**Less sugar intake reduce caries risk**

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***Introduction:***

Sugar is one of the primary sources of energy supply and one of the essential nutrients for the human body, but excessive free sugar intake may cause many health hazards. Among them, the intake of Sugar-sweetened beverages (SSBs) and foods is one of the critical factors of overweight and dental caries[1]. Dental caries are caused by the local loss of hard tissues of teeth due to the acid produced by the fermentation of sugar and bacteria ingested in the mouth. In the oral cavity, Mutans streptococci and Lactobacillus acidophilus are the main bacteria causing the occurrence of dental caries, and they play a vital role in the formation and development of dental caries. When dental plaque adsorbs dietary sugars, they are metabolized by dental plaque microorganisms into organic acids, mainly lactic acid. Afterward, acids will diffuse into the enamel, resulting in demineralization under the subsurface and triggering the caries progression. Calcium hydroxyapatite, the material of which the enamel is composed, generally initiates demineralization at approximately pH 5.5, sometimes known as the "critical pH."Among the many food groups, "sugar and confectionery" contains the most added and free sugars, followed by beverages and delicate baked products, which vary significantly from country to country[2]. However, due to their unique taste, these foods are the daily diet of most children and teenagers, and to a lesser extent, adults and the elderly.

In a daily intake experiment with teenagers, the results indicated that despite the fact that about two-thirds of the participants had received dietary counseling and had been warned repeatedly about consuming excessive Sugar-sweetened beverages, approximately 60% of them continued to consume excessive amounts of Sugar-sweetened beverages on a weekly basis. The experiment also showed that males consumed significantly more Sugar-sweetened beverages than females. And 50% of the participants consumed more than 10% of the recommended amount of sucrose[3]. Therefore, increasing people's awareness that sugar indirectly increases the chance of dental decay while helping them manage their diet is an essential solution to reduce the possibility of dental decay at the fundamental level.

***Assessment***:

For the Sugar Intake and Dental Caries Review project, the main target population to cover is teenagers just entering high school, an age group in a rebellious phase and lacking self-control. Without proper management, this population is at high risk for dental caries. Therefore, the project focuses on educating these teenagers and understanding their level of knowledge about dental care. Our focus is on teenagers in their first year of high school at the John Bowne High School in Flushing, Queens. These high school students are at an age where they enjoy consuming Sugar-sweetened beverages and delicate baked products and are beginning to neglect their oral health. As dental health professionals, we have the technology and knowledge to provide professional assessments to these high school students regarding their sugar intake and dental caries status. We also conduct Individualized Educational Planning to achieve the goal of reducing oral disease, ultimately improving oral health.

There are many assessment methods that can be applied to this type of scenario. Some of the methods implemented are written surveys as questions and direct observations. We began with a survey in which students were asked to choose to answer about how many 355ml cans of sugary beverages and how many baked products containing sugar they consumed per week. The data indicated that 85% of the 55 high school students that randomly selected consumed more than seven cans of Sugar-sweetened beverages per week. All 55 high school students who went through Type III Examinations and Inspections discovered that 76% of the 55 high school students had at least one cavity. In addition, 90% of these high school students with cavities consumed more than seven cans of Sugar-sweetened beverages per week. The Sugar Intake and Dental Caries Review project will explain the effects of too much sugar on the teeth and uses a "Tell-Show-Do" method to demonstrate proper teeth brushing and identification of food labels.

***Planning:***

High school students are one of the major groups that consume high sugary food and drinks. They have more freedom on purchasing food but lack of self restriction on the amount of sugar intake. Therefore, it is essential to implement our service learning project there. The most important goal of this project is to raise awareness about the sugary food damage among teenagers and encourage them to start taking care of their teeth. This project is divided into two visits and takes one month for completion. The first visit includes ice-breaker activity, pre-survey questionnaires, tell-show-do, and product recommendations. On the second visit, we are going to evaluate students’ technique on brushing and floss, as well as the ability to interpret food labels. A post-survey will also be given at this time, we will compare it with the pre-survey and see if there are any improvements.

