EFFECTS OF PORK ROUND POWDER ADDITION ON THE QUALITY CHARACTERISTICS OF NOODLE PRODUCT

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Abstract – The quality characteristics like color, viscosity, texture profile, tension, cooking properties and sensory evaluation were tested to find out the effect of pork round powder treatments in the noodle at the ratio of 1%, 3%, 5% and 7% respectively. In the color test, with the increment of pork round powder ratio, L value and b value decreased but a value increased. In the test of viscosity, the result of peak (P), trough (H), breakdown (P-H), final viscosity (C) and setback (C-P) was found highest in 1% treatment and it decreased with the pork round powder ratio increased. With this experiment, 3% of pork round powder treatment was the best condition for noodle manufacturing because it was most similar condition with the control (p<0.05). In the test of texture profile, the higher ratio of pork round powder in the noodle, its hardness was getting higher while tensile force and tensile distance were down. Tensile force in the 3% treatment was 44.15g which showed similar result with the control of 44.65g (p<0.05). In the turbidity test of the noodle soup, it went up while the pork round powder ratio was high, which resulted that solid in the noodle moved to the soup. Sensory evaluation of color, flavor and taste test resulted also reasonable in the 1% and 3% treatment (p<0.05) and there was no significant difference in the 5% treatment with control in the overall acceptability.

Key Words – Pork round powder, Noodle, Viscosity, Texture, Sensory evaluation,

I. INTRODUCTION

Meat consumption pattern in Korea is normally for roasting uses. Pork belly part is very popular in Korea because it is believed the best part for roasting with its rich flavor comes from fat. This results pork belly part should be imported for short of domestic supply. In the other hands, the round part is called 'less preferred part' in the market because it is not good for the roasting with less fat contents and results oversupplied because of its less consumption. With this unique situation of unbalanced meat consumption in Korea, many researches are trying to find the solution to make up demand and supply balance with development of popular meat processed products including pork round part.

Noodle is very common food around the world for a long time. It is made mainly by wheat flour, salt and water after mixing, kneading dough and cutting in a certain form [1]. Nowadays, many convenient types of noodle products are found in the market and the consumption of those kinds of noodle products is increasing. But they seem to focus for its convenient purposes not much for its nutrition value. Now we believed that new concept noodle products with higher nutrition value but maintain its convenience function and texture profile at the same time need to be developed. In this study, new technology for binding capacity between wheat flour and meat powder was tried and physico-chemical quality of noodle with pork round powder was researched.

II. MATERIALS AND METHODS

Samples Treatments

Material like wheat flour, pork round powder, salt, gluten and water were mixed with the ratio in Table 1 and aged for 30 min. Mixed material of paste was passed through pasta roller (KitchenAid, K5SS, USA) several times until it had same thickness of 2 mm and then cut at same thickness with pasta cutter. Each noodle was cooked at 100℃ for 3 min in separated pots and washed with cold water for 30 sec. Pork round powder was made with chopping (Hand Blender, MR5550MCA, Braun, Spain), deep freezing (VIP Series, Sanyo, Japan), freeze drying for 48 hrs in a freeze drier (Ilshin FD5512, Ilshin, Korea) and then sieving at 20 mesh (Test sieve, 850 ㎛, Chuggye, Korea) before experiment. In this experiment, 3 samples of noodle were prepared and analyzed with triple replicates.

Table 1 Mixture formula of noodle with various ratio of pork round powder addition

(Unit: %)

	Flour	PP	Water	Salt	Gluten
Control	71	0	27	1	1
PP-1%	70	1	27	1	1
PP-3%	68	3	27	1	1
PP-5%	66	5	27	1	1
PP-7%	64	7	27	1	1

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition

Analysis

Color : L value (lightness), a value (redness) and b valve (yellowness) were detected by color difference meter (Chroma meter, CR-410, Minolta Co., Japan) at the condition of L: 97.10, a: -0.17 and b: 2.08 in the standard white plate.

Viscosity : Rapid Visco Analyzer (RVA, New Port Scientific Pty, Ltd, Australia) was used to evaluate the viscosity with the method of AACC [2] and resulted with value of Rapid Visco Unit (RVU).

