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RESEARCH ARTICLE

Black Tea Jelly Candy (*Camellia Sinensis*) to Increase Salivary Volume in Elderly: Preliminary Research

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ABSTRACT

Background: *Physiological changes in the elderly include decreased saliva production that causes dry mouth, difficulty in chewing and swallowing. Chewing gum and candies with a chewy texture like jelly can help stimulate the salivary glands. Black tea contains some phenolic and flavonoid compounds that have antioxidant properties that can increase the saliva flow rate.* ***Objective:*** *To determine the gap in saliva volume of elderly subjects before and after chewing black tea jelly candy compared to the saliva production when subjects chewed non-black tea candies and the control group (no treatment). This study also determined the prevalence of xerostomia in subjects.* ***Materials and Methods:*** *This field experiment was conducted using a Randomized Controlled Clinical Trials design with a pretest-posttest control group design. 30 elderly subjects aged 45-90 years in the Tresna Werda Budi Mulia 1 Nursing home, Jakarta were selected based on the predetermined inclusion criteria. They signed the informed consent and answered the Summated Xerostomia Inventory Questionnaire (SXI). Salivary volume before and after chewing black tea jelly candy was measured using a measuring cup. Statistical tests consisting of Oneway ANOVA and Dependent T-Test were performed to analyze the data.* ***Results:*** *The prevalence of elderly who complaining of xerostomia in this research was 40%. There was a significant gap in saliva volume between the three groups with p = 0.002 (P<0.05). An increase in saliva volume in the black tea jelly candy treatment group was identified. The average volume before intervention in the black tea jelly candy treatment group was 1.26 mL and after the intervention was 2.15 mL.* ***Conclusion:*** *Chewing black tea jelly candy increase the saliva volume in elderly subjects.*

Keywords: *Black Tea, Dry Mouth, Eelderly, Jelly Candy, Saliva*

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INTRODUCTION

Dry mouth (Xerostomia) often occurs in the elderly due to a decrease in salivary flow (hyposalivation). This physiological problem is caused by the decrease in the number of acinar cells, causing lower saliva production[1]. Saliva contains 99.5% water and other substances consisting of Calcium, Phosphorus, Sodium, and Magnesium. Saliva functions as a lubricant, protector, buffer, cleanser, and anti-bacterial. Low saliva production reduces the protection of the teeth, leading to negative consequences including reduced antibacterial function, inadequate food residue cleansing and reduced buffering due to changes in oral acidity makes the oral environment more acidic. Saliva flow in the mouth is closely related to the pH of saliva which shows the degree of acidity or alkalinity of body fluids. The ideal pH level in saliva is 6.7 (alkaline). Several factors cause changes in salivary pH including the saliva flow rate, oral microorganisms, and the buffering capacity of saliva. The salivary flow rate can be stimulated by mechanical and chemical means. Salivary flow rate can be mechanically increased through masticatory activity and chemically increased by sour, sweet, salty, and bitter tastes that stimulate the salivation reflex[2].

Lozenges can stimulate salivary flow that can treat dry mouth.[3] Chewing sugar-free candy or sucking on hard candies also helps stimulate salivary flow.[4] Research on the effect of different types of candy in treating dry mouth (Xerostomia) has been widely carried out. A research has shown the effect of chewing gum in increasing the salivary flow rate.[5] Other research also showed the ability of black tea in increasing the salivary flow rate.[6,7,8] Black tea produced from the Camellia plant offers positive benefits for health. Black tea contains phenols and flavonoids that give many benefits, including as antioxidants. Black tea is fermented tea favored by many people for its distinctive taste that it is widely used in food products, including black tea jelly candy.

The simplified Xerostomia Inventory (XI) questionnaire called the Summated Xerostomia Inventory (SXI) containing five questions was employed to identify and measure the symptoms and severity of xerostomia[9,10]. The questionnaire was translated into Indonesian language and tested for validity and reliability. [11] Research on xerostomia symptoms in the elderly in Indonesia, particularly those that employed SXI are still limited. This research was carried out to determine the volume of saliva in the elderly subjects before and after consuming black tea jelly candy compared to the control group and non-black tea jelly candy treatment to analyze subject's complaints or self-perception of xerostomia.

