

Quantitative evaluation of number of chewing times and saliva secretion in adults with regard to different diet styles in Japan and Sri Lanka

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Abstract - Chewing is the process in which pieces of food are ground into a fine state, and mixed with saliva. The process of chewing is affected by characteristics of oral physiology, initial food properties, and neuromuscular control of chewing. The effect of food properties with different diet styles in Japan and Sri Lanka were examined in relation to both chewing and salivation. The study was conducted on ten adults each from Japan and Sri Lanka who were healthy without any dental illness and did not skip the main meal time. The participants were asked to fill a questionnaire regarding meal pattern, take a sample of saliva before and after the meals to weigh the amount of saliva. They were asked to record a video while eating to count the number of chewing times. The collected data were analysed using Mann-Whitney U test and Spearman's rank correlation coefficient. The average chewing times was more in Japanese (776.1 times) than Sri Lankans (507.9times). The nutritious value of the food was nearly same for both parties. There was no statistically significant difference in salivation between Japanese (0.214g) and Sri Lankans (0.805g). The results of the study were influenced by several factors including the food habits, starters of the main meal, number of meal times, instruments using while eating, behavioural changes, mood swings of particular time, food preference. It was not possible to change the confounding factors affecting the study as it was a descriptive study. The study had shown that there was no significant correlation between chewing times and difference in salivation with regard to different diet styles in Japan and Sri Lanka.

Key words- Adults, Chewing times, Diet styles, Japan and Sri Lanka, Saliva secretion

I. INTRODUCTION

Chewing is the process in which pieces of food are ground into a fine state, and mixed with saliva. The process of chewing is affected by characteristics of oral physiology, initial food properties, and neuromuscular control of chewing. The reasons to chew food properly are to absorb more nutrients and energy from food, to maintain a healthy weight, to get more exposure to saliva for food, to easier the digestion, to keep the teeth in good condition, to avoid excess bacteria lingering in intestine and to enjoy and taste the food (van der Bilt et al. 2006). The traditional cuisine of Japan (washoku) is based on rice with miso soup and other dishes with an emphasis on seasonal ingredients. Sri Lankan cuisine has been influenced by many historical, cultural and other factors.

The diet styles of both countries vary according to culture, traditions, seasonal changes, availability of spices, different rituals and functions. It was mentioned that, chewing for long time reduce the risk of diabetes mellitus, increase the satiety level (Kimura et al. 2013), increases the basal blood flow in means of glucose and oxygen thereby increasing brain functions, act as a stress coping behavior (Kubo et al. 2015). This study was designed to evaluate the number of chewing times in adults quantitatively with regard to different diet styles in Japan and Sri Lanka. It will be effective in patient care when considering the nutritional value to be supplied and also it will be used in a way to increase the nutrient intake by increasing the chewing times considering the different diet styles. The study was conducted to evaluate the number of chewing times and salivation difference between before and after meal in adults with regard to different diet styles in Japan and Sri Lanka.

II. MATERIALS AND METHODS

A descriptive cross sectional study was conducted on a convenient sample of ten adults each from Japan (Niigata prefecture) and Sri Lanka within the age limit of 20 and 50 who were healthy without any dental illness and did not skip the main meal time. The information about their daily diet style was assessed using the data from questionnaire which was undergone for pre-test. The number of chewing times was counted using video and amount of saliva was measured by chemical balance and difference in salivation was calculated. Preliminary experiment was done in the lab of Graduate School of Health Sciences, Niigata University with 2 participants from both countries to validate the questionnaire and to assess the possibility of collecting saliva sample with the selected container and recording a video while eating. The participants were asked to fill three documents for the study. The test tubes to collect saliva, and photograph and video recording equipment were given to participants. The participants were requested to fill the document 1 containing demographic data and the document 2, which is the questionnaire containing 12 questions regarding the usual diet style & food preferences.

They were asked to take a photograph of the meal which participants were going to eat for the study once a day for three days within data collection week (December 2016) and to take a sample of saliva before meal by keeping saliva in the mouth without swallowing for three minutes and spitting into the appropriate container. The participants were also asked to record a video while eating, focusing on face in order to enable

counting of chewing cycles. They were asked to collect the sample of saliva in the same way after having the meal and to keep in the freezer. Finally, they were requested to fill the document 3 comprised of data about the meal time, quantity and saliva sample collecting time. The collected data were processed in SPSS version 22.0 and analysed using Mann-Whitney U test and Spearman's rank correlation coefficient. Prior to conducting this study, the research plan was submitted and approved by the Research Ethics Committee of Niigata University (approval number 3043).