Texture Profile Analyzer (TPA) : Texture was experimented by texture analyzer (TA-XT, stable micro system. UK) with a p20～40 mm round probe under the condition of pre-test speed 0.5 mm/s, test speed 0.5 mm/s, post speed 0.5 mm/s, strain 50% and 75% distance.

Tension : Tension was tested by texture analyzer (TA-XT2i, stable micro system. UK) under the condition of pre-test speed 5.0 mm/s, test speed 5.0 mm/s and post speed 5.0 mm/s. Force (g) and distance (mm) of the cooked noodle were extended until it cut after gripping the end of noodle hold tight.

Water Absorption ratio (WAR) : WAR of the noodle was test with below calculation method.

WAR (%)=Noodle wt (after cooking-before cooking) /Noodle wt before cooking x 100

Volume : Increased volume of the cooked noodle was measured with mess cylinder.

Turbidity : Turbidity of the cooked noodle soup was tested by the spectrophotometer (Mecasys, Optizen 2120UV, Korea) at 675 nm of Optical Density (OD).

Sensory evaluation : Trained 20 panel evaluated the cooked noodle with 9-point scale.

Statistics Analysis : ANOVA test was done with SAS/PC+ program [3]. Significance test of the differences between samples was done with Duncan's multiple range test (p<0.05).

III. RESULTS AND DISCUSSION

Color

Color of cooked noodles with the various mixture ratio of pork round powder (PP) 1～7% is resulted in Table 2. Lightness (L) value of control was 70.79 but decreased to 60.36 as the PP ratio increased up to 7% treatment. Redness (a) value of control was -1.82 but increased while the PP ratio was getting higher up to 1.95 at the 7% treatment. Yellowness (b) value was also went down from 15.30 in the control to 11.54 in the 7% treatment (p<0.05). The changes of color was affected by the mixture ratio of pork round powder and also considered to influence to the palatability. The papers which studied the color changes of noodles with the additives like shiitake mushroom (*Lentinula edodes*) [4], Sanghwang mushroom (*Phelllinus linteus*) [5], king oyster mushroom (*Pleurotus eryngii*) [6] or kudzu powder [7] also showed the same result L value decreased at the higher mixture ratio but increased a value and b value in the same conditions.

Table 2 Color changes of cooked noodle with various ratio of pork round powder addition

Treat-ment	Hunter's color value		
	L	a	b
Control	70.79±0.30[a]	-1.82±0.04[d]	15.30±0.06[a]
PP-1%	69.64±0.15[b]	-1.25±0.01[c]	14.53±0.18[b]
PP-3%	67.12±0.44[c]	-0.55±0.04[b]	14.15±0.13[c]
PP-5%	60.94±0.16[d]	1.95±0.00[a]	11.88±0.04[d]
PP-7%	60.36±0.29[d]	1.95±0.02[a]	11.54±0.13[e]

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition

[a-e] Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

Viscosity

Viscosity of the various mixture ratio of pork round powder (PP) 1～7% is resulted in Table 3. With the higher ratio of PP, peak viscosity (P), trough (H), breakdown (P-H), final viscosity (C), setback (C-P) of the powder mixture declined gradually except 1% of PP treatment. In the peak viscosity, 72.89 RVU was in the control while 75.55 RVU in 1% treatment and 71.22 RVU in 3% treatment respectively, which showed no significant difference with the pork round powder mixture ratio. But in the 5% and 7% treatment, peak viscosity decreased 65.75 RVU and 61.42

RVU each, this result is believed that meat powder which has no amylose related more to the viscosity than the other treatments. When peak viscosity is high, the texture of noodle is getting strong but the noodle becomes too soft when it is cooked [8]. Trough (H) had highest result of 56.70 RVU in 1% treatment and 51.44 RVU in 3% treatment but there was no significant difference compare to the 53.33 RVU in the control. But it went down to 48.50 RVU and 44.67 RVU in the 5% and 7% treatment respectively. Breakdown (P-H) and final viscosity (C) has also no significant differences between control and 1% and 3% treatment. Setback (C-P) is the difference value of trough deducted from final viscosity which can predict the retrogradation tendency. With the result, all the treatments except 1% treatment shows slower retrogradation than the control [9].