MATERIALS AND METHODS

This field-experimental research examined the effects of different treatments on research subjects. The Randomized Controlled Clinical Trials with a pretest-posttest control group design was used.

This research took place in Tresna Werda Budi Mulia 1 Nursing Home, Jakarta in March 2022. Elderly aged 45-90 years were the population of this research, from which 30 samples were selected. This research is preliminary research done to obtain initial data regarding the effect of black tea candy in increasing saliva volume. Since this research was carried out during the COVID-19 pandemic, the researchers were restricted to including more samples and had to strictly apply safe saliva draw technique.

The inclusion criteria included the people aged 45 - 90 years, did not use drugs and therapies that affect saliva, did not suffer from diabetes, rheumatoid arthritis (RA), HIV, or Sjogren's syndrome, and were willing to sign a letter of consent as research subjects. Meanwhile, the exclusion criteria included subjects who did not consent and were not cooperative during the sampling. A simple random sampling technique was performed to

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select 30 samples. The independent variables of this study were the SXI score and treatments with 0.2% black tea jelly candy, jelly candy without black tea, and control without treatment, while the dependent variable was saliva volume. This research has received ethical approval from the ethics committee of YARSI University with registration number: 017/KEP-UY/BIA/I/2022.

The ingredients of black tea jelly candy were black tea, water, sucrose, distilled water, tamarind salt, and beef gelatin. These ingredients are mixed, then heated and then left at room temperature so that candy with the consistency of jelly will be formed. The procedure for collecting saliva at the baseline for the control group was to collect unstimulated saliva in a measuring tube. After 5 minutes, subjects gargled in distilled water before their saliva was collected again. As for the black tea treatment group, before consuming the jelly candy without tea or in the black tea jelly candy, subjects were instructed to slightly bow their heads during saliva collection. Saliva collection was carried out for 5 minutes with the interval of spitting into the saliva container once every 1 minute. The saliva volume in the containers was measured. Then the treatment group was instructed to chew jelly candy for approximately 5 minutes. During the saliva collection in the post-intervention examination after consuming black tea and non-black tea jelly candies, subjects were instructed to slightly bow their heads slightly. Saliva collection was carried out for 5 minutes with the interval of spitting into the saliva container once every 1 minute. The volume of saliva in the container was measured according to the number printed on the container.

Every subject was required to answer the SXI questionnaire which consisted of 5 questions that had been validated to determine the prevalence of xerostomia. Each question is answered in a 3-point Likert scale expressing never = 1; sometimes = 2; and often = 3. All the answers were summarized with a total score ranging between 5-15. The total score was then categorized into categories of normal or no xerostomia complaints (5-7); mild (8-10); moderate (11-13); and severe complaints (greater than 13).[11] The data were then statistically analyzed in Shapiro Wilk normality test, dependent T-Test, Wilcoxon and Oneway ANOVA using SPSS program.

RESULTS

The frequency distribution based on the different groups, number of subjects, sex, age, and saliva volume is presented in the following tables.

Table 1. Frequency distribution based on different treatments and subject's sex

Variable	Group						Total	
	Control		Non-black tea		Black tea			
	N	%	N	%	N	%	N	%
Number of Subjects	10	100	10	100	10	100	30	100
Sex:								
- Male	4	40	4	40	3	30	11	36.7
- Female	6	60	6	60	7	70	19	63.3

The table above shows that each group consists of 10 elderly subject (100%). There were more elderly women (63.3%) than elderly men (36.7%).

Table 2. Subject's complaints of xerostomia based on the SXI

Degree of Severity	Number of Subjects	p value
Normal	18	60%
Mild	5	16.7%
Moderate	3	10%
Severe	4	13.3%
Total	30	100%

Table 2 presents the complaints of xerostomia of 40%, while the 60% of the

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subjects did not complain about having xerostomia.

