The Role Of Various Toothpaste In Reduction Of Bacteria Load In The Mouth

Abubakar El-Ishaq#, Lawan Bello and Ahmad Abdul Azeez Aidi

School Of Scienc and Technology Science Laboratory Technology Department
Federal Polytechnic, P.M.B.1006, Damaturu.

ABSTRACT: This research work was done to ascertain the effect of toothpaste on plaque. The work involved ten different brands of toothpastes: - Colgate, Oral B, Smile up, Close- up, Herbal Dabur, Maclean, My- My, fluoride, Angola and Olive. The amount of bacteria in the mouth was reduced after brushing the teeth with toothpaste, the following bacteria growth was recorded: Colgate having 0.2±0.1mm, Close- up 0.25±0.1mm, Olive 0.26±0.21mm, My- My 0.25±0.07mm, Herbal Dabur 0.28±0.02mm, fluoride 0.3±0.1mm,Oral B 0.3±0.21mm, Angola 0.33±0.11mm, Smile up 0.33±0.05mm, Maclean 0.4±0.2mm, and. Colgate was fund to be more effective in bacterial load reduction than the rest.

Keywords: Antimicrobial, Antifungal, Enamel, triclosan, plaque and gingivitis

INTRODUCTION

Bacteria constitutes a large domain of prokaryotic micro organisms. Typically a few micrometers in length, bacteria have a wide range of shapes, ranging from spheres to rods and spirals. Bacteria were among the first life forms to appear on earth, and are present in most habitats on the planet, growth in soil, acidic hot springs, radioactive waste, water and deep in the earth crust as well as in organic matter and the live body of plants and animals, providing outstanding examples of mutualisms in the digestive tracks of Humans, Termites and Cockroaches (Akamo, 2001).

There are typically 40 million bacteria cells in a gram of soil and million bacteria cell in milliliter of fresh water: in all, there approximately five nonillion (5X10^30) bacteria on earth, forming a biomass that exceed that of all plants and animals. Bacteria are vital in recycling nutrient, with many steps in nutrient cycles depending on these organisms, such as the fixation of nitrogen from the atmosphere and putrefaction. In the biological communities surrounding hydrothermal vents and cold seeps, bacteria provide the nutrient needed to sustain life by converting dissolved compound such as hydrogen sulphite and methane. Most bacteria have not been characterized, and only about half of the phyla of bacteria have species that can be grown in the Laboratory. The study of bacteria is known as bacteriology a branch as microbiology (Atlas, 2005).

There are approximately ten times as many bacterial cells in the human flora as there are many human cell in the body, with large numbers of bacterial on the skin and as gut flora. The vast majority of the bacteria in the body are rendered harmless by the protective effect of the immune system, and a few are beneficial. However, a few species of bacteria are pathogenic and cause infectious disease, including cholera, syphilis, anthrax, leprosy, and bubonic plaque. The most common fatal bacterial disease are respiratory infections; with tuberculosis alone killing about 2 million people a year, mostly in sub-Sahara Africa. In developed countries, antibiotic are used to treat bacteria infections and in agriculture, so antibiotic resistance in sewage treatment and the breakdown of oil spills, the production of cheese and yoghurts through fermentation, the discovery of gold, palladium, copper and other metals in the mining sector, as well as in biotechnology, and the manufacture of antibiotics and other chemicals (Holt , 2004).

Once regarded as plants constituting the class schizomycetes, bacteria are now classified as prokaryotes. Unlike cells of animals and other eukaryotes bacterial cells donot contain a nucleus and rarely harbor membrane bound organelles. Although the term bacteria traditionally included all prokaryotes, the scientific classification changed after the discovery in the 1990s that prokaryotes consist of two different groups of organisms that evolved independently from ancient common ancestors. These evolutionary domains are called bacteria and Achaea (Martinko, 2005).
**Toothpaste**

Paste or gel *dentifrice* used with a toothbrush as an accessory to clean and maintain the aesthetics and health teeth. Toothpaste is used to promote oral hygiene; it serve as an abrasive that aids in removing the dental plaque and food from the teeth, assists in suppressing *halitosis* (bad breath), and delivers active ingredients (mainly fluoride) to help prevent tooth and gum disease like gingivitis. Most of the cleaning is achieved by the mechanical action of the toothbrush, and not by the tooth paste. Salt and sodium bicarbonate (baking soda) are among materials that can be substituted for commercial toothpaste. Toothpaste is not intended to be swallowed in small amounts.

