The study of the optimum shape of chopsticks for pinching food

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1. Introduction:

Chopsticks are a pair of narrow sticks. The word 'chop' means 'quick' or 'speedy' (Chan, 1998). Chopsticks have been the most fundamental eating utensils in oriental society for thousands of years (Chang et al., 2007). The earliest chopsticks were invented by the Chinese in about 400-500 B.C. (Wu, 1995). Today, chopsticks are also used widely in non-Asian countries.

Nowadays, there are many shapes of chopsticks and they are also made from different materials such as wood or plastic. There are many researches about effect of shape and they show that different shape of chopsticks has an effect on the efficiency of chopsticks use. Chopstick handle diameter and tip angle both had significant effects of the food-pinching, food-pulling, food-shearing and food-thrusting tasks, and subjective ratings (Wu, 1995).

Another important factor also effect on the efficiency of chopsticks us is the operation of chopsticks. Typically, there are two modes of chopstick operations adopted by people, one is pincers-

pinching and the other is scissors-pinching. In pincers-pinching, one stick passes through the space between the thumb and first finger; it is held against the flesh at the side of the ring finger so the stick cannot move. The other stick is held by the middle and index fingers so that they can move apart or together. In scissors operation, two sticks cross each other between the thumb and the index fingers. The researcher also noted that the pincers-pinching operation is superior to the scissors-pinching operation in pinching precision and stability but inferior in pinching force (Chen, 1998).

However, we still do not know whether different mode of chopstick operations has different optimum shape of chopsticks. In this research, effect of four kinds of chopsticks and two modes of chopstick operations on food-pinching were studied. Additionally, this study can suggest the shape of chopsticks that suitable for pinching food, the optimum chopsticks for the different operation of chopsticks in pinching food and also better chopsticks operation to pinching food.

2. Material & Method

2.1. Participants

Mahidol Wittayanusorn students whose age are between 15 - 18 years. They were participants who hold chopsticks with pincers-pinching operation and with scissors-pinching operation.

2.2. Experimental foods

In this study, we used peanuts. The peanut is round and has about 10 mm in diameter (Fig. 1).

Fig. 1 The peanuts used in this study

2.3. Experimental chopsticks

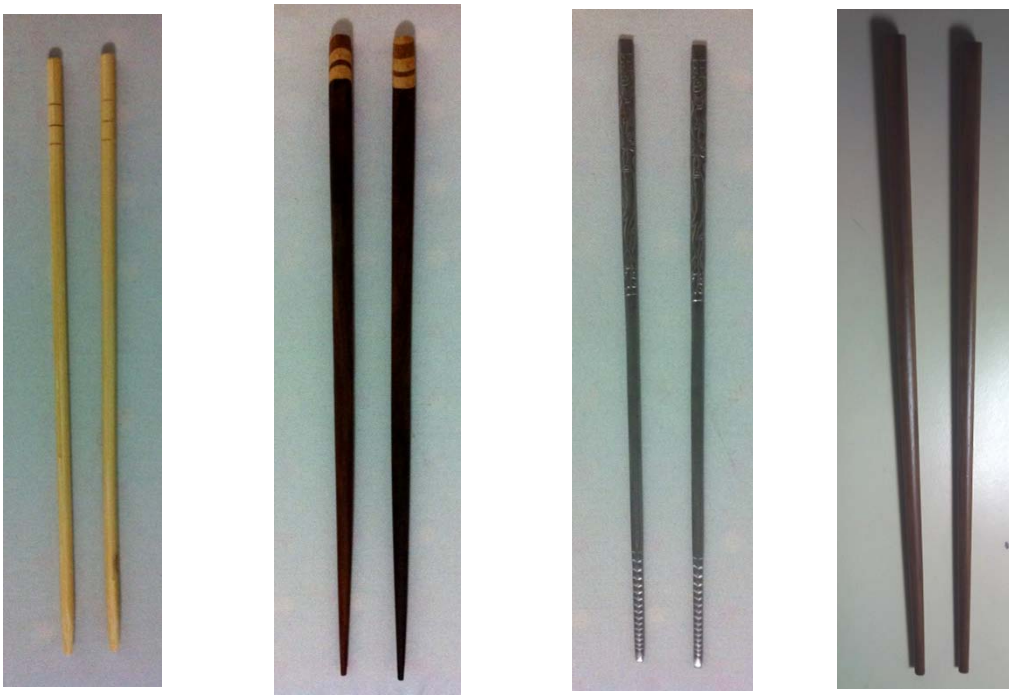
There were four different designs of chopsticks in this experiment. The first was wood chopsticks, 224 mm in total length, shaped round in the handle portion and round in the tip portion. Diameter of tip is 4 mm and handle is 5 mm. The portion of handle is long about 210 mm (Fig. 2a).

