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STUDIES ON THEEFFECT OF FERMENTED CORTEX RESIDUEOF ALOE AS FOOD ADDITIVES ON PIG'S MEAT QUALITY

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Abstract
In this study, the feasibility of using Aloe saponaria species cortex residues as a dietary supplement for pigs by feeding the aloe fermentation treatments was investigated.Two groups of pigs were became a subject in this research. One group of pigs was fed by diets food containing general food and the other group was fed by diets food containing fermented aloe.The diet food was fed once every 10 days up to 70 days, and then once every 20 days up to 152 day. In the end of experimental period, the meat qualityof both groups was analyzed. The storage weight lossat 4 ± 1 ℃, pH, water retention, and flesh colorwere measured. The experimental results shows that the meat quality of pigs fed by fermented aloe is similar with the pigs fed by general food. Therefore, the fermented Aloe saponaria cortex residues could be an alternative solution for dietary supplement food.

INTRODUCTION

Aloe has been used as an important medicinal herb in the world since many centuries. The history shows that Aloe has been a favorite medical herb in the Ephrus papyrus in the 15th century BC and in Greecein the 4th century BC. Aloe belongs to the Asparagales order,Asphodelaceae family, Asphodeloideae subfamily, and monocots plant.

In Korea, interest in Aloe has increased, and it is mainly used as a healthy food for improvement health condition.Recently, Aloe has widened its range of use on the healthy food and skin beauty. Aloe can be divided into three parts such as a cortex, a yellow fluid layer and a gel layer. The yellow fluid layer has an anthraquinone and chromium effective ingredients. The thick gel layer called aloe flesh is composed of polysaccharides and glycoproteins. It also contains active ingredients and minerals. Gel layer is mainly used as raw materials of medicines and cosmetics. After extracting the inside of the aloe leaf, a large amount of cortex part of the aloe leaves rich in dietary fiber, cellulose, and minerals should be recycled.

To solve this problem, this paper investigates the feasibility of using Aloe saponaria species cortex residues as a dietary supplement for pigs. Aloe saponaria fermentation could be an alternatives solution to improve the economic value of aloe waste.

MATERIAL & METHOD

Material

In the beginning of experiment, 120 piglets were selected in the farm and the piglets were divided into two groups. One group was fed by diets food containing general food and the other group fed by diets food containing fermented aloe.The diet food was fed once every 10 days up to 70 days, and then once every 20 days up to 152 day.

Method

After completion of the experiment period, the results were checked and the gradeswere determined by livestock product quality assurance center.After picking the grade, the fresh fillet muscle were stored immediately at the

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refrigeration temperature (4 ± 1 ℃), and shipped to animal husbandry laboratory at Busan National University. Then the meat quality such as storage weight lossat 4 ± 1 ℃, pH, water retention, and flesh colorwere measured.

1) pH

10g of pork samples were homogenized with 90 ml of distilled water at 14,000 rpm for 2 minutes using a homogenizer and measured with a pH meter (Seven Easy pH, Mettler-toledo, Switzerland).

2) Storage weight losses

The storage weight losses was measured by cutting the sirloin 680 ~ 720g and wrapping them with 3 laps wrapped to measure the weight decreasing due to the juice produced during the storage period at the refrigerating temperature of 4 ± 1 ℃ .

3) Water retention

The water retentivity was obtained by uniformly grinding and mixing the samples, placing them in a wire mesh and centrifuge tube, sealing them, placing the centrifuge tube in a Büchi heating bath B-490, heating at 70℃ for 30 minutes, cooling for 10 minutes, centrifuging at 100 rpm for 10 minutes (Centrifuge Union 5KR).The amount of water measured is called F (%).The sample is divided into the same amount and size, and then dried at 100 ~ 102℃ (Forced convection drying oven C-DF). The amount of water obtained by measuring the weight after cooling was calculated as W (%).The water retention can be calculated according to the following equation:

$$W.H.C(\%) = \frac{W(\%) - F(\%)}{W(\%)} x100 \quad (1)$$

4) Shear value

Shear coolers were prepared in the size of 1cm × 3cm and stored on a rack of an Instron universal testing machine (TT42R, Instron, USA). The stretching and load of the tensile tester were zeroed and the pressure and tension of the force or energy values involved in the interaction were measured. The shear value was measured using Warner-Bratzler at a test speed of 100 mm/min.

5) Meat color

The meat color samples were measured by cutting the sample and measured using a Chromameter (CR 301, Minolta Co, Japan) and the CIE (Commission Internationalized Leclairage) L* value indicating the lightness and the redness. The CIE a* value and the CIE b* value indicating yellowness were repeatedly measured three times. At this time, the standardization work was normalized to Y = 93.5, x = 0.3132, y = 0.3198 using the punching plate No. 12633117.

RESULTS AND DISCUSSION

1) pH

Table 1 shows the results of pH measurement of sirloin from pigs fed with and without aloe.The pH of the control did not show any significant change over the storage period. However, the pH of the experimental group tended to gradually increase with the storage period. There was a significant difference ($p < 0.05$) between the experimental value of 1 day and the measurement value of 6 and 15 days ($p < 0.05$). But there was no significant difference on the other days. The pH of control and experimental group did not show significant difference in the same storage period. As a result, in the experimental group, the measured values were significantly increased around 15 days, but the control and experimental groups showed only slight increase with the lapse of storage period. It can be said that there is no significant difference.

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Table 1. Changes in pH of longissimusdorsi from pigs fed different feeds during storage periods at 4±1℃

Treatments[1)]	Storage periods (days)					
	1	3	6	9	12	15
C	5.45±0.04	5.56±0.08	5.47±0.33	5.58±0.08	5.57±0.07	5.55±0.22
T	$5.33±1.73^{B}$	$5.48±0.08^{AB}$	$5.76±0.28^{A}$	$5.55±0.05^{AB}$	$5.54±0.12^{AB}$	$5.63±0.13^{A}$

A ~ B: Means with different superscript in the same row are significantly different($p<0.05$).
1) C: Pork feds without fermented aloe feed, T: Pork feds with fermented aloe feed.

