DISCUSSION ON THE OPERATIONAL PERFORMANCE OF CHOPSTICKS TIP TEXTURE

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Abstract - Chopsticks are one of the most commonly used tableware for the Orientals. In this study, the chopsticks tip line of chopsticks was used as the research focus, mainly to evaluate the influence of the chopstick tip line on the food gripping efficiency. A total of 30 subjects used the experiment and used the pliers type chopsticks method to separate the peanuts. Take the test of black bean operation and red bean operation. The results confirmed that chopsticks with chopsticks tip lines had a significant effect on the intake of peanuts, black beans, red beans and meal performance. Overall, this study suggests the use of chopsticks with chopsticks and sharp lines.

Index Terms - Chopsticks, texture, operational performance, Human factors and ergonomics

I. INTRODUCTION

As the saying goes, "Bread is the staff of life", it is a matter of importance for human beings to eat. People must eat in order to provide the energy needed for daily life. Chopsticks are the simplest and most commonly used hand tool in the diet. It is precisely because of the ability of chopsticks to make up the hand. Please enhance the functionality of the hand. When people use chopsticks during meals, they can display the functions of clamping, dialing, picking, cutting, and splitting instead of fingers.

According to scientific measurements, when using chopsticks, five fingers can cooperate well, and drive the movement of dozens of joints and muscles of the wrist, palm, arms and shoulders, and connect with the cranial nerves. Give the cerebral cortex a beneficial exercise. There are quite a number of factors that affect the use of chopsticks to pick up food. For example, Hsu and Wu (1991) studied the length of chopsticks, and then Wu (1995) made a more in-depth discussion on the angle of the fast shank and the angle of the chopstick tip. Chen (1998) studied the operation mode and shape of chopsticks. Chan (1999) further studied the diameter of the chopsticks and the difference of the target. However, in addition to the above factors, there are still many factors for chopsticks. For the purpose of discussion, materials, gripping methods, and chopstick tip textures can be factors.

Therefore, this study is aimed at the effect of chopstick tip texture on the efficiency of the clamping. It is possible to find out the most suitable chopstick tip texture through experimental research to improve the performance of the meal.The main purpose of this study was to investigate the impact of the chopsticks' tip texture design on the efficiency of chopsticks, which are commonly used, and to evaluate them. In the way of human experiment, the actual use of chopsticks was observed for adults who can use chopsticks normally, have no sensory function, and have an age greater than or equal to 18 years old and less than or equal to 55 years old.

II. LITERATURE DISCUSSION

A. The Function of Chopsticks

In general, the functions of chopsticks include picking up food, cutting food, puncture food, pulling food, moving food, etc. Also, it can resist extremely high temperatures and is less hygienic and less susceptible to infection.

In addition, it is worth mentioning that chopsticks were passed to Japan by the Special Envoy of the Sui Dynasty in the past 1300 AD, and it still applies to Japan. According to a survey of more than 15,400 schoolchildren in the third and sixth grades of primary school, the Japanese Ministry of Education found that only 48.4% of the children were able to use chopsticks correctly. On the other hand, after the observation in the past two years, it is concluded that the young children aged 2~3 years old are the best time to learn how to use chopsticks, and the effect is also remarkable. In recent years, many Japanese elementary schools have incorporated “how to use chopsticks” into their teaching plans.

According to the results report, students who use chopsticks correctly are calmer and focused than before, and of course their fingers are more dexterous (Jang, 1990).

B. Factors Affecting the Performance of Chopsticks

According to the research data of previous scholars, the factors affecting the performance of chopsticks

meal can be roughly divided into three categories, namely, artificial variables, work variables, chopsticks attributes, etc., which will affect the factors affecting the performance of chopsticks. A table is organized (Table 1).

Table 1 Factors in the various variables of meal performance

Artificial variable	Job variable	Chopsticks attribute
Age	Target: Beans, vegetables, meat, etc.	Material: Stainless steel, canon, porcelain, bamboo, wood, plastic, acrylic, glass, jade, etc.
Gender	Operation category: Clipping, puncture, cutting, pulling, moving objects, etc.	Appearance: Shape, texture, surface treatment, etc.
Experience	Working space: Cup size, table and chair height, etc.	weight: Solid, hollow, semi-solid, etc.
Operation method		Specification scale: Diameter, angle, length, etc.

The following content will explain each item in more detail.

III. ARTIFICIAL VARIABLES

1. AGE

The size of the hand will vary with age, so chopsticks will change with the size of the hand. Hsu and Wu (1991) have confirmed that chopsticks of different lengths have a significant effect on the performance of chopsticks for adults and children, with lengths of 240 and 180 mm, respectively.