 Since this project takes place in a high school, the first step is to communicate with the principal and the teacher. We will explain how beneficial this project will be for the students, and it only takes about two class periods. Once we have the consent from the school, the next step is to prepare the materials, including two paper surveys, snacks, and drinks with food labels, 11 typodonts, some toothbrushes and floss. The budget for all these supplies should be controlled within 300 dollars. Besides the materials, we will also lecture the participated teachers about the correct way of brushing and flossing technique, so they can be teaching and evaluating the students later on.

On the day of the presentation, we begin with our self-introduction, then distribute some snacks and drinks to the students. After that, have them read and discuss the sugar on the food label. Meanwhile, deliver the fact that sugar can cause negative impacts to the teeth, so they can have a sense of how easily their teeth can get damaged by the food that they see in daily life. It is also necessary to emphasize how to avoid high sugar food and select alternative food. This activity serves as the ice-breaker and hopes to get students’ attention and interest in our project. Next, we will distributed the pre-survey to the randomly selected 55 students. The survey contains 10 multiple choice questions and each question worths 10 points. If students’ answer toward a healthy attitude, they will earn more points. Questions include the number of sealant placement, the amount of weekly sugar consumption, fluoride exposure, frequency of dental visits, oral hygiene home care, anything that reduces salivary flow and some facts about oral hygiene. These questions allow us to have a basic understanding of the caries risk level in this specific population. Then, we will begin the tell-show-do activity. A Youtube video would be the perfect way to show the entire class how to brush and floss their teeth correctly. However, this is not enough for them to retain all the techniques after one-time video playing. A demonstration is needed to reinforce the memory in their head. Due to the Covid-19 outbreak, it is better to limit the exposure to others’ oral cavities without any PPE protection, the hands-on showing part is canceled and replaced by the typodont. Last but not least, we will recommend some toothbrushes, toothpaste and mouth rinse, instruction will also be provided. One month later, we will see these students again for evaluation. We will check if they could perform the correct way of brushing and flossing, and have them fill out the post-survey. Some randomly selected students will also be tested on how to read the food label. After all the surveys are back to us, we will compare the pre- and post- survey and see if any students successfully change their home care habits, the frequency, and the amount of daily sugar consumption.

***Implementation:***

Motivation is required for our Service Learning Project. Therefore, we need to take some efficient action for 55 target students to be willing to reduce their sugar intake. Our project will stimulate students' memory in many ways, combining vision, hearing, and hands-on skills to achieve our goal. Among them, “Tell-show-do” is an essential educational method.

In order to solve the problem more effectively, understanding our respondents' awareness of dental care and perceptions of sugar intake is important. The questionnaires can be considered as a motivation for learning. We prepared two surveys: a pre-survey and a post-survey. In line with our plan, all the students need to answer the questions honestly because they need to return a month later to see if they have improved. After the pre-survey, we will play a 5-minute video[4] showing how sugar food damages the teeth, from enamel to dentin then to the nerve. This video is funny and easy to understand, and it can make students aware of the adverse effects of high sugar foods on their teeth.

After that, we take out the pre-prepared food labels, including Coca-Cola, snack, candy, cookie, pudding, etc., and ask the students to answer the proportion of sugar in each food. Students who answer correctly will receive a free toothbrush. However, if the answer is too different from what is expected, the teachers will help students identify it immediately. This interaction reinforces students' knowledge of the sugar content and increases their confidence in our Service Learning Project.

