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Abstract- Chewing well and eat slowly are good habits for maintaining good health. A slow rise in blood sugar after eating can keep people away from overeating, obesity, and diabetes. In this study, we conducted a subjective self-administered questionnaire survey on chewing and a chewing ability test using chewing ability chewing gum for 34 high school students, 55 university students, and 23 middle-aged people who participated in the university festival. The chewing ability test, a chewing gum manufactured by LOTTE used. As a result, most of the participants knew xylitol and some word, the 8020 campaign (holding 20 teeth at the age of 80). Also, although many participants could bite apples with skin, a few were confident in their teeth. Many participants replied they were chewing their meals well, but a few participants bite 30 times one bite of food. Participants chewed the chew-ability gum 60 times, and the inspector judged the gum color.

Keywords: *chewing power, chewing ability gum, questionnaire survey, university festival.*

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Chewing Questionnaire Survey Results and Chewing Ability Test Results of 118 People Who Participated in the University Festival

Naomi Katayama [α] & Shoko Kondo [σ]

Abstract- Chewing well and eat slowly are good habits for maintaining good health. A slow rise in blood sugar after eating can keep people away from overeating, obesity, and diabetes. In this study, we conducted a subjective self-administered questionnaire survey on chewing and a chewing ability test using chewing ability chewing gum for 34 high school students, 55 university students, and 23 middle-aged people who participated in the university festival. The chewing ability test, a chewing gum manufactured by LOTTE used. As a result, most of the participants knew xylitol and some word, the 8020 campaign (holding 20 teeth at the age of 80). Also, although many participants could bite apples with skin, a few were confident in their teeth. Many participants replied they were chewing their meals well, but a few participants bite 30 times one bite of food. Participants chewed the chew-ability gum 60 times, and the inspector judged the gum color. As a result of chewing gum, the number of participants with sufficient chewing ability (gum color is red) was 2.9% for high school students, 18.2% of university students, and 13.0 % of Middle-age peoples. Many participants had a chewing ability of 4 (gum color is pink) or 3 (gum color is beige).Those with the weak chewing ability (gum color is yellowish-green) were 8.8 % for high school students, 1.8 % for university students, and 8.7 % for Middle-age peoples. Many participants found that their chewing ability was rather weak. To live long and healthy, the firm chewing ability required. In the future, it may be well to perform training to chew gum to develop chewing ability.

Keywords: chewing power, chewing ability gum, questionnaire survey, university festival.

I. Introduction

Biting stimulates the brain, and the satiety center can stimulated to control food intake. In Japan, the 8020 campaign has widely publicized by the government. By the time you are 80 years old, you should have 20 teeth and chew your teeth to eat enough to maintain your nutrition and maintain your health. However, Japanese food is mainly rice, and soft food is the staple food. Opportunities to bit and eat hard food have been reducing from 50 years. As for meals, the chances of eating as a family together over time have decreased, and the number of people who eat alone in a short time for work and study is increasing. If we eat without chewing in a short time, we will eat more food than we need before the stimulation to the satiety center. And our blood sugar level will rise sharply, and excess sugar will accumulate in our body as fat, resulting in obesity. The probability of getting diabetes increases. Therefore, the purpose of this study was to grasp the actual situation by grasping the subjective of the mastication of people of various ages and examining the chewing ability of the people.

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II. Materials and Methods

a) Participants

Chewing questionnaire Survey and Chewing Ability Test conducted on 34 high school students, 55 university students, 23 Middle-age who participated in the university festival. Participants voluntarily participated in the chewing questionnaire and chewing ability test.

b) Chewing questionnaire survey

Participants completed a self-administered questionnaire about nine items related to chewing. Table 1 shows the contents of each item.