2. GENDER

Gender is also one of the factors that influence meal performance because both men and women differ in terms of human measurement, biomechanics, and physiology (Grasley et al., 1978).

Therefore, whether there is a significant difference in the performance of men and women in the use of chopsticks, there is no relevant research findings yet, and the follow-up researchers can discuss it.

3. Experience (training)

Experienced or trained people can easily use chopsticks to pick up food. Because chopsticks operate in a way that requires a higher acuity and long-term practice of the hand, the chopsticks can be manipulated and the contents can be easily picked up. At present, the relevant research on chopsticks is only for the oriental people who are accustomed to eating with chopsticks. There is no research on Western ethnic groups that have not used chopsticks for dining. It is hoped that relevant researchers will be able to discuss this in depth. Experienced or trained people can easily use chopsticks to pick up food.

4. Type of operation

Since the operation of chopsticks requires the sensitivity of a higher hand and long-term learning, how to use chopsticks is often a habit that is developed after hours, so different personal habits will have different ways of operation.

Chen (1996) evaluated the different operation modes of chopsticks and found that the pliers type operation chopsticks are obviously superior to the scissors type operation in terms of grip performance and stability, but in the performance of the pull force, the scissors type The operation method is better than the pliers type. Later, Wu Shuiyu and Cai Wuhuang (2001) conducted in-depth discussion on the performance of the chopsticks. The results showed that the pliers-type chopsticks method was significantly better than the scissor type in the operation of gripping peanuts and plucking the number of peas.

IV. OPERATION VARIABLE

1. Targets

When people dine, they often use chopsticks to pick up foods such as vegetables, beans, meat, and so on. Chan (1999) found that using different chopsticks to pick up red beans and peanuts, the number of pieces that can be taken per unit time is significantly different, among which peanuts are best. And pointed out that the size of the target and the diameter of the chopstick handle have an interaction with the meal performance.

2. Operation category

Generally speaking, when people use chopsticks to eat, they will use various operations depending on the target, including picking up food, pulling food, cutting food, shaking food, puncture food, moving food and so on.

1) Pick up food

Hsu and Wu (1991) pointed out that the length of chopsticks significantly affects the performance of gripping food, and the length of chopsticks that are too long or too short is longer than the length of moderate chopsticks, and the performance of food grips is worse. Wu (1995) pointed out that different chopstick handles and chopstick tips have an effect on the performance of chopsticks. For the performance of gripping work, the chopstick tip diameter of the best chopsticks is 6 mm. 2. Chen (1998) believes that the different ways of operating chopsticks and the appearance of chopsticks have a significant impact on the performance of the food. At the same time, it is pointed out that the pliers type operation chopsticks will have an advantage in gripping performance

compared to the scissors type operation chopsticks, and the round chopsticks are superior to the square type chopsticks.

Chan (1999) found that the diameter of the target and the length of the chopsticks interacted with the performance of the food being picked, and pointed out that the diameter of 6 mm was optimal for the gripping effect. The results of Wu Shuiyan and Cai Wuhuang (2001) confirmed that the cross-section shape of the chopstick handle has a significant effect on the gripping operation, and also pointed out that the best cross-section shape of the chopstick handle is round and rounded square, and in the efficiency of inclusion. The pliers-style chopsticks method is superior to the scissors-type chopsticks.

2) Puncture food

Wu (1995) used different experiments of the diameter of the chopsticks and the angle of the chopsticks to measure the performance of the puncture food. The results showed that the diameter of the chopsticks and the angle of the chopsticks had an interaction effect. He also proposed a 4 mm chopstick handle diameter and a 6° chopstick tip angle, which is best for performance in puncture food.

3) Cutting food

Wu (1995) the diameter of the chopstick handle and the angle of the chopsticks have a significant impact on the performance of cutting food. It is also pointed out that chopsticks using a 6 mm chopstick handle diameter and a 6° chopstick tip angle are the Best for cutting food.

4) Pulling food

According to a study by Hsu and Wu (1991), the shorter the length of the chopsticks, the greater the pulling force, and the difference in the strength of the individual in pulling food. Wu (1995) pointed out that the diameter of 8 mm chopsticks and the angle of 0 ° chopsticks are the best in pulling the power of food. But Chen (1998)'s research shows that the way in which chopsticks are handled differs only slightly in the power of pulling food. However, research by Wu Shuiyu and Cai Wuhuang (2001) pointed out that round and rounded squares are better at pulling performance than other cross-section shapes.