Table 3 Viscosity changes of cooked noodle with various ratio of pork round powder addition (Unit: RVU)

	P	H	P-H	C	C-P
Control	72.89± 11.09^{a}	53.33± 8.53^{ab}	19.56± 8.53^{a}	109.97± 15.49^{ab}	56.64± 6.97^{ab}
PP-1%	75.55± 1.733^{a}	56.70± 0.46^{a}	18.86± 1.29^{ab}	114.06± 2.25^{a}	57.36± 1.80^{a}
PP-3%	71.22± 1.15^{a}	51.44± 1.18^{abc}	19.78± 0.25^{a}	106.44± 2.50^{abc}	55.00± 1.32^{ab}
PP-5%	65.75± 1.61^{ab}	48.50± 1.15^{bc}	17.25± 1.68^{bc}	99.08± 2.04^{bc}	50.58± 2.30^{bc}
PP-7%	61.42± 1.09^{b}	44.67± 0.75^{c}	16.75± 0.66^{c}	93.03± 1.40^{c}	48.36± 0.80^{c}

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition
$^{a-c}$ Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

Texture profile

The result of texture profile analysis of cooked noodle made with various ratio of pork round powder in the mixture is in Table 4. Hardness in the control was 1,123.97g and it grew up when the additional ratio of pork round powder increased. In the 7% treatment, it resulted highest value of 1,448.33g among the treatments (p<0.05). There were no significant differences in the springiness and cohesiveness between control and treatments while gumminess and chewiness increased when the mixture ratio of pork round powder was high (p<0.05).

Table 4 Texture profile changes of cooked noodle with various ratio of pork round powder addition

Treatment	Hardness (g)	Springiness	Cohesiveness	Gumminess	Chewiness
Control	1123.97± 48.56^{c}	0.85± 0.06^{a}	0.72± 0.02^{ab}	811.32± 46.51^{c}	688.15± 76.65^{b}
PP-1%	1257.21± 165.55^{bc}	0.87± 0.10^{a}	0.73± 0.01^{a}	853.88± 157.02^{bc}	813.77± 182.77^{ab}
PP-3%	1304.08± 51.11^{b}	0.90± 0.03^{a}	0.73± 0.01^{a}	947.23± 35.64^{ab}	945.39± 58.38^{a}
PP-5%	1320.61± 120.51^{ab}	0.90± 0.04^{a}	0.72± 0.03^{ab}	944.20± 93.59^{ab}	848.62± 91.42^{a}
PP-7%	1448.33± 77.74^{a}	0.88± 0.01^{a}	0.70± 0.02^{b}	1004.40± 86.10^{a}	850.76± 44.51^{a}

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition
$^{a-c}$ Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

Tension

In the result of test on tensile force and tensile distance of cooked noodle with various mixture ratio of pork round powder is shown in the Fig.1. The tensile force of noodle was 44.65g in the control but it got down gradually to 33.54g in the 7% treatment (p<0.05). Tensile distance was 110.68mm in the control but decreased to 81.75mm in 7% treatment which showed also it became shorter when the mixture ratio increased. But 3% treatment had no significant differences compare to control. And it results the best condition in the treatments.

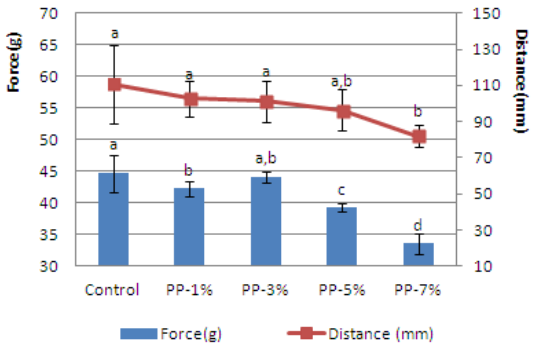

Fig. 1. Tensile force and tensile distance changes of cooked noodle with various ratio of pork round powder addition

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition
$^{a-d}$ Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

Cooking properties

The result of water absorption ratio, volume and soup turbidity of the cooked noodle with various mixture ratio of pork round powder is shown in the Table 5. Water absorption ratio of the cooked

noodle was 69.11% in the control but gradually went down to 58.26% in the 7% treatment. And in the volume test, there were no differences between control and treatments except 7% treatment, which meant pork round powder had less capacity for water absorption [10].

