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Antibacterial Effects of Some Commonly Used Toothpastes in Nigeria

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Abstract: *The antibacterial quality as well as the effectiveness of ten brands of toothpastes marketed in Nigeria, were assessed for reducing the bacterial flora of the mouth. The toothpastes were randomly purchased from markets in Enugu, Nigeria. One brand contained triclosan and sodium fluoride as antibacterial while seven contained sodium fluoride only. Two were herbal. Thirteen students were enrolled who brushed their teeth with 50mg of the toothpastes after an initial rinse with sterile water; each rinse was collected in a sterile container and then cultured on three different media. They were incubated at 37C for 24 hours. Percentage bacterial reduction or increase was calculated from the differences in bacterial counts before and after brushing. There was increase in mouth bacterial counts after the use of six brands of the toothpastes. No toothpaste achieved 100% reduction of oral bacterial flora. TPI achieved the highest reduction in oral bacterial flora (-11.7%); followed by TP4 (-6%).*

Keywords: *Toothpaste, antibacterial, oral bacteria,*

I. Introduction

An adult's mouth may contain 500 to 1000 different types of bacteria as part of the human oral flora about 100 to 200 species may live in it at any given time. Those who care for their teeth and have a relatively clean mouth have 1000 to 100,000 bacteria living on their tooth surfaces. Those that do not have a clean mouth have between 100 million bacteria on their tooth surfaces [1]. (Steven et. al 2008).

Normal flora of the mouth include Staphylococcus salivarius, Enterococcus fecalis, Streptococcus pneumoniae, Streptococcus pyogenes, Neisseria meningitides, Escherichia coli, Heamoplus influenzae, Actinoomycetes, Mycoplasmas, Pseudomonas aeruginosa. Others are Lactobacilli, Corynebacteria, Neisseria, Proteus, Clostridium and other Streptococci and Staphylococci [2]. (Rogers 2008)

Toothpaste is a paste or gel dentifrice used with a toothbrush as an accessory to clean and maintain the aesthetic and health of teeth. Toothpaste is used to promote oral hygiene. It serves as an abrasive that aids in removing dental plaque and food from the teeth, assists in suppression of halitosis, and delivers active ingredients such as fluoride or xylitol to help prevent tooth and gum disease (gingivitis). Most of the cleaning is achieved by the mechanical action of the toothbrush and not by the toothpaste [3]. (Wolfgang 2005). Salt and baking soda are among material that can be substituted for commercial toothpaste. In the last decade many consumers have switched over to herbal toothpastes in order to avoid synthetic and artificial flavors commonly found in regular toothpastes.The aim of this study is to isolate and identify the bacterial present in the mouth of the participants and to determine the effects of toothpastes on the isolated bacteria.

II. Methods

Table 1 shows the toothpastes used in this study and their constituents.

2.1 Sampling:

Each student was given 20 ml of sterile water to rinse his or her mouth at the beginning of the study after which 50 mg of each toothpaste was given to each of them in the new toothpastes. Sterile distilled water was again given to them to rinse their mouths for two minutes. The water used for each rinsing was collected into different sterile universal containers for laboratory analysis.

2.2 Culturing:

Each of the samples (pre and post toothpaste rinse)was cultured on three different culture media namely blood agar, Mac Conkey agar, Chocolate blood agar with enriched carbon dioxide (C02). All cultures were incubated at 37 C for 24 hours and inspected after for growth suppression or total inhibition of growth. The bacterial colonies were characterized on the basis of their morphology and pigmentation of their colonies.

Thin smears of the isolates were made on clean slides, Gram stained and examined under the microscope. Isolates were identified by biochemical tests.

Table I. Toothpastes and their Constituents

Brand Code	Ingredients
Tp 1	Sodium fluoride 0.306% (1350 ppm Fluoride ion), Sodium fluoride (1450 ppm), fluoride sorbitol, water, hydrated silica, sodium lauryl sulfate, PEG -32 Flavor, cellulose gum.
Tp 2	Sodium fluoride (1450 ppm fluoride sorbitol, water, hydrated silica), sodium lauryl sulfate, PEG - 32 Flavour, cellulose gum, sodium saccharin, eugenol, cl16035,cl17200
Tp 3	Aqua calcium corbonate, sorbital, Alumina, sodium Lauryl sulfate Aroma, Sodium monotluoro phosphate, cellulose gum, sodium, Biocarbondate, x anthan gum, sodium silicate, methylparaben, limonene
Tp 4	Aqua, Sorbital, hydrated silica PEG-6 sodium lauryl sulfate, Tetrapotassium, Aroma cellulose gum, xanthan gum Sodium fluoride carbonate
Tp 5	Rosemary, Chamonila, safe, Nyroh,sorbitol, purified water, polyethylene glycol 1500, sodium lauye 804, cellulose gum sodium sauhaine, Trisodotho po4 citric acid, FD & C blue
Tp 6	Potassium nitrate 5%w/w, sodium fluoride 0.0306%,w/w (1400 ppm fluoride) sorbitol glycerol, silica dental type, purified water, Sod. Lauri sulphate, titranum Dioxide (EII), saceham sodium, milk flavor 826443, cocamido puple betain xanthan gum and macrosie.
Tp 7	Sod.0.32% fluoride, triclosan (sorltoe, silica, wawo, sod. lauryl S04, fluoro-cellulose gum, Sod. saccarin, food grade red colour
Tp 8	Sod. Fluoride 0.306% w/w, aqua/water hydrated Silica sorbitol, glycerine, PEG 6, Sod. Lauryl S04, aroma/flavor,canageenan, xanthan gum, sod. Fluoride, sod. Saccharin, Titanum dioxide, eucalyptus. Globules matha Arvensis, salvia officialis, Anthenis nobilis, ClA7492, Cl74260.
Tp 9	Sorbitol, hydrated silica, sod. Lauryl sulphate aroma, cellulose gum, trisod. P04, Sod p04, sod. Saccharin, sod fluoride, 1100ppm, carbomar, limonen, mica, cl77891, cl42090, cl19140
Tp 10	Sodium fluoride (1450 ppm) fluoride herbal extract-encalyptus, peppermint, sage thyme, aloe vera leaf extract, sorbitol, aqua hydrated silica, sodium lauryl sulfate, PEG-32, Aroma cellulose gum, sodium fluoride sodium saccharin, aloe babadensis leaf extract limonen, cl73360 cl74269, cl 772681,cl. 77492, cl.77891

