caries, plaque and oral thrush, respectively. Additionally, it can be stated that the various mouthwashes used in this study have been found to be useful in inhibiting the growth of dental caries, plaque and oral thrush causing organisms.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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