5) Moving objects

Chen (1998) used different types of chopsticks and chopsticks to explore the performance of food removal. The pliers type of chopsticks is better than the scissors, but there is no significant difference in the appearance of chopsticks.

1. Working space

The layout of the work space will vary with the layout, such as the height of the table and chair, the size of the cup and the distance of the target, etc., will affect the performance of people picking up food. However, research in this area has not yet been developed.

C. How to Use Chopsticks

In general, the operation of chopsticks can be divided into two types. The first looks like a pair of pliers in parallel, and the second is a scissor that looks completely crossed. Chen et al. (1996) conducted a questionnaire survey on chopsticks operation methods for 412 adults in Taiwan. The results showed that about half of the ratios were handled using pliers type, while the other half were scissors-type. Tang (1992) conducted a survey on the use of chopsticks by Japanese elementary school students. The survey results showed that 48% of primary school students operated chopsticks in the type of pliers. It can be seen that the proportion of chopsticks for adults and children using pliers and scissor is about half.

The pliers operation type is actually the use of the lever principle, and the lever principle is classified into three categories according to the point of application of the force point, the resistance point, and the fulcrum in the relative position of the lever.

The points of application and resistance of the first type of lever are on both sides of the fulcrum, such as scissors, fascia, and balance. The second type of lever has a force point and a fulcrum on the two sides of the resistance point, such as a wheelbarrow and a nutcracker. This is a labor-saving lever that can apply a small force to move a heavier object, but the displacement of the force is longer. The resistance points and fulcrums of the third type of lever are on the two sides of the force application point, such as the scorpion and the broom. This is a laborious lever, which can save the displacement of the force applied. When a person wants to use pliers to pick up food, the procedure is roughly as follows: first place a chopstick (this is a "fixed chopstick") into the crotch between the thumb and forefinger, and use the first knuckle and thumb of the ring finger. The second knuckle supports the chopsticks in about half of the position. Next, place another chopstick (this is a "movable chopstick") along one side of the index finger, hold it with the middle finger and the first fingertip, and then press it with the skin at the bottom of the thumb. Third, by using the index and middle fingers to open and close the "movable chopsticks" for feeding, and use the thumb and forefinger as fulcrums while maintaining the stability of the "fixed chopsticks". Therefore, the operation of chopsticks can be classified as a third type of lever. This study briefly introduces the pliers type of operation used by most people.

The first step is to put a chopstick on your hand. Relax your palms and move your fingers forward (Fig. 1).

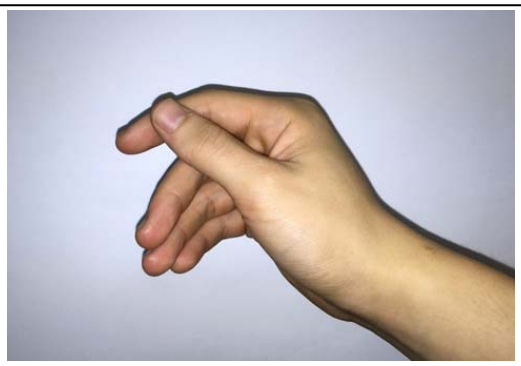


Fig. 1

Place the bottom half of the chopsticks to the bottom of the index finger (Fig. 2).



Fig. 2

At the same time, use the inside of the root joint of the thumb to clamp the chopsticks with the tiger's mouth, then touch the chopsticks with the middle fingertips, and use the end of the ring finger to hold the chopsticks (Fig. 3).



Fig. 3

To put it simply: fix it with three points, the web, the thumb and the ring finger.
In this way, the first chopsticks should be firmly fixed to the hand. Then, place the second chopsticks in place (Fig 4).



Fig. 4

Place the bottom one-fifth to one-sixth of the chopsticks on the side of the first section of the index finger, then press the fingertips against the chopsticks, press the chopsticks on the tip of the index finger, and then use the middle finger to end the last section. Press the chopsticks on the back. In this way, the second chopstick should be stabilized through the thumb, index finger and middle finger. When the chopsticks are gripped, the thumb does not move. The thumb and the abdomen (or the base of the index finger, as shown in Fig. 5) are used as the fulcrum. The index finger and the middle finger gently grip the chopsticks on the upper side, and the upper chopsticks are moved by the upward movement.