III. RESULTS, DISCUSSION AND CONCLUSION

According to the analysis, 90% of Sri Lankans preferred more spicy foods while 70% of Japanese preferred sugary and salty foods. Water or fluid intake while eating was more in Japanese than Sri Lankans. The water consistency in food is medium in both Japanese and Sri Lankans. Japanese preferred starters as soup or salad while Sri Lankans had no starters. The nutritious content of the food intake between two groups was nearly equal (95%) according to nutritional analysis. The average chewing times was more in Japanese (776.1 times) than Sri Lankans (507.9times). It was found that, there was a statistically significant difference in chewing times between Japan and Sri Lanka ($p < 0.05$). Japanese were always having soup or salad as starters. Sri Lankans usually didn't have starters with main meal. With the starters, the Japanese consumed a larger meal and also chewed more frequently than the Sri Lankans. The second observation is most likely to be a result of the first. However, the Japanese had only the three main meals during a day while the Sri Lankans had two tea time snacks in addition to the three main meals. The food preference varied from individual to individual.

As it is a descriptive study, each participant was allowed to have their preferred food at the meal time. So, with this, the number of chewing times and saliva secretion got affected. It might influence the results of the study. Participants were not asked to take the meal at a fixed time, so the meal time varied. The satiety level (the feeling of fullness) varied with the variance of meal time (Yamazaki et al. 2013). Therefore, the amount of meal varied from individual to individual which also had an impact on the results. The mood swings and level of stress at a particular time might affect the study results (Kimura et al. 2013). The nutritious value of the food is 95% same for both parties. Comparison of the results of this study was not possible due to mere lack of reports from similar studies where food habits of two cultures were compared in electronic data bases accessible to the authors. 100% of Japanese ate the food using chopsticks. However, the Sri Lankans used several ways of eating methods (75% using hands –traditional method, spoon, and fork) at different meal times. The number of chewing times varied with meal duration (prolong eating) with the variance from usual eating

behavior. There was a previous study (Smit, E Katherine Kemsley, et al. 2011) where they hid the purpose of the study (recording video to count the number of chewing times) to avoid the behavioral changes in the study. However, for the ethical issues, the need of recording a video (to count the number of chewing times) and collecting saliva sample before and after meal (to calculate the change in saliva secretion) were explained to all participants before getting the written consent during this study. Some of the participants were really conscious about recording a video while eating. Therefore, they had focused much on video which also might have an impact on the results.

There was no statistically significant difference in salivation between Japanese (0.214g) and Sri Lankans (0.805g). It might be due to the mean number of chewing times of each participants in two countries are in same range for one bite (all had about 20-25 chewing times). The results had revealed that even though chews per mouthful are nearly same between the two groups, Japanese consumed a larger quantity at a single meal. However there was a finding indicating that (Kohyama, et al., 2007) more chews per mouthful reduced the food/energy intake, without affected by prolonged meal duration.

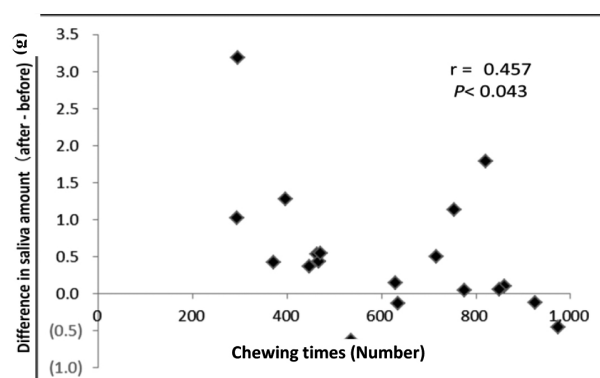


Fig.1 Correlation between number of chewing times and salivation

It was shown in Fig.1, there was no significant correlation between the chewing times and difference in amount of saliva between Japanese and Sri Lankans.

Dearth of Sri Lankans living in Japan but following the Sri Lankan dietary pattern was the main reason for the smaller sample size.

There was a change in number of chews between Japanese and Sri Lankans and no statistically significant difference in salivation between Japanese and Sri Lankans with the different food habits.

It might be helpful to find the foods with different physical properties having same nutritious content in further studies and to prefer diet for patients with dental problems.

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