Table 1: Questionnaire result about mastication

Do you chew gum everyday?
Do you know the word Xylitol?
Do you know the word Mutants?
Can you bite an apple with skin?
Are you confident in your teeth?
Are your teeth strong?
Do you know the 8020 campaign?
Can you chew the food?
Can you chew a bite of food 30 times?

c) Chewing Ability Test

The chewing ability test, a chewing gum manufactured by LOTTE used. The gum made for

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chewing 60 times (about one minute) and judge the chewing ability by looking at the color of the gum. The mechanism that changes the color of this gum is that by chewing it, a new neutral/alkaline oral environment can created by mixing the citric acid and uncolored pigment mixed in the gum with the saliva. The uncolored pigments in the gum are usually colorless under acid. The salivary pH is neutral. By chewing the gum in the oral cavity, neutral saliva and citric acid in the chewing gum mix well, making it neutral and alkaline. This oral reaction changes the gum color from green to red. This phenomenon determines chewing ability. The gum is green (chewing ability 1) at first, then yellowish-green (chewing ability 2), beige (chewing ability 3), pink (chewing ability 4), and finally red (chewing ability 5). If chewable, the gum will turn red after 60 chewing times.

d) Ethical review board

This study conducted with the approval of the Ethical Review Board (Nagoya women's university 'hito wo mochii ta kennkyuu ni kansuru iinnkai'). The approval number is 30-7 and 30-17.

III. Results

a) Participant results

Participants were 34 high school students, and the average age± standard deviation was 17.03±0.67. Participants were 55 university students, and the average age ± standard deviation was 20.46±0.54. Participants were 23 Middle-age people, and the average age ± standard deviation was 47.14±2.61.

b) Questionnaire survey results

Table 2 shows the results of a questionnaire survey on mastication conducted for high school students of participants. There are few high school students can chew gum everyday and know the word mutants. Everyone knew the name xylitol. High school students also could bite an apple with skin and thought they had firm teeth. Also, many high school students know the 8020 campaign, and they say that they often chew food. However, many high school students answered that they did not bit their bite 30 times when they ate the food.

Table 2: Questionnaire result about mastication for high school students (n=34) (%)

	Yes	No	No answer
Do you chew gum everyday?	**6 (18%)**	**26 (76%)**	**2 (6%)**
Do you know the word Xylitol?	**32 (94%)**	**0 (0%)**	**2 (6%)**
Do you know the word Mutants?	**9 (26%)**	**25 (74%)**	
Can you bite an apple with skin?	**29 (85%)**	**5 (15%)**	
Are you confident in your teeth?	**16 (47%)**	**18 (53%)**	
Are your teeth strong?	**24 (71%)**	**10 (29%)**	
Do you know the 8020 campaign?	**23 (68%)**	**11 (32%)**	
Can you chew the food?	**20 (59%)**	**14 (41%)**	
Can you chew a bite of food 30 times?	**6 (18%)**	**28 (82%)**	

Table 3 shows the results of a questionnaire survey on mastication conducted for university students of participants. There are few university students can chew gum everyday. Most university students knew the name xylitol. About half of the university students knew the name mutants. The university students also could bite an apple with skin. The University students were not very confident in their teeth, and about half of them thought their teeth were firm. Also, many university students know the 8020 campaign, but they say that they do not often chew food. And many university students answered that they did not bit their bite 30 times when they ate the food.

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Table 3: Questionnaire result about mastication for female university students (n=55) (%)

	Yes	No
Do you chew gum everyday?	11 (20%)	44 (80%)
Do you know the word Xylitol?	52 (95%)	3 (5%)
Do you know the word Mutants?	30 (55%)	25 (45%)
Can you bite an apple with skin?	49 (89%)	6 (11%)
Are you confident in your teeth?	18 (33%)	37 (67%)
Are your teeth strong?	29 (53%)	26 (47%)
Do you know the 8020 campaign?	45 (82%)	10 (18%)
Can you chew the food?	22 (40%)	33 (60%)
Can you chew a bite of food 30 times?	8 (15%)	47 (85%)

Table 4 shows the results of a questionnaire survey on mastication conducted for the middle-age people of participants. There are few middle-age people can chew gum everyday. All of the middle-age people knew the name xylitol. About half of the middle-age people knew the name of mutants. Middle-age people also could bite an apple with skin. The middle-age people were not very confident in their teeth, and about half of them thought their teeth were firm. Also, many middle-age people know the 8020 campaign, but they say that they do not often chew food. And middle-age people answered that they did not bit their bite 30 times when they ate the food.

