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Research on the Combination of Commercially Available Thickeners and Commercially Available Nursing Food-Universal Design Food: UDF (Can be Crushed with Gums)

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Keywords: *thickener, nursing food, viscosity test.*

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RESEARCHONTHECOMBINATIONOFCOMMERCIALLYAVAILABLETHICKENERSANDCOMMERCIALLYAVAILABLENURSINGFOODUNIVERSALDESIGNFOODUDFCANBECRUSHEDWITHGUMS

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Research on the Combination of Commercially Available Thickeners and Commercially Available Nursing Food-Universal Design Food: UDF (Can be Crushed with Gums)

Mayumi Hirabayashi [α], Shoko Kondo [σ] & Naomi Katayama [ρ]

Abstract- In Japan, a super-aging society, there is much debate about how to provide safe home care in the future. To provide safe nursing care food, it is necessary to consider not only the nutritional aspect of the diet but also the dietary form. In the case of diminished or impaired swallowing function, it is useful that the viscosity of the diet matches the ability of the care recipient to swallow the food. Therefore, in this study, we report the viscosity measurement using a commercially available thickener and a commercially available universal design food (which can crush with gums) by changing the blending amount and combination of them. In this study, we used commercially available thickener A, and thickener B, which can purchase at pharmacies and three types of commercially available universal design foods (which can crush with gums) can purchase at pharmacies. In the case of foods having a large amounts of carbohydrates, the thickener B (high in thickening polysaccharides) can stabilize the viscosity and is suitable for adjusting the viscosity.

On the other hand, in the case of foods having a small number of carbohydrates, the thickener A (high in water-soluble dietary fiber) can stabilize the viscosity and is suitable for adjusting the viscosity. After all, there is thickener that is compatible with food materials and nutrients contained in foods. In the future, we could like to measure the viscosity of more food materials and thickener combinations.

Keywords: thickener, nursing food, viscosity test.

I. Introduction

Older adults in need of nursing care may have problems with the oral cavity, lose their teeth, and cannot chew food sufficiently, resulting in reduced food intake and malnutrition. Therefore, physical dysfunction due to lack of muscle mass such as sarcopenia and flail due to lack of protein may occur. There is a meal that can be crushed with games in the universal design food (UDF) on the market. Since it can purchased at pharmacies, it is a useful consumption for home care. However, since the health condition of the subject in need of long-term care changes daily, it is difficult to adjust the shape and viscosity of the meal in the case of long-term care at home. Also, there are many types of thickener sold in pharmacies and the like, and the amount of viscosity adjustment varies. Therefore, it is necessary to consider the compatibility with the target food to adjust the viscosity, and we would like a report on the combination of the food and the thickener, and the amount of the thickener added as a guide. This study reports the results of measuring the viscosity by combining a commercially available universal design food and a commercially available thickener.

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II. Material and Methods

a) Commercially Available Thickeners

The two thickeners obtained at the pharmacy. The price of thickener A was 1296 yen (12 USD), and thickener B was 1274 yen (11.54 USD), which were almost the same price. Both contained 50 individual packages of 3 grams. The raw material of the thickener is that thickener A is 8.1kcal energy, 0g protein, 0g lipid, 2.04g sugar, 0.75g dietary fiber, and 18.6mg sodium per 3g, and thickener B is 7.9kcal energy, 0g protein, 0g lipid, 1.9g sugar, 0.7g dietary fiber and 16mg sodium per 3g.

b) Commercially Available Nursing food

Three types of products used from the can be crushed with gums of the universal design food (UDF) on the market. These are Sukiyaki, Sardine dumpling and Creamed chicken. All of them are 100g retort pouches and sold for 180 yen (1.67 USD). The nutritional value of Sukiyaki was 74 kcal, 3.1g protein, 3.2g lipid, 8.2g carbohydrates, and 0.96g salt equivalent per 100 grams. The nutritional value of Sardine dumpling was 45kcal, 1.8g protein, 1.3g lipid, 6.5g carbohydrates, and 0.68g salt equivalent per 100 grams. The nutritional value of Creamed chicken was 77 kcal, 3.5g protein, 4.0g lipid, 6.8g carbohydrates, and 0.78g salt equivalent per 100 grams.

c) Sample (food with thickener added) adjustment

Each of the three foods prepared as five samples.

