

5-11-2015

The Effect of Cheese on the pH Levels in the Oral Cavity

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THE EFFECT OF CHEESE ON THE PH LEVELS IN THE ORAL CAVITY

A Capstone Experience/Thesis Project

Presented in Partial Fulfillment of the Requirements for

the Degree Bachelor of Science with

Honors College Graduate Distinction at Western Kentucky University

By:

Madison R. Hayden

Western Kentucky University
2015

CE/T Committee:

Dr. Lynn Austin, Advisor

Professor Dianna Ransdell

Dr. Clay Motley

Approved by

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2015

ABSTRACT

In the Fall of 2014, research was conducted with 20 participants on the campus of Western Kentucky University. Participants were given two ounces of Coca Cola[®] to drink and the pH level in their mouth was tested one minute later. After waiting a minute, the participants were given a one ounce square of mild cheddar cheese to eat and the pH level was tested again one minute later. For further study, this project will be expanded to include more subjects as well as an increased exposure time to Coca Cola[®]. This research is conducted to help support that cheese can help increase the pH level in the oral cavity by reducing bacteria which in the long term could reduce decay. The cheese helps to provide a protective shield around the teeth that fights the release of acids. Cheese also increases the flow of saliva, which helps to keep the teeth cleansed, preventing bacteria from adhering to tooth surfaces. Also, the consumption of cheese also increases calcium and phosphorus levels, which helps reduce the acidity of dental biofilm.

Keywords: pH, , dental biofilm, cheese, Coca Cola[®], decay, dental hygiene

Dedicated to my Savior, Jesus Christ along with the Faculty and Staff of the WKU Dental Hygiene Program who helped me pursue my dream of being a dental hygienist and always making me strive to be the best I can be.

ACKNOWLEDGEMENTS

I would first like to thank Western Kentucky Universities Dental Hygiene Program director, Dr. Lynn Austin, for her encouraging words of wisdom and guidance especially during the last semester of Dental Hygiene. Without your support, I could not have done it.

To the faculty and staff of the dental hygiene program, thank you for always believing in us and providing us with the best education. The following thanks goes to Dr. Lynn Austin, RDH, MPH, PHD, Dr. Joseph Evans, DDS, Dr. Terry Dean, DMD, Mrs. Becky Tabor, RDH, MEd, Mrs. Barbara Bush, RDH, MEd, Mrs. Wendi Hulsey, RDH, MDH, Ms. Dianna Ransdell, RDH, Mrs. Julee Burt, RDH, Mrs. Stephanie Riehn, RDH, Miss Jessica Durrant, RDH, Dr. Daniel Carter, DMD, Mrs. Bonny Petty, RDH, Mr. Ken Whitley, MS, RN, Mrs. Jo Ellen Scruggs, and Mrs. Lorie Ryan.

The members of the defense panel, Ms. Dianna Ransdell and Dr. Clay Motley, for their time and influence on helping me reach the goal of finishing my thesis.

The Dental Hygiene Class of 2015, we did it! They said the next two years would fly by and it is bittersweet for it to all come down to an end. Each and every one of you will forever hold a special place in my heart.

My parents who have stood behind me rather it be athletically or academically. You've both seen me fail and succeed, but you never stopped believing in me. Thank you for molding me into the woman I am today.

To Terry and Lesley Henry, thank you for your constant prayers, words of encouragement, and never ending love. From day one you have taken me in as your own and I could not thank God enough for blessing me with two amazing in-laws.

My fiancé, Mitchell, thank you for always having the patience that love demands. You have always pushed me to be my best and follow my heart. God could not have placed anyone more special in my life to spend forever with.

My Lord and Savior Jesus Christ who constantly reminds me I can do all things through him because he is the one who gives me strength,

VITA

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FIELDS OF STUDY

Major Field: Dental Hygiene

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CHAPTER 1

INTRODUCTION

In the world today, people are consuming acid-producing foods and drinks on a regular basis. Whether it be a bottle of Coke[®], a piece of candy, or other foods containing sugar, Americans today are most likely to consume food that is easy and affordable. These types of foods can help in the process of caries development or tooth decay. The rate at which caries spread can either be at a faster or slower rate depending on factors such as the foods that are eaten, the minerals in saliva, and how often an individual brushes and flosses.

While brushing and flossing your teeth is the best prevention against the spread of caries, there are some alternatives to help reduce the pH level from acid attack when brushing your teeth is not an option. There are many different options on how to help increase the pH level in the oral cavity including modifications in ones' diet. Foods such as cheese can help to serve as a protective barrier or shield around the teeth helping to fight off decay.

An example of this can be found in the results of a study that was conducted on a group of children who consumed dairy products such as milk, yogurt, and cheese. After testing the children, it was shown the cheese created a stronger shield that increased the pH level of the saliva (Reilly, 2013).