**history of bacteriology**

Teeth cleaning agents date as far back as 5,000BC. Egypt, the Roman Empire, Greece and China used various formular over thousands of years. The first commercial toothpaste didn't appear until the 1800s, however, and it was quite a bit different than our modern versions of toothpaste.

Egyptians in ancient times were cleaning teeth with a cream made of eggshells and powdered ashes of oxen hooves, mixed with myrrh, pumice, and water. By, 500BC; people in China, Greece and Rome were using crushed oyster and crab shells, along with crushed bones, hooves and horns of various animals in teeth powders. They added charcoal or bark powder for breath-freshening. Over time, the Chinese people added ginseng, mint and salt, mint leaves and iris. The ingenious Romans added hartshorn for it ammonia bleaching properties, then added human urine, which was also used in lauding. The Roman Emperor Nero even levied a tax on urine in first century A.D. people either used sticks, frayed twig or their fingers as brushes. Ancient writers indicate than people used all these sort of mixtures to clean their teeth and make them white, fix loose teeth, strengthen their gums and bring relief for tooth-aches.

Antonie van Leeuwenhoek, the first microbiologist and the first person to observe bacteria using a microscope. Bacteria were first observed by Antonie van Leeuwenhoek in 1676, using a single lens microscope of his own design (Akamo, 2001). He called them animalcules and published his observations in a series of letters to the Royal Society (Atlas, 2000). The name bacterium was introduced much latter by Christian Gottfried Ehrenberg in 1828, (Hugenholtz et al., 1998). In fact, bacterium was a genus that contained non spore forming rod-shaped bacteria, (Funke et al., 2004), as opposed to bacillus, a genus of spore forming rod shape bacteria defined by Ehrenberg in 1835 (Shivery et al., 2006).

Louis Pasteur demonstrated in 1859 that the fermentation process is cause by growth of micro organisms, and that this growth is not due to spontaneous generation. (yeast and molds, commonly associated with fermentation, are not bacteria, but rather fungi.) Along with his contemporary Robert Koch, Pasteur was an early advocate of the germ theory of disease (Shivery, 2006). Robert Koch was a pioneer in medical microbiology and worked on cholera, anthrax and tuberculosis. In his research into tuberculosis, Koch finally proved the germ theory, for which he was awarded a noble prize in 1905 (Funke et al., 2004). In Koch's postulates, he set out criteria to test if an organism is the cause of a disease, and these postulates are still in use today.

Though it was known in the nineteenth century that bacteria are the cause of many diseases, no effective antibacteria treatment were available. In 1910, Paul Ehrich developed the first antibiotic, by changing dyes that selectively stained *Treponema pallidum* the spirochaete that cause syphilis into compounds that selectively killed the pathogen (Martinko, 2005). Ehrich had prize for his work on immunology, and pioneered the use of stains to detect and identify bacteria, with his work being the basis of the gram stain and the Ziehl Neelsen stain. A major step forward in the study of bacteria was the recognition in 1977 by Carl Woese that archaea have a separate line of evolutionary descent from bacteria. This new phylogenetic taxonomy was based on the sequencing of 16s ribosomal RNA, and divided prokaryotes into two evolutionary domains, as part of the three-domains system. (Hugenholtz et al., 1998).

**NEW ANALYSIS REVEALS HUMAN MOUTH CARRIES MORE GERMS THAN EXPECTED**

The human mouth is awash with bacteria. Mostly neighborly bugs, they live on our teeth and gums helping to digest food and to ward of attack by less friendly, disease-causing bacteria that can steal their way in. Standard researchers have now shown that many of these oral inhabitants exist than previously thought. Using a combination of old and new scientific method to study a scraping of plaque from a healthy mouth, 35 unique bacteria that microbiologists had never before was recorded. Some were closely related to bacteria that scientists are familiar with, but others were very different (Weidenbach, 2001).

Knowing more about the bacteria that reside in a normal, healthy mouth may help physicians understand changes in the bacterial population that can lead to *gingivitis, periodontitis* and *tooth decay*. “Data suggest that a significant proportion of the resistant human bacteria flora remain poorly characterized, even within this well studied and familiar microbial environment.” (David et al., 2000).

According to Relman, the subgingival cravice, the deep gum pocket cradling each tooth has been repeatedly scrutinized in the search of microbes. Even though almost 500 bacteria stains have been identified already, Relman believes this may be only a fraction of the bacteria living in this oral groove.
Oral bacteria have traditionally been studied by taking a scraping or sample from inside the mouth, growing the bugs in the Laboratory and then identifying different species according to biochemical tests and the type of food sources that each bacteria prefers. Using this method, the Relman team identified bacteria found in a sample of plaque taken from the subgigival crevice.