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1) The viscosity of the food product itself measured without any modification.
2) The food was pulverized for 20 seconds using a mixer into a liquid state, and the viscosity was measured.
3) The viscosity measured after adding 1 gram of thickener (A or B) to the food (100g) ground for 20 seconds with a mixer and stirring for 5 minutes.
4) The viscosity measured after adding 2 grams of thickener (A or B) to the food (100g) ground for 20 seconds with a mixer and stirring for 5 minutes.
5) The viscosity measured after adding 3 grams of thickener (A or B) to the food (100g) ground for 20 seconds with a mixer and stirring for 5 minutes.

d) Viscosity measurement method

The viscosity of each food was measured using the Line Spread Test Start Kit (LST) manufactured by SARAYA. The measurement procedure is as follows. The viscosity test performed at 24 degrees (room temperature). The test repeated three times, and the average value calculated.

1. Place the sheet on a level surface. Place a ring with an inner diameter of 30mm in the center of the concentric circles.
2. Add the liquid to be measured to the full thickness of thering (20ml) and let stand for 30 seconds.
3. Lift the ring vertically and, after 30 seconds, measure the spread distance of the solution. Since there are a total of 6 points to measure, the average value of them used as the LST value.
4. After still standing for 5 minutes, the spread of the samples is measured again at 6 points, and the average value recorded as the LST value.

e) Criteria for viscosity

There are three levels of classification by LST value[1]. The first stage is the mildly thick with a viscosity that falls within the range of 43mm to 36mm (50-150 mPa・s). As for the properties, when the spoon is tilted, it flows down quickly[1]. The second stage is moderately thick with a viscosity that falls within the range of 36mm to 32mm (150-300 mPa・s). As for the properties, when you tilt the spoon, it flows to the surface[1]. The third stage is extremely thick with a viscosity that falls within the range of 32mm to 30mm (300-500 mPa・s). Even if the spoon is tilted, the shape maintained to some extent, and it does not flow easily[1].

f) Statistical processing

This study was statistically processed using statistical processing software, Excel 2010 (SSRI Co., Ltd). The data to be compared were first tested for normal distribution by F-test. For comparisons between correlated data, the paired Student t-test used for normally distributed data. Wilcoxon test used for non-normally distributed data. For comparisons between uncorrelated data, the unpaired Student t-test used for non-normally distributed data. Mann-Whitney test used for non-normally distributed data.

III. Result

a) Result of Sukiyaki LST test

Table 1 shows the results of viscosity measurement performed by adding the thickener Ain Sukiyaki. As a result of measuring the viscosity of commercial care food without treatment, it found to be the stage 3 (Extremely thick) after 30 seconds, but after 5 minutes, the stage changed the stage 2 (Moderately thick). The result of viscosity measurement after the mixer treatment was also the stage 3 (Extremely thick) after 30 seconds, but after 5 minutes age changed stage 1 (Mildly thick). It found that there is a statistical advantage after 5 minutes rather than 30 seconds, and the viscosity loosens and spreads. However, when the thickener A was added (1g or 2g or 3g), the LST value did not change stably even after 5 minutes as compared with after 30 seconds. The viscosity was within Stage 3.

Table 2 shows the results of the viscosity measurement performed by adding the thickener B in Sukiyaki. When the thickener B added (1g or 2g or 3g), the LST value did not change stably even after 5 minutes as compared with after 30 seconds. The viscosity was within Stage 3.

Table 1. Universal Design Food : UDF(Can be crushed with gums) Sukiyaki (Thickener A)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 min
Average value	29.3	33.3	30.7	46.4	29.9	30.6	24.1	24.2	21.6	22.3
SD	3.0	2.8	2.9	47.6	1.4	1.0	5.3	5.4	6.2	7.1
F test	P=0.386		P=0.0001**		P=0.125		P=0.481		P=0.302	
Paired Student-t	p=0.0001**				p=0.049*		P=0.579		P=0.012*	
Wilcoxon			p=0.001**							

* P<0.05, ** P<0.01

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Table 2. Universal Design Food : UDF(Can be crushed with gums) Sukiyaki (Thickener B)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 min
Average value	29.3	33.3	30.7	46.4	25.9	28.4	22.9	25.0	21.9	21.4
SD	29.3	33.3	30.7	46.4	25.9	28.4	22.9	25.0	21.9	21.4
F test	P=0.306		P=0.0001**		P=0.371		P=0.474		P=0.433	
Paired Student-t	p=0.0001**				P=0.0001**		P=0.001**		P=0..461	
Wilcoxon			p=0..001**							

* P<0.05, ** P<0.01

b) Result of Sardine dumpling LST test

Table 3 shows the results of viscosity measurement performed by adding the thickener A in Sardine dumpling. As a result of measuring the viscosity as it was on the market without treatment, it was Stage 2 after 30 seconds and Stage 1 after 5 minutes. The viscosity after the mixer treatment was in stage 1 after 30 seconds and in stage 1 after 5 minutes. When 1g of thickener A added, the viscosity was Stage 2 after 30 seconds and after 5 minutes. When the thickener A added in 2g or 3g at the food, the viscosity was in Stage 3 after 30 seconds and 5 minutes.