Dental caries, also referred to as a cavity, is defined as the formation of cavities in the teeth by the action of bacteria according to the (Merriam-Webster, 2011). According to Cost Helper Help, American's are spending approximately \$50 to \$300 on amalgam(silver) fillings and \$90 to \$450 on composite(tooth colored) fillings on each tooth to prevent the tooth from further decay and to fix the decay that has already taken place (2014). Dental caries affects approximately 60-90% of school-aged children and adults. A restoration, sometimes referred to as a filling, is considered to be the best way to repair a tooth that has decayed. Also, it has been reported that approximately 50% of individuals brush their teeth at least twice a day and 4.5% of adults do not brush their teeth at all. If dentists and dental hygienists can't convince a patient to brush or floss their teeth, why not give them "patient education" that can benefit them without possibly having to change their daily habits. A majority of Americans consume cheese on a daily basis; this study was conducted to determine if consuming cheese could benefit an individual's oral health in addition to the other nutritional values of cheese.

CE/T Statement

What if cheese helped to increase the pH in the oral cavity to help reduce bacteria, which in long term could reduce decay?

CHAPTER 2

REVIEW OF THE LITERATURE

Diet has been shown to be the one of the most important factors in causing tooth decay (Loesche, 1996). This chapter will review studies on how the effects of cheese can help to reduce the amount of bacteria in the oral cavity leading to a possible decrease in caries.

What is pH?

pH is defined as the measurement of something to determine if it is basic or acidic. The pH scale measures from 0.0-14.0. According to the pH scale, 0.0-6.9 is acidic, 7.0 is neutral, and 7.1-14.0 is basic. A pH of 5.5 or lower creates an environment conducive to demineralization of tooth enamel. During the process of making cheese, the pH is tested numerous times using a Milwaukee instrument. The pH of cheeses ranges from 5.1 to 5.9, however there are exceptions to cheeses such as Camembert cheese, which has a pH of 7.4. American and other mild cheeses have a pH measuring approximately 4.98. Soda/Coke products have an estimated pH level of 3.

A base accepts hydrogen ions while an acid donates hydrogen ions. When an acid donates hydrogen ions, there are more hydrogen ions than hydroxide ions in the solution making it lower on the pH scale, which would be a reading between 1-6. When a base accepts a hydrogen ion, the base is known to “soak up” the ions causing the solution to have more hydroxide ions allowing it to be more alkaline and higher on the pH scale

resulting in a reading between 8-14. The pH is measured using a logarithmic scale which compares the alkalinity and acidity of an object Anything measuring as a 7 would be considered neutral meaning it is neither acidic nor basic.

Effects of Cheese

According to the U.S. Academy of General Dentistry, cheese has been proven to increase the alkaline production in saliva helping to form a protective shield around the teeth (2013). The research consisted of 68 children between the ages of twelve and fifteen; the subjects were then divided into three groups. The first group was asked to consume a glass of milk, the other group was asked to consume a daily portion of cheddar cheese, and the third group was asked to consume a dairy product such as yogurt. The pH of their dental plaque was tested before the test and ten minutes, twenty minutes, and thirty minutes after the test.

The pH of the participants who drank the milk and those who ate the yogurt did not change while the pH of the subjects who ate the cheddar cheese had a rapid increase at each of the time intervals. Researchers then went on to state that, since cheese helps to increase the amount of saliva resulting in an increased pH level, this could suggest that cheese has anti-cavity properties that release chemical compounds helping to form a protective shield around the teeth to fight against an acid attack on enamel.

Following the study of the U.S. Academy of General Dentistry, another study was conducted by Ravishankar, et. al. (2013). This study was very similar in terms of the number of participants they used and the way they performed the study. Ravishankar took a group of 68 people who were both caries-active and caries-free and assigned them to three groups at random. Each group was either assigned to the control group or assigned

to eat one of the following: cheese, milk, or yogurt. The participants then had their calcium, phosphorus, pH, and biofilm levels tested.

The subjects were asked to abstain from oral hygiene care for a total of 48 hours and to also refrain from eating prior to the second set of testing the biofilm levels. Results indicated that the subjects who consumed the cheese had the most significant increase in the plaque calcium and phosphorus levels followed by the subjects who consumed the yogurt products. The participants who consumed milk and the ones who were a part of the control group did not experience any increase in the plaque calcium and phosphorus levels.

Results of the study indicated that by eating cheese and yogurt (without sugar added), the overall pH, calcium, and phosphorus levels in the oral cavity helped to provide a more cariostatic property. The authors then stated that the consumption of dairy products can help in remineralization of the tooth surface. Results of this study support the claim that individuals at risk for dental caries should try to consume dairy products on a daily basis especially after eating cariogenic foods. The cheese will help by decreasing *Streptococci mutans* in dental plaque and saliva and the yogurt will also help to promote remineralization of dental enamel by reducing bacterial attachment to the tooth surface.

Summary

There are many products and behaviors that can lead to tooth decay including sodas, cariogenic food, plaque buildup, smoking, diabetes, respiratory issues, and medication side effects. After reviewing the literature, it is apparent that cheese has been shown to help increase the overall pH in the oral cavity.

Still missing from the literature, however, are studies, which examine the effects of calcium-containing products on college students. The next chapter describes methodology that was used to conduct the study.