Table 4: Questionnaire result about mastication for middle age (n=23) (%)

	Yes	No	No answer
Do you chew gum everyday?	6 (26%)	17 (74%)	
Do you know the word Xylitol?	23 (100%)	0 (0%)	
Do you know the word Mutants?	15 (65%)	8 (35%)	
Can you bite an apple with skin?	20 (87%)	3 (13%)	
Are you confident in your teeth?	8 (35%)	15 (65%)	
Are your teeth strong?	8 (35%)	15 (65%)	
Do you know the 8020 campaign?	15 (65%)	8 (35%)	
Can you chew the food?	3(13%)	20 (87%)	
Can you chew a bite of food 30 times?	0 (0%)	22 (96%)	1 (4%)

c) Chewing Ability Test results

Participants chewed the chew-ability gum 60 times, and the inspector judged the gum color (see Table 5 and 6). As a result of chewing gum, the number of participants with sufficient chewing ability (gum color is red) was 2.9% for high school students, 18.2% of university students, and 13.0 % of the middle-age peoples. Many participants had a chewing ability of 4 (gum color is pink) or 3 (gum color is beige). Those with the weak chewing ability (gum color is yellowish-green) were 8.8 % for high school students, 1.8 % for university students, and 8.7 % for Middle-age peoples.

Table 5: Chewing ability test gum color after chewing 60 times (numbers)

	1	2	3	4	5
	Green	Yellowish green	Beige	Pink	Red
High school students (n=34)	0	3	20	10	1
Female college student (n=55)	0	1	15	29	10
Middle age (n=23)	0	2	10	8	3

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Table 6: Chewing ability test gum color after chewing 60 times (%)

	1	2	3	4	5
	Green	Yellowish green	Beige	Pink	Red
High school students (n=34)	0	8.8	58.8	29.4	2.9
Female college student (n=55)	0.0	1.8	27.3	52.7	18.2
Middle age (n=23)	0	8.7	43.5	34.8	13

IV. Discussion

Most of the people who attended the university festival this time did not have a habit of chewing gum. However, almost everyone knew the word xylitol. But about half of the participants knew the word mutants.

Participants were able to bite the apple with the skin on but were less confident in the teeth. The 8020 campaign, most participants, knew. Participants replied that they chew food well, but did not chew 30 times. Participants chewed the chew ability test gum. Results chewing ability was 2 (gum color is beige) or 3 (gum color is pink) in all age groups. Few participants were chewing well (gum color is red). It turned out that many people couldn't bite enough. Past studies have shown that the time to spend eating are also working; for example, middle-age is6-10 minutes shorter than school students. Also, even for students who should have time, all the times to spend eating were within 30 minutes. People were not chewing enough food to eat. Overeating can prevented by eating the food bite little by little over time.

Furthermore, the blood glucose level after a mealcan moderated. Previous studies used device development and computational models to measure masticatory force [1,2]. Also, there are many reports of studies that clarify the occlusal force [1,2,3,4]. It has reported that the lack of teeth and the inability to shew sufficiently affect the brain [5]. The relationship between chewing and cognitive and dementia risk has also been reported [6]. I have reported that oral exercise with gum improves oral function in the elderly [7]. Chewing gum from a young age and getting into the habit of chewing may help preserve oral function and reduce cognitive and dementia risk in the future. From the results of this study, since there are many young people and middle-aged people who do not chew sufficiently, we think that they are better to practice chewing by using chewing ability test gum. And we would like to increase the number of data and report the results in more detail.

V. Conclusions

For 118 people who participated in the university festival, a subjective self-report questionnaire about chewing and chewing ability tests using chewing ability gam conducted. The participants were 34 high school students, 55 university students, and 23 middle-aged peoples.

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