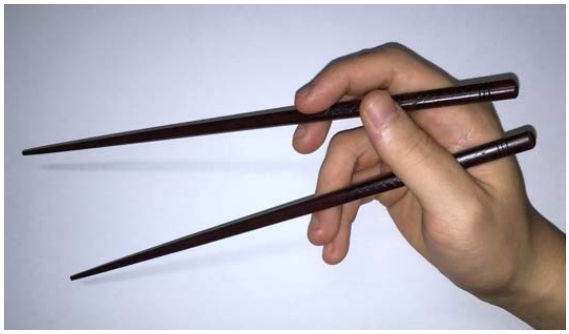


Fig. 5

Conversely, when the index finger and the middle finger are pressed down, the chopsticks can be closed and the food can be taken by the chopsticks. The key is to move the chopsticks on the upper side, the chopsticks on the lower side are almost motionless, and the ring finger is slightly pushed up to bear its weight. The characteristic of this chopsticks posture is that the chopsticks are never crossed, and the chopsticks are always separated. The only point where the chopsticks will touch each other is only at the tip of the chopsticks, so that no matter how small the beans and sesame seeds can be picked up (Fig. 6).



Fig. 6

V. METHODS

The investigation method conducted by the Experimental Method. The main project is to test and analyze the effectiveness of the chopsticks.

A. Research process

This study used the survey statistics method to conduct the first phase of testing and data collection. The subjects were randomly and voluntarily participated in the experiment, and the required data were collected by image recording. In the second stage, the collected data were statistically analyzed, and the data were summarized as to whether the chopstick tip line had a positive influence on the effectiveness of using chopsticks.

D. Test Sequence

1) Research Subjects

The experiment was conducted randomly with 30 volunteers. The subjects must meet the following conditions:

(1) Age greater than or equal to 18 and less than or equal to 55 years old
(2) Those without hand muscles, bones, nerves, or degenerative diseases
(3) Sensory perceptions are not impaired and thus affect the conduct of the experimental test.

2) Test tools

Mobile phone, chronograph, chopsticks test group (a pair of chopsticks with chopsticks and no chopsticks), a set of test clips (red beans, black beans, peanuts), a set of paper pens, tables and chairs.

3) Method of measurement

The subject was placed in front of the test table in a sitting position. The palm of the hand was placed face down and the fingertips were placed flat on the table and outside the test tray. Each test is started and counted down for one minute. Pick up the chopsticks with the used hand and take the test clip to the fixed small round bowl until the time is counted down. The experiment time is a total of three minutes (red bean clip for one minute, black bean clip for one minute, peanut clip for one minute). During the test, the camera was used to record the subject's chopstick operation posture.

C. Limitations and Solutions

It may be that the experimental results are biased due to insufficient sampling of the sample size, so that the gestures are slightly different to produce statistical errors. In this paper, I think that if there is enough research time, we can consider increasing the number of samples of the subjects. Other difficulties that may be faced, for example, if the subject is unable to perform a clear gripping behavior because he is not accustomed to the gesture, the subject may be asked to perform a second or more test or practice to perform the test.

VI. RESULTS

This study collected 30 subjects, including 16 males and 14 females, and took ANOVA single-factor variation analysis to list the performance of red beans, black beans, and peanuts under chopsticks with tip texture and no tip texture.

A. Red Beans results

Table2: Red bean ANOVA single factor variation analysis significance

Group	Number	Average	Variance	P
Subjects	30	15.5	77.5	9.04932E-11
None texture	30	23.03333	75.96437	
With texture	30	35.66667	152.7162	

P<0.05

B. Black Beans results

Table3: Black bean ANOVA single factor variation analysis significance

Group	Number	Average	Variance	P
Subjects	30	15.5	77.5	1.53497E-13
None texture	30	25.43333	50.11609	
With texture	30	36.66667	111.4713	

P<0.05

C. Peanuts results

Table3: Peanuts ANOVA single factor variation analysis significance

Group	Number	Average	Variance	P
Subjects	30	15.5	77.5	2.84319E-22
None texture	30	25.66667	15.33333	
With texture	30	38.73333	39.02989	

P<0.05

All of the above results showed that the significance was close to 0 and the p value was less than 0.05, so all samples were significant.

CONCLUSION

Through the results of the literature and analysis, the following factors that may affect the impact are obtained. In the future, it is hoped that the improvement or subsequent related research can be carried out according to the influencing factors. The improvement and suggestions are as follows:

1. Only one of the ways to use chopsticks is discussed. The rest of the methods are not discussed together. I hope that in the future, statistical analysis can be done together with the effects of other methods.
2. In the experiment, the number of peanuts was the highest. Because of its large volume, the target of clamping was clearer, followed by black beans, and the most difficult to grasp with red beans. Since the experimental time is not sufficient, the round food that is difficult to take in the previous test is used as the test body. It is hoped that the future test body can be increased in different types and more diversified research.

Based on the overall performance of chopsticks, this study suggests that chopsticks with tip texture have better gripping performance than chopsticks without tip texture.

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