Table 4 shows the results of viscosity measurement performed by adding the thickener B in Sardine dumpling. When 1g of thickener B added, the viscosity was Stage 2 after 30 seconds and Stage 1 after 5 minutes. The viscosity when the thickener B added in 2g or 3g was in Stage 3 after 30 seconds and 5 minutes.

Table 3. Universal Design Food : UDF(Can be crushed with gums) Sardine dumpling (Thickener A)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 min
Average value	35.9	38.6	36.3	40.2	32.3	35.2	24.2	25.4	22.9	22.8
SD	5.2	5.2	2.9	3.3	1.2	1.4	6.5	7.0	8.5	9.1
F test	P=0.498		P=0.270		P=0.304		P=0.389		P=0.383	
Paired Student-t	P=0.003**		P=0.0001**		P=0.0001**		P=0.OO0**		P=0.805	
Wilcoxon										

* P<0.05, ** P<0.01

Table 4. Universal Design Food : UDF(Can be crushed with gums) Sardine dumpling (Thickener **B**)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 min
Average value	35.1	38.6	36.3	40.2	35.4	38.0	25.8	26.6	22.1	22.6
SD	5.4	5.2	2.9	3.3	2.8	1.9	6.8	7.1	8.1	8.3
F test	P=0.419		P=0.270		P=0.057		P=0.434		P=0.455	
Paired Student-t	P=0.0001***		P=0.0001**		P=0.001**		P=0.415		P=0..626	
Wilcoxon										

* P<0.05, ** P<0.01

c) Result of Creamed chicken LST test

Table 5 shows the results of the viscosity measurement performed by adding the thickener A in Creamed chicken. As a result of measuring the viscosity as it was on the market without treatment, it was Stage 3 after 30 seconds and Stage 2 after 5 minutes. The viscosity after the mixer treatment was in stage 2 after 30 seconds and in stage 1 after 5 minutes. The thickener A added (1g or 2g or 3g), the LST value did not change stably even after 5 minutes as compared with after 30 seconds. The viscosity was within Stage 3.

Table 6 shows the results of the viscosity measurement performed by adding the thickener B in Creamed chicken. When the thickener B added (1g or 2g or 3g), the LST value did not change stably even after 5 minutes as compared with after 30 seconds. The viscosity was within Stage 3.

Table 5. Universal Design Food : UDF(Can be crushed with gums) Creamed chicken (Thickener A)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 min
Average value	29.1	32.1	35.7	38.9	27.8	28.6	24.3	25.2	20.6	21.9
SD	3.3	3.6	3.1	1.2	2.2	2.4	6.0	6.4	7.8	8.3
F test	P=0.358		P=0.0001**		P=0.405		P=0.405		P=0.389	
Paired Student-t	P=0.0001**		P=0.0001**		P=0.012*		P=0.0001**		P=0.215	
Wilcoxon										

* P<0.05, ** P<0.01

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Table 6. Universal Design Food : UDF(Can be crushed with gums) Creamed chicken (Thickener **B**)

	No processing		After mixing		Add 1g thickener		Add 2g thickener		Add 3g thickener	
	After 30 se	After 5 mir	After 30 se	After 5 min	After 30 se	After 5 mir	After 30 se	After 5 mir	After 30 se	After 5 min
Average value	29.1	32.1	35.7	38.9	27.9	29.1	23.6	22.9	20.9	21.3
SD	3.3	3.6	3.1	1.2	1.8	2.6	5.0	6.8	7.9	8.3
F test	P=0.358		P=0.0001**		P=0.068		P=0.098		P=0.407	
Paired Student-t	P=0.0001**		P=0.0001**		P=0.041		P=0.690		P=0..006**	
Wilcoxon										

* P<0.05, ** P<0.01

d) Results of comparison of two thickeners

The result of comparing the stability of the two types of thickeners shown in Table 7, 8, and 9.

In the case of the Sukiyaki, when 1g of thickener added, both thickeners A and B became Stage 3 after 30 seconds and after 5 minutes. Thickener B was statistically significantly more stable than A. (to see Table 7).

In the case of Sardine dumplings, when 1g of thickener added, both thickeners A and B became Stage 2 after 30 seconds. After 5 minutes, thickener A was Stage 2, but thickener B was Stage 1. Thickener A was statistically significantly more stable than B. When a thickener added 2g or 3g, the LST value did not change stably even after 5 minutes as compared with after 30 seconds. The viscosity was within Stage 3 (see Table 8).