Turbidity was tested in the cooked noodle soup to find the transferring effect of solid content from noodle to soup. With the higher contents of pork round powder in the noodle, the higher value of turbidity was resulted from 0.12 OD in the control and 1% treatment to 0.23 OD in the 7% treatment (p<0.05). All of these results causes for the weakness of binding capacity of noodle because the additives like meat powder replaces flour can't make up the combining strength enough when they are heated [11].

Table 5 Water absorption, volume and turbidity changes of cooked noodle with various ratio of pork round powder addition

Treatment	Water absorption (%)	Volume (ml)	Turbidity of Soup (OD)
Control	69.11	70±0.02^{a}	0.12±0.01^{d}
PP-1%	68.26	70±0.01^{a}	0.12±0.02^{d}
PP-3%	61.71	70±0.02^{a}	0.15±0.01^{c}
PP-5%	60.49	70±0.02^{a}	0.17±0.01^{b}
PP-7%	58.26	70±0.05^{b}	0.23±0.03^{a}

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition
[a-d] Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

Sensory Evaluation

The result of sensory evaluation of cooked noodles added pork round powder is in Table 6. The sensory score in the color of 1% and 3% treatments showed higher than that of control, which was believed panels preferred the colored noodle than the white. Because they can think colored noodle contains functional material which helps health than just flour based white noodle. In the flavor and taste, there were similar results in the 1% and 3% treatment compare to control but different significantly in the 5% and 7% treatments (p<0.05). And there was no significant difference in the texture of the cooked noodle between 1%, 3% treatment and control. In the overall acceptability, the sensory score of 5% treatment was 5.3 but there was no significant difference compare to the score of 6.7 in the control. The sensory score in the 7% treatment was 4.8, which showed lowest result among the treatments and also had significant different to the control (p<0.05). According to the result of this sensory evaluation, 3% of pork round powder treatment is found the best result among the treatments.

Table 6 Sensory evaluation of noodles with various ratio of pork round powder addition

Treat-ment	Color	Flavor	Taste	Texture	Overall acceptability
Control	5.3±0.9^{b}	6.2±1.3^{a}	6.4±1.3^{a}	6.9±1.0^{a}	6.7±1.1^{a}
PP-1%	6.4±1.1^{a}	6.2±1.2^{a}	5.9±1.5^{ab}	6.2±0.7^{ab}	6.2±1.1^{a}
PP-3%	6.4±0.9^{a}	5.7±1.2^{ab}	5.7±1.1^{ab}	6.3±1.0^{ab}	5.7±1.3^{ab}
PP-5%	6.0±1.1^{ab}	4.9±1.3^{b}	4.9±1.6^{bc}	5.3±0.5^{b}	5.3±1.4^{ab}
PP-7%	6.0±0.9^{ab}	4.4±1.3^{b}	4.1±1.2^{c}	5.1±0.7^{b}	4.8±1.6^{b}

PP-1,3,5,7% : Pork Round Powder 1,3,5 and 7% addition
Hedonic scale: 1 (extremely bad) to 9 (extremely good).
[a-c] Mean with same letter in each column are not significantly different by Ducan's multiple range test (p<0.05).

IV. CONCLUSION

Noodles added pork round powder 1%, 3 %, 5% and 7% respectively were manufactured and compared its quality characteristics with control. In the color test, control showed highest L and b value but a Value of 5% and 7% treatment had higher than other treatments significantly. In the test of viscosity, up to 3% treatment showed no difference compare to control and recognized it in the acceptable scope. In the hardness of texture profile test, it got higher score with more addition of pork round powder because it had different type of physical properties. Tensile force and tensile distance were important quality criteria in this experiment because of its binding strength of noodle. In this experiment, tensile force in the 3% treatment was 44.15g which showed similar result with the control of 44.65g (p<0.05). Turbidity went up while the pork round powder ratio was high which meant solid in the noodle extracted to the soup. In the color, flavor and taste test of sensory evaluation resulted reasonable in the 1% and 3% treatment. With these above results of test, 3% pork round powder treatment in the noodle is the best condition in this test because it remains reasonable ranges when it is compared to control.

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