The second was a pair of wood chopsticks, shaped round in the handle portion and in the tip portion and 255 mm long. Diameter of tip is 2 mm and handle is 7 mm (Fig. 2b).

The third chopsticks were made of stainless steel, 228 mm in total length, shaped rectangle in the handle portion and in the tip portion. Size of the tip portion is 1.5×2.5 mm and size of the handle portion is 2×4.5 mm in cross section (Fig. 2c).

The forth chopsticks were made of wood, 245 mm in total length, shaped square in the handle portion and round in the tip

portion. The width of the square handle is 7×7 mm and the round tip is 4mm in diameter (Fig. 2d).



(a) (b) (c) (d)

Fig. 2 The chopsticks that were used in this study

2.4 Experimental procedures

Put peanuts in one dish and placed that dish in front of the participants 30 cm far from the participants and placed the empty dish in front of the participants.

Gave the participants 1 minute to get used to one kind of chopsticks randomly and practiced to pinch the peanuts. After that, started the experiment, the participants used chopsticks to pinch one peanut at the time form the dish and put it into the bowl when

30 seconds passed record the amount of peanuts that the participants can pinch. Then give the participants 2 minutes break for preventing any effect of fatigue. After that gave the participants the other kind of chopsticks and do the experiment again.

2.5. Statistical methods

The Wilcoxon signed-rank test was used to compare the difference of using different chopsticks in the same mode of operation and in both modes.

The Kruskal-Wallis Test was used to compare efficiency of the operation mode in the same chopsticks.

P values less than 0.05 were considered to be statistically significant.

3. Result

Table 1 and 2 show the median and the number of peanuts that was pinched by using different types of chopsticks with pincer-pinching and scissors-pinching modes, respectively.

Table 1
The number of peanuts that was pinched with pincer-pinching mode

participants	The number of peanuts			
	a	b	c	d
1	18	15	20	19
2	11	15	12	10
3	17	20	11	17
4	25	26	23	19
5	16	23	16	20
6	17	18	19	20
7	22	19	20	20

8	23	20	17	19
9	21	19	17	21
10	17	19	12	20
11	17	18	11	11
median	17	19	17	19

Table 2
The number of peanuts that was pinched with scissors-pinching mode

participants	Type of chopsticks			
	a	b	c	d
1	22	14	15	17
2	20	15	12	15
3	12	9	7	12
4	15	14	13	12
5	20	17	11	17
6	20	16	15	17
7	19	15	16	17
8	19	18	17	22
9	17	18	11	19
10	17	8	9	11
11	19	17	14	17
12	8	9	7	7
13	18	22	13	17
14	18	18	13	12
15	18	16	18	18
16	21	19	18	18
17	20	13	14	13
18	16	16	15	19

19	21	20	21	20
20	16	16	18	18
21	22	20	15	20
22	23	21	18	15
23	15	20	12	13
median	19	16	14	17

* based on negative ranks
** based on positive ranks

Table 3 The statistical comparison of using different types of chopsticks with pincer-pinching mode

	Tybe 'b' - Tybe 'a'	Type 'c' - Tybe 'a'	Tybe 'd' - Tybe 'a'	Tybe 'c' - Tybe 'b'	Tybe 'd' - Tybe 'b'	Tybe 'd' - Tybe 'c'
p	0.591*	0.045**	0.513**	0.040**	0.284**	0.171*

Table 3 shows the statistical comparison of using different types of chopsticks with pincer-pinching mode (n=11) by using Wilcoxon signed ranks test. There were significant differences in the number of peanuts between type ’a’ and type ‘c‘ chopsticks, and between type ’b’ and type ‘c‘ chopsticks (*p*=0.045 and *p*=0.040, respectively). Based on positive ranks, type ’a’ and type ’b’ chopsticks were better than type ‘c‘.