In the case of Creamed chicken, when the thickener A or B was added (1g or 2g or 3g), the LST value did not change stably even after 30 seconds or after 5 minutes as compared with both thickener. The viscosity was within Stage 3 (see Table 9).

Table 7. Comparison of viscosities with two thickeners (A and B) in Sukiyaki

	1g thickener, After 30		1g thickener, After 5		2g thickener, After 30		2g thickener, After 5		3g thickener, After 30		3g thickener, After 5	
	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener
Average value	29.9	25.9	30.6	28.4	24.1	22.9	24.2	25.0	21.6	21.9	22.3	21.4
SD	1.4	4.5	1.0	4.9	5.3	9.2	5.4	9.4	6.2	9.4	7.1	9.0
F test	P=0.0001**		P=0.0001**		P=0.012 *		P=0.011*		P=0.047*		P=0.157	
Unpaired Student-t											P=-0.743	
Wilcoxon	p=0.003**		P=0.050*		p=0.234		p=0.668		p=0.461			

* P<0.05, ** P<0.01

Table 8. Comparison of viscosities with two thickeners (A and B) in Sardine dumpling

	1g thickener, After 30		1g thickener, After 5		2g thickener, After 30		2g thickener, After 5		3g thickener, After 30		3g thickener, After 5	
	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener
Average value	32.3	35.4	35.2	38.0	24.2	25.8	25.4	26.6	22.9	22.1	22.8	22.6
SD	1.2	2.8	1.4	1.9	6.5	6.8	7.0	7.1	8.5	8.1	9.1	8.3
F test	P=0.0001**		P=0.082		P=0.421		P=0.467		P=0.467		P=0.355	
Unpaired Student-t			P=0.0001**		P=0.477		P=0.624		P=0.624		P=-0.939	
Wilcoxon	P=0.0001**											

* P<0.05, ** P<0.01

Table 9. Comparison of viscosities with two thickeners (A and B) in Creamed chicken

	1g thickener, After 30		1g thickener, After 5		2g thickener, After 30		2g thickener, After 5		3g thickener, After 30		3g thickener, After 5	
	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener	Thickener
Average value	27.8	27.9	28.6	29.1	24.3	23.6	25.2	22.9	20.6	20.9	21.9	21.3
SD	2.2	1.8	2.4	2.6	6.0	5.0	6.4	6.8	7.8	7.9	8.3	8.3
F test	P=0.178		P=0.370		P=0.207		P=0.395		P=0.478		P=0.497	
Unpaired Student-t	P=0.902		P=0.552		P=0.700		P=0.299		P=0.916		P=-0.839	
Wilcoxon												

* P<0.05, ** P<0.01

IV. Discussion

The viscosity test results of universal design foods that can crushed with gums were Stage 2 or 3 when untreated. Therefore, it considered better to add a thickener to stabilize the physical properties, but neither of the two types of thickeners used this time could maintain Stage 3 with 1g. When 2g or 3g of the two types of thickeners used this time were added to food, Stage 3 could maintain. Further, in the case of foods having a large number of carbohydrates (Sukiyaki in this study), the thickener B (high in thickening polysaccharides) can stabilize the viscosity and is suitable for adjusting the viscosity. On the other hand, in the case of foods having a small number of carbohydrates (Sardine dumpling in this study), the thickener A (high in water-soluble dietary fiber) can stabilize the viscosity and is suitable for adjusting the viscosity. Safe dietary intake is important in the field of nursing[2]. A guideline for the combination and amount of foods and thickeners is required so that safe and adjustable nursing foods can be prepared even at home. If the care recipients do not eat enough, there is an increased risk of malnutrition and flail[3-9], or protein deficiency leading to sarcopenia[10,11]. We think it is good to continue research on nutritional supplemental drink[12,] and many other drinks[13] for senior citizens and patients. In the future, we would like to report useful data that can be used in ordinary households by measuring the combination and blending ratio of more commercially available thickeners and commercially available universal design foods.

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V. Conclusions

Viscosity measured in different combinations of two commercially available thickeners and three commercially available care foods (the can crushed with gums of the universal design food) result. The viscosity stabilized by adding a thickener. Thickener B (high in thickening polysaccharides) had a higher viscosity than thickener A (high in water-soluble dietary fiber) when 1g of thickener added when the number of carbohydrates in the food was high. Vice versa, thickener A had a higher viscosity than thickener B when 1g of thickener added when the number of carbohydrates in the food was low. After all, there is thickener that is compatible with food materials and nutrients contained in foods. In the future, we could like to measure the viscosity of more food materials and thickener combinations.

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