CHAPTER 3

METHODS AND METHODOLOGY

In the Fall of 2014, the researcher was involved in testing several different subjects to see how cheese affected the pH levels in the oral cavity. After obtaining approval from Western Kentucky University's Institutional Review Board (670051-1), a consent form was then developed (Appendix) so there would be signed permission to participate in the study.

The study was conducted on the campus of Western Kentucky University with a convenience sample of 20 subjects chosen at random by asking if they would like to participate. The participant would first drink two ounces of Coke[®], wait 30 seconds and then have their pH levels tested. Then the participant would eat one square ounce of mild cheddar cheese, wait 30 seconds, and have their pH levels tested again. Subjects with a dairy allergy were excluded from this study.

The control group was a group of 27 Western Kentucky University Dental Hygiene students. After having the consent form signed, the students were asked to drink two ounces of Coke[®] and their pH levels were tested 30 seconds after consumption. The pH of the control group was tested 2 minutes after consumption of the Coke[®] with no buffering agent such as cheese.

Another study conducted in the spring of 2015 further developed this topic to see if cheese has a long lasting benefit or a benefit of only two minutes. This study entailed

having 20 subjects drink Coke[®], waiting 2 minutes, and having the pH levels tested. Then the subjects consumed one square ounce of cheese and waited 5 minutes until the pH level was tested again. The next section will describe results of this study.

CHAPTER 4

RESULTS

The 20 subjects were randomly selected during February 2015. The first measurement that was obtained was the initial pH level. It was found that the average pH level thirty seconds after drinking Coke[®] was between six and seven. The subjects then consumed one ounce of mild cheese. The average pH thirty seconds after eating the cheese was between nine and ten. These results indicated that, the average increase in pH was three points. The evidence from this study suggested that cheese does increase the pH level of the oral cavity. While the pH level of the twenty participants never registered below 5.5 after drinking Coke[®], it is believed that a longer exposure time or greater quantity consumed would have resulted in this.

To follow up on this hypothesis, the researcher conducted another study to determine if a longer exposure would still be beneficial. This time it was found that the average pH two minutes after consumption of the Coke[®] was, on average, five. As before, the subjects then consumed one ounce of mild cheddar cheese. The average pH five minutes after eating the cheese was between ten and eleven. The increased exposure time did have an effect on the pH level. While there was not a drastic increase in cheese compared to thirty seconds, it was shown that cheese did help increase the pH level in the oral cavity to be more basic. Between the minerals in saliva and the natural cleansing

materials cheese promotes, the results confirmed that eating cheese could be a viable option to temporarily neutralize the acids in the oral cavity.

CHAPTER 5

CONCLUSION

The results indicated that cheese does increase the pH of the oral cavity shortly after consumption. While the pH of the 20 participants never registered below 5.5 after drinking Coke[®], the researcher concluded that a longer exposure time or greater quantity consumed did in fact result in an increased pH level.

Dental hygienists are well educated in ways to educate patients on the steps to better their oral health. This could be an excellent piece of advice to give patients especially parents who have children. Throughout the day children do not get the chance to brush their teeth while at school so if a child is more susceptible to decay, it may be appropriate for dental personnel to recommend placing a piece of cheese in a child's lunch box. Whether it be a piece of string cheese or cubes of cheese, this could help to neutralize the pH levels in the oral cavity helping to reduce the amount of decay in the long run.

This suggestion is appropriate for adults and geriatric patients as well, if they are not able to brush their teeth after eating. If dental personnel adopted a practice of recommending that patients eat a piece of cheese to help increase their pH, their mouths would become healthier. In conclusion, ending a meal with cheese could be a viable option to help neutralize the acids in the oral cavity and prevent caries.

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APPENDIX

The Effect of Cheese On The pH Levels in the Oral Cavity Informed Consent

Investigator: Madison Hayden
Coordinator: Dr. Lynn Austin
Department of Allied Health
Program of Dental Hygiene
(270)-745-2427

You are being asked to participate in a project conducted through Western Kentucky University. The university requires that you give your signed agreement to participate in this project.

The investigator will explain in detail the purpose, procedure, and potential benefits/possible risks of participation. Please ask any questions you may have.

If you decide to participate in the project, please sign the last page of this form in the presence of the person who explained the project to you.

Purpose: To assess the pH increasing properties of cheese in the oral cavity.

Procedure:

1. Participants will drink 2 oz. of Coca Cola.
2. pH will be tested either 30 seconds or two minutes later.
3. Participants will eat one 1 oz. square of mild cheddar cheese.
4. pH will be tested either 30 seconds or five minutes later.
5. The difference will be calculated.

Risks: Dairy or Coca Cola allergies.

Benefits: Learning about the capabilities cheese may possess to help increase pH, which may help reduce an environment conducive for tooth decay.

Confidentiality: Any document bearing participant names will be kept in a safe lock box in an instructor's office. All files will be shredded after the conclusion of this project.

Refusal to participate in this study will have no effect on any future service you may be entitled to from the university. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

By signing this you understand that it is not possible to identify all potential risks in an experimental procedure. You also believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Signature of Participant

Date

Witness

Date

The dated approval on this consent form indicates that this project has been reviewed and approved by the Western Kentucky University Institutional Review Board.