Table 4 The statistical comparison of using different types of chopsticks with scissors-pinching

	Tybe 'b' - Tybe 'a'	Type 'c' - Tybe 'a'	Tybe 'd' - Tybe 'a'	Tybe 'c' - Tybe 'b'	Tybe 'd' - Tybe 'b'	Tybe 'd' - Tybe 'c'
p	0.010**	0.000**	0.007**	0.009**	0.981*	0.005*

* based on negative ranks
** based on positive ranks

Table 4 shows the statistical comparison of using different types of chopsticks with scissors-pinching mode (n=23) by using Wilcoxon signed ranks test. There were significant differences in all of pairing except the comparison of type ’b’ and type ‘d‘ chopsticks. Based on positive ranks, type ‘a’ chopsticks were better than type ‘b’,

‘c’, and ‘d’, and type ’b’ were better than type ‘c‘. Based on negative ranks, type ’d’ were better than type ‘c‘.

Table 5 The statistical comparison of using different types of chopsticks with both modes

	Tybe 'b' - Tybe 'a'	Type 'c' - Tybe 'a'	Tybe 'd' - Tybe 'a'	Tybe 'c' - Tybe 'b'	Tybe 'd' - Tybe 'b'	Tybe 'd' - Tybe 'c'
p	0.067**	0.000**	0.010**	0.001**	0.464**	0.002*

* based on negative ranks
** based on positive ranks

Table 5 shows the statistical comparison of using different types of chopsticks with both modes (n=34) by using Wilcoxon signed ranks test. There were significant differences in four out of six pairing, except the comparison of type ’a’ and type ‘b‘ chopsticks, and of type ’b’ and type ‘d‘ chopsticks. Based on positive ranks, type ‘a’ chopsticks were better than type ‘c’, and ‘d’, and type ’b’ were better than type ‘c‘. Based on negative ranks, type ’d’ were better than type ‘c‘.

Table 6 The statistical comparison of using different modes with same chopsticks

	Type 'a'	Tybe 'b'	Tybe 'c'	Tybe 'd'
p	0.926	0.038	0.209	0.058

Table 6 shows the statistical comparison of using different modes with same chopsticks by using Kruskal-Wallis test. There was only a significant difference in modes of chopsticks operations when using type ‘b’ (p=0.038).

4. Conclusion and Discussion

Our study showed that the shape of chopsticks had an effect on pinching food. Type ‘a’ and type ‘b’ were better than type ‘c’ in pincer-pinching mode. We could not see much significant differences in this mode because of small number of participants (n=11).

In scissors-pinching mode, type ‘a’ chopsticks was better than the other types so type ’a’ chopsticks was the best optimum shape of chopstick in pinching for scissors-pinching mode.

And in overall (both mode), type ‘c’ chopsticks was the least optimum shaped for pinching

Since both type ‘a’ and type ‘b’ chopsticks had round handle, the result showed that round handle tended to be better than rectangle or square handle in pinching and this result was similar to the study of Chen, (1998). Type ‘a’ chopsticks’ diameter of handle was 5 mm, which was in the range of handle diameter (4 to 6 mm) that was suggested to be used by Chan (1999).

Chen (1998) noted that the pincers-pinching operation is superior to the scissors-pinching operation in pinching. In this study, we also founded that pincer-pinching was better than scissor-pinching for using type ‘b’ chopstick.

However, this result may can only use with pinching peanuts or other food that has similar shape. In further study, we may use other types of food such as noodle.

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