After the round of prize-winning activities, an essential “Tell-show-do” session will begin. We will play two Youtube videos[5][6], with only two minutes long. One of them teaches students how to use a toothbrush properly (Bass/Modified bass technique); the other shows how to floss appropriately. Both videos are short and powerful. At the same time, the teachers will use typodonts to demonstrate how to use a manual toothbrush: make it circles, place the bristles at a 45-degree angle between the gums and the teeth, and brush 2-3 teeth at a time. Flossing is to use the middle finger to roll the floss together, the thumb and index fingers are to control the strength. The floss must be pulled under the gums and up to the tooth surface, preferably maintaining the “C shape”. The 55 students will divide into 11 groups. Each group has 5 students with one typodont, and they will take turns practicing on it while the video is playing. Combining visual, auditory, and manual manipulation ensures that students have memorable impressions.

At the end of the event, we will recommend some toothbrushes, toothpaste and mouth rinse to the target students with proper instruction. Also, we request that all 55 students who participated today come back a month later to take a post-survey. We will re-evaluate their typodont activity and randomly select 20 students to interview how they read food labels to see if they avoid consuming high-sugar food. Above all, we aim to achieve our goal of “Less Sugar intake reduces caries risk.”

***Evaluation：***

 To evaluate the Service Learning Project properly, a summative evaluation in three parts was used to represent the project results. The first part of the evaluation was to analyze the data collected from the post-survey and compare them to the pre-survey. We sent out 55 pre-surveys by the first visit and 54 data were collected with only 1 surveys being invalided. The average score of the pre-survey was 43 and the medium score was 40. Many students showed less understanding about how sugar intake affected dental caries and daily oral home care methods. A post-survey was then sent to the same group of students in a one-month revisit and 55 valid surveys were collected. The average score of the post-survey was 86 and the medium source 85. Comparing the average score from both surveys showed that the post-survey had increased by 50% and the medium score increased 45 points. Participated students showed improved understanding about oral home care information and sugar intakes increase dental caries risks.

The second part was to analyze the data collected from the toothbrushing and flossing techniques demonstration and compare them to the revisited results. The first set of data shows that during the first demonstration of the tell-show-do activity, 50 of the 55 students can perform both the Bass / Modified Bass toothbrushing technique and “C shape” flossing technique correctly on the typodont with instruction help by the clinician, teachers, and the youtube video. The other 3 students were not able to perform the “C shape” flossing technique, 1 students were not able to perform the Bass / Modified Bass toothbrushing technique, and only 1 student failed to perform neither oral homecare techniques. A 90% success rate was shown in the student's “Tell- show-do” activity, about 10% failed to perform for uncontrollable reasons. During the revisit activity, about 45 students were able to perform both techniques correctly on the typodont models. Other 6 students were not able to perform the “C shape” flossing technique, 2 students were not able to perform the Bass / Modified Bass toothbrushing technique, and 2 students failed to perform neither oral homecare techniques. Comparing both oral homecare techniques demonstrations in two visits, 90% of students remained at a stable rate to perform both oral homecare techniques. Participated students showed an improved understanding of oral homecare techniques.

The third part was analyze the data collected from the randomized interview about food label recognition and food choice. In the total randomized selected 20 students, 17 of them can correctly read sugar content in one serving size, while 3 students remained have confusion calculation the serving size. 15 amount the 20 students reported that they had read the sugar content of the food labels and avoided choosing Sugar-sweetened beverages. 10 of the 20 students reported that they had promoted what they learn from the first visit to their family members. An 85% success rate shows students have improved skills of reading food labels and 75% of them started to choose less sugar content food and beverages. Participated students showed improved skills about food labels recognition, understanding how to avoid high sugar content food and get it into a habit.

***Conclusion:***

In our Services Learning Project, participating students show increased awareness of how sugar indirectly increases the chance of dental decay and the effect of managing their diet and oral home care can reduce the possibility of dental decay. Our project has overall higher success rates as learning motivation increases and as we enforced more “tell-show-do” teaching techniques. In the future extent, we are looking forward to promoting these public health services to more local high schools. Helping more teenagers to improve their oral hygiene and provide dietary counseling.

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