**INGREDIENTS OF TOOTH PASTE**

**ACTIVE INGREDIENTS:**
- Flouride
- Antibacterial agents, most often triclosan is used to control plaque.
- Desensitizing agents
- Anti-tartar agents
- Sodium bicarbonate (baking soda)
- Enzymes, to enhance the antibacterial properties for saliva
- Xylitol, a non-sugar sweetener, which reduces levels of cariogenic (causing tooth decay) bacterial in the mouth and enhances reminerazation.

(Natural toothpastes may contain a variety of ingredients anything from oil of ginger to seaweed extract.)

**INACTIVE INGREDIENTS:**
- Water
- Detergents, to make the toothpaste foam
- Binding agents
- Humectants to retain moisture
- Flavouring, sweetening and colour agents like peppermint, spear mint, cinnamon, wintergreen and menthol.
- Preservatives
- Abrasives for cleaning and polishing

(Retrieve from ask.yahoo.com 26-01-2013)

**FLOURIDE MODE OF ACTION**

The action flouride on enamel: Enamel consists primarily of a calcium- phosphate- based crystalline mineral called hydroxyapatite (HAP). (Arends et al., 2000).

The HAP crystals are packed tightly together to form millions of microscopic prisms and lattices. Flouride is incorporated into the solid crystal lattices by iso-ionic exchange to form flourhydroxyapatite (FAP). This form of enamel is harder than the naturally occurring HAP and more resistance to decay.

This can be precipitated on the enamel surface and act as source of flouride ions and may also act as a barrier to demineralization. The CaF₂ derived flouride ions are released in acidic conditions and either diffuse rapidly on to the underlying enamel, resulting in formation of FAP and subsequent enamel hardening or increase flouride level in the saliva.

The concentration of flouride ions and pH of the saliva effect the extent and rate of benefit associated with flouride by altering the degree of saturation of FAD. (Arend et al., 2000). Even at very low concentrations in saliva, flouride drives the thermodynamic equilibrium for remineralization by calcium and phosphate from saliva. In addition to improving the balance remineralization and demineralization, flouride may also have an antimicrobial effects. (Tencate, 2004). Flouride inhibits a step in glycolysis, which slows down plaque metabolism. The rate of baterial reproduction may be decreased leading to reduction in rate of plaque growth and acid production.

In summary, flouride can protect against caries in three distinct ways:
1. It makes the tooth enamel more resistant to demineralization by converting hydroxyapatite, which is less susceptible to acid attack by plaque bacteria.
2. It promotes remineralization of tooth enamel in areas that have been demineralized, by favouring the precipitation of flourhydroxyapatite from saliva.
3. It inhibits the ability of plaque bacteria to grow and produce acid that can attacks the teeth.

**HOW FLOURIDE CONTROL TOOTH DECAY**

Tooth decay begins when the outer surface of the tooth is attacked by acid. The acid is produced by bacteria which live on the surface of the teeth as a layer called plaque. When food or drinks containing sugars enter the month, the bacteria within the plaque rapidly converts the sugars into acid, in contact with the tooth surface for up to 2 hours before it is neutralized by saliva. During the time that the plaque is acidic, some of the calcium and phosphate minerals of which enamel is largely composed, are dissolved out of the enamel into the plaque. This process is called, demineralization. However, once the plaque acid has been neutralized and minerals can return
to the enamel surface - a process called remineralization. This whole process is often described as an “ionic seesaw” in which mineral ions constantly move back and forth between the tooth surface. (www.flourideaction.com.)

**TRICLOSAN ACTIONS ON TOOTH PASTE**

Triclosan is an antibacteria and antifungal agent. It is a polychlorophenoxyphenol. They provide an extra benefit to health beyond its anti-gingivitis effect in toothpaste. Triclosan has been used since 1972 and is present in soaps (0.10-1.00%) deodorants, toothpastes, mouthwashes and cleaning supplies.

Triclosan has been showed to be effective in reducing and controlling bacterial contamination on the hands and on treated products.

\[
\begin{align*}
\text{Triclosan (polychlorophenoxyphenol)}
\end{align*}
\]

**MATERIAL AND METHODS**

**preparation of nutrient agar**

Nutrient agar was prepared by dissolving 28g of the agar powder in 100ml of distilled water. It was thoroughly mixed and sterilized in an autoclave at 121°C for 30mins. The agar was allowed to cool at about 45°C before pouring it into various Petri dishes. The plates were allowed to get set. The plates were then inoculated with the samples.