Table 3. The results of *Wilcoxon* test before and after treatment in the control group

Group	Saliva Volume		*P-value*
	Before	After	
	Median (Min-Max)	Median (Min-Max)	
Control	0.40 (0.1-1.0)	0.21(0.1-0.5)	0.114
Black tea jelly	1.00 (0.2-4.0)	2.15 (0.5-4.0)	0.018*
Non-black tea jelly	1.55 (0.5-3.0)	1.90 (1.0-4.0)	0.059

Table 3 presents the saliva volume before and after the intervention. The control group shows no significant difference with p value of 0.114 (p>0.05). Meanwhile, the one of non-black tea shows no significant difference with p value of 0.059 (p=0.05). In the black-tea treatment group, a significant difference was found in saliva production with p value of 0.018 (p < 0.05).

Table 4. The results of Oneway ANOVA and Posthoc tests among the three groups

Group	ΔSaliva Volume		Post Hoc		
	Mean ± SD	p-value		Jelly	Jelly + Tea
Control	-0,19± 0.32	0.002	Control	0,015	0,001
Jelly	0.35± 0.47		Jelly	-	0.165
Jelly + tea	0.89± 0.89		Jelly + tea	-	-

In the Table 3, gaps in saliva volume (salivary volume after treatment minus saliva volume at baseline) among the three groups indicate a significant difference with a value of P=0.002 (P<0.05). The results of the post hoc follow-up test also show a significant gap between the control group compared to the jelly candy group without tea, namely P = 0.015 (P < 0.05) and the control group with black-tea jelly candy with p = 0.001 (P < 0.05), and no significant difference with P value = 0.165 (p 0.05) between the black-tea candy group and non-black tea group.

DISCUSSIONS

The prevalence of xerostomia among the elderly varies globally. In this study, 40% of the elderly experienced xerostomia (mild, moderate and severe). There were 13.3% of subjects complained of having severe xerostomia are which finding is similar to the previous research showing that 19.1% of elderly subjects had dry mouth is 19.1%.[12] Xerostomia in the elderly can be triggered by various factors including poor health, drugs, radiation therapy, stress, depression, and anxiety.[13] Xerostomia is different from hyposalivation. Xerostomia refers to the condition where the quantity and quality of saliva decrease, while in hyposalivation, the decrease in the amount is physiological from aging.[14] Hyposalivation in the elderly can decrease the health of their oral cavity because saliva helps the natural oral cleansing from food.[15] Hyposalivation in elderly treatments includes mechanical salivary stimulation and gustatory stimulation by chewing candy or by using ingredients that can increase the production of saliva in salivary glands.[16]

Black tea was measured in this study for its potential as an alternative treatment for hyposalivation which causes dry mouth in the elderly. The results of this study indicate that chewing jelly candy can increase saliva volume compared to the control group. Black-tea Jelly candy shows a more significant increase in saliva production compared to the use of non-black tea jelly candy. The black tea content in jelly candy can increase the amount of salivary gland production. Bitter taste from tannins in black tea stimulates the gustatory reflex on the tongue, thereby increasing the salivary flow rate and saliva volume. The combination of mechanical and gustatory stimulation when chewing black tea jelly candy may lead to better

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results compared to non-black tea jelly candy.Saliva secretion can increase due to stimulation of the stomatognathic muscles due to the chewing process. This is what stimulates jelly tea candy which can increase saliva volume mechanically. However, research on the use of black tea to increase saliva volume is still limited. Previous research only presented the potential of black tea in increasing the salivary flow rate.[7,8] Salivary secretion can increase due to the perception of taste that stimulates the taste buds in the lingual papilla.[17]

CONCLUSIONS

Based on the results of this study, it could be concluded that black tea has the potential in increasing the saliva volume production that can be used as an alternative treatment for dry mouth of xerostomia in elderly.

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