Table II: Organisms found before using toothpaste and after using toothpastes

Brands of toothpaste codes	Organisms Isolated Before Using Toothpaste	Organisms Isolated After Using Toothpaste
Tp1	E. coli, Klebsiella pneumoniae, Streptoccous mutans	Klebsiella pneumoniae Streptoccous mutans
Tp2	Salmonella typhi,, Streptococcus mutans, Staphylococcus aureus. Kliebsiella pnuemoniae	Staphylococcus aureus Salmonella typhi
Tp3	Proteus, E.coli, Klebsiella pneumoniae	Klebsiella pneumoniae Salmonella typhi
Tp4	Klebsiella pneumoniae, E.coli, Salmonella typhi	Salmonella typhi
Tp5	K. pneumoniae, S mutans	K. pneumoniae. S mutans
Tp6	K pneumoniae, S. mutans	K. pneumoniae, S.mutans
Tp7	K. pneumoniae, S. typhi, S. mutans	S. mutans
Tp8	K. pneumoniae, S. aureus	S. mutans, K. pneumoniae
Tp9	K. pneumoniae, S. mutans	K. pneumoniae, S. mutans
ENO 10	K. pneumoniae, S. mutans Proteus spp.	S. mutans

Table III Effectiveness of Toothpaste in Removing Mouth Bacteria

Toothpaste brand	Bacteria counts before using toothpastes	Bacteria count after using tooth paste (cfu)	Increase/Reduction in mouth bacteria counts (cfu)	% increase/ reduction in mouth bacteria counts (CFU)
TP1	850,200	750,500	-99,700	-11.7%
TP2	400,000	450,000	+50,000	+12.5%
TP3	560,000	635,000	+75,000	+13.4%
TP4	540,000	508.3225	-32,475	-6%
TP5	450,000	430,000	-20,000	-4.4%
TP6	800,000	900,500	+100,500	+12.6%
TP7	360,000	400,000	+50,000	+14.3%
TP8	300,000	400,000	+100,000	+33.3%
TP9	400,200	465,000	+54,800	+13.7%
TP10	670,000	660,000	-10,000	-1.5%

III. Discussion

Table III shows the reduction or increase in oral bacterial flora counts for the toothpaste brands. Six toothpaste where found to significantly increase bacterial counts. The reason for this is not clear but maybe due to the anti-bacterial ingredients in the toothpastes, No toothpaste achieved 100% reduction in oral bacterial flora, The highest reduction was obtained by TP I (11.7%). The herbal toothpastes had the lowest reduction. The results would appear to call for further research into possible value of toothpastes in reducing oral bacterial flora. Four toothpastes (40%) reduced oral bacterial flora to varying degrees. Increase In oral bacterial was observed in 60% of the toothpastes i.e TP2, TP3. TP6, TP7, TP8, and TP9. TP8 had the highest increase. Why there was increase in bacteria counts after brushing cannot be explained. As also reported in other studies,

fluoride containing toothpastes did not do better in reducing bacteria flora[4]. (Rule , et al 2005, [5].Fine et.al. 2000).

The number of bacteria increased after brushing in the case of TP2, TP3, and TP6, and TP7,TP8, and TP9. Salmonella typhi was introduced in one case. (TP3) after brushing whereas it was present before brushing in TP2 and TP4. The presence of Salmonella typhi in the mouth poses a serious health hazard as its entry into the blood stream could cause typhoid fever. Typhoid fever was found to be common in Enugu in a previous study[6]. (Ohanu & Ogeneh, 2014).

Two out of the three herbal toothpastes (TP5 and TP10) achieved the lowest reductions (-4.4& and -1.5%) respectively. This explains why more people are switching over to herbal toothpaste. This trend was reported in another study[7] (Sheen et. al 2000). Bacterial isolated before brushing included: **Staphylococcus aureus, Streptococcus mutans, Klebsiella pneumoniae, Salmonella typhi, E. coli and some Proteus species.** The presence of E, coli probably suggests fecal contamination from the hand or water during brushing, since E. coli is not a normal resident flora of the mouth. None of these bacteria was completely removed by brushing with any toothpaste tested although some reduced their numbers to varying degrees.

The poor antibacterial quality of these toothpastes maybe due to poor storage as some of them may have been left on the shelves for long before being sold, thus subjecting them to adverse environmental conditions. This may lead to loss of potency in some of the antibacterial constituents.

In conclusion, The results from this study shows that none of the toothpastes marketed in Nigeria are of good antibacterial quality, The efficacy of the toothpaste in reducing oral bacterial flora is poor, for no brand of toothpaste was found to reduce oral bacterial flora by up TP 15%. Therefore the results from this study would appear to call for additional research into the possible value of toothpastes marketed in Nigeria.

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