**procedure**

The 20 Petri dishes that are prepared using agar are stored in a refrigerator. The Petri dishes are brought to room temperature before the start of the experiment by taking them out of the refrigerator and allowing them to attain room temperature.

Using a different brand of toothpaste each, the same type of toothbrush was used in all cases.

On the first day of the experiments the toothpaste was used by the participants. First, the participants were asked to rinse his mouth for 5 second and to spit out the water.

The sterilized swap was first made damp using the sterilized water. The swap rubbed over the front and back teeth of the participant and then inoculated on the surface of the Petri dish. The cover was closed and the Petri dish is marked “Before”. The Petri dishes was kept in cool shady places for the bacterial to grow.

The participants were then brush their tooth’s using the toothpaste according to the requirements set out as mentioned. After brushing tooth’s, it was also swaped and inoculated again and the Petri dish was marked “After”. The diameter of the bacteria colonies was measured and recorded after three 72Hours/3day.

**RESULTS AND DISCUSSION**

**RESULTS**

The table bellow shows the growth of the bacteria colony in the agar Petri dish in millimeters(mm).

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Oral-B</th>
<th>Close-up</th>
<th>Olive</th>
<th>Smile-up</th>
<th>Maclean</th>
<th>Colgate</th>
<th>My-my</th>
<th>Dabur Herbal</th>
<th>Flouride</th>
<th>Angola</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before brush</td>
<td>0.5±0.1</td>
<td>0.36±0.05</td>
<td>0.46±0.05</td>
<td>0.36±0.05</td>
<td>0.4±0.1</td>
<td>0.4±0.1</td>
<td>0.35±0.1</td>
<td>0.36±0.0</td>
<td>3.8±0.0</td>
<td>0.41±0.07</td>
</tr>
<tr>
<td>After brush</td>
<td>0.3±0.21</td>
<td>0.25±0.1</td>
<td>0.26±0.21</td>
<td>0.33±0.05</td>
<td>0.4±0.2</td>
<td>0.2±0.01</td>
<td>0.25±0.07</td>
<td>0.28±0.0</td>
<td>0.3±0.1</td>
<td>0.33±0.11</td>
</tr>
</tbody>
</table>

The result are in triplicate, Means±Standard Error (SE)
DISCUSSION

The results obtained from this research work shows that Colgate toothpaste has 99.7% of the active ingredients, which indicate that Colgate toothpaste has the highest concentration of the active ingredient than the rest of the sample. These indicate that the action of the Colgate toothpaste has more effect on plaque bacteria, also make the tooth enamel more resistance to demineralization than the rest of the tooth paste.

Sample like Oral-B, Close up and Herbals, Maclean’s, also has an active ingredient which also reduces or promote remineralization of the tooth enamel having 85-89% of the active ingredient. These action shows that they are also active because they are also more or less active in tooth’s plaque. On other toothpaste like fluoride, simile up, olive and Angola are also active reduce the amount of plaque leading to demineralization of tooth enamels showing that some little active ingredient are also present in these types of toothpaste samples. Therefore Colgate toothpaste and sometime oral B, Close –up, Herbals and MacLean’s are mostly effective and active types of tooth paste to be use for us to have a healthy teeth.

CONCLUSION

Within the limit of the research carried out shows that there are plenty of bacteria and other micro organism living in our mouth. These bacteria attack the food left over. That sticks to, and in between our teeth. They cause our teeth to decay, forming plaque and causing bad breath. When they digest sugar and starch that stick to our teeth’s they produce acids that will dissolve tooth enamel.

Some types of toothpaste are even able to prevent ingredient in toothpaste is fluoride. It helps in strengthening the tooth surface and prevents bacteria growth. It also helps to repair tooth decay in the early stages. Another ingredient in tooth paste that help in fighting bacteria is Triclosan, an anti bacteria agent.

RECOMMENDATIONS

In view of the research work it is thereby recommended as follows:

- Proper brushing of teeth everyday with toothpaste is very important for our dental hygiene.
- Using toothpaste that contains active ingredient together with proper brushing techniques can help in getting rid of plaque and also remove bacteria and loss of teeth can be prevented.

APPENDIX I

REFERENCES