After slaughter, glycogen in the muscle is anaerobically metabolized and accumulation of lactic acid lowers the pH of the muscle. The post-slaughtering temperature and the speed of the process tend to be proportional. In general, the pH of muscle after slaughter has dropped to pH 5.4 within 24 hours (Penny, 1977), and the pH and descent rate of the conductor have been reported to affect other physicochemical properties such as water holding capacity and meat color (Briskey, 1964; Boles , 1993). In addition, it has been reported that the pH is increased by the proteolytic enzyme during fermentation (Boakye, 1993), and the same results were obtained on the 1st and 15th days in this study.

As a result of this experiment, the change of pH according to the storage period is not significant, but the whole interval stays within the range of minimum 5.33 to maximum 5.76, which is similar to the pH value of fresh meat. The FAO also stated that the pH of pork fresh meat was 5.5 to 6.2, which means that the samples used in the experiment, even after 15 days of storage can be used for food. In addition, the pH value increased from 5.45 and 5.33 at the end of storage period to 5.63 at each storage period.

2) Storage weight losses

Table 2 shows the results of the juice loss of the sirloin obtained from the pigs fed with and without aloe.Juvenile loss was about 4% after 3 days of storage, steadily increased with the passage of time, and increased to 6.38% at 15 days. In both control and experimental groups, there was a significant difference ($p<0.05$) between 1 and 3 days, but this was due to the absence of juice loss at the start of the experiment. There was no significant difference between the control and experimental measurements in the same storage period, which means that both the pigs fed with the aloe supplement and the pigs fed without aloe had no difference in juice loss over time.

Table 2. Changes in drip loss of longissimusdorsi from pigs fed different feeds during storage periods at 4±1℃(%)

Treatments[1)]	Storage periods (days)					
	1	3	6	9	12	15
C	0B	4.01±2.07A	4.32±0.78A	4.65±2.13A	5.62±1.33A	5.94±1.52A
T	0B	3.92±1.65A	4.02±0.88A	4.66±1.24A	5.70±1.24A	6.38±2.45A

A ~ B: Means with different superscript in the same row are significantly different ($p<0.05$).
1) C: Pork feds without fermented aloe feed, T: Pork feds with fermented aloe feed.

Meat juice loss is influenced by water conservatism. Hamm (1974) reported that the decrease in pH decreased the space between muscle fibers and decreased the water holding capacity, resulting in an increase in juice loss. According to Kauffman (1986), water present in food is chemically bonded to other molecules tightly or loosely, or

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freely. It is assumed that the water treatment is affected by the physical treatment and the cutting and physical pressure for the packaging is the physical treatment which affected the juice loss in this experiment.According to Kim et al. (2008), when the sample is shaped to a certain shape and then cut into 2 cm thickness and packed with polyethylene, the weight loss is increased from 1.95 to 3.67% on the 1st day to 11.94% on the 7th day.

3) Water retention

Table 3 shows the results of the water holding capacity measured by sirloin from pigs fed with and without aloe.The control group showed a tendency to decrease with the storage period. There was a significant difference ($p < 0.05$) between the experimental results of 1 day and the results of 3, 6 and 15 days ($p < 0.05$). But there was no significant differenceat the rest of the time. The experimental group showed a tendency to decrease overall, but no significant difference was observed. There was no significant difference between the control and experimental values in the same storage period.

Table 3. Changes in WHC of longissimusdorsi from pigs fed different feeds during storage periods at 4±1 ℃

Treatments[1)]	Storage periods (days)					
	1	3	6	9	12	15
C	75.78±3.83BC	89.95±4.50A	84.09±3.64AB	88.79±2.07A	79.76±7.28B	68.71±3.13C
T	76.06±9.85	88.42±10.64	80.16±9.91	80.19±6.97	73.04±9.10	73.16±4.28

A ~ C: Means with different superscript in the same row are significantly different($p<0.05$).
1): C: Pork feds without fermented aloe feed. T: Pork feds with fermented aloe feed.

The fact that the water-retaining property of food is good means that when a series of physical treatments such as cutting, crushing, and pressing are applied to the food, it retains the moisture inside it. Conservative properties of meat products affect other physical properties such as meat color and dry weight loss, which are influenced by pH, erosion length, etc. (Barge et al., 1991; Roseiro et al., 1994). As pH reaches isoelectric point,it is reported that about 65% of the water holding capacity of the meat is derived from myofibrils such as actin and myosin (Hamm, 1960).In addition to the physicochemical properties, water conservancy is influenced by the freshness and grade of food, and it has been reported that when the protein in the meat is denatured, the water holding capacity decreases (Jung, 1999; Jung et al. 2003).

4) Shear value

Table 4 shows the results of the shear rate test using the sirloin obtained from the pigs fed with and without aloe.The control did not show significant shear value change within storage period. The shear value of the experimental group showed a significant increase at 3 days ($p < 0.05$), but no significant difference was observed at the rest of the time, indicating that the storage period did not affect the shear value. There was no significant difference in shear value between control and experimental sites during each storage period. As a result, the maximum value of 2.33, which is similar to or lower than that of Jung et al. (2006), is considered to be no error in the result. It is judged that the lapse of the storage period does not affect the shearing value.

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Table 4. Changes in shear force of longissimusdorsi from pigs fed different feeds during storage periods at 4±1 ℃ (kgf)

Treatments[1)]	Storage periods (days)					
	1	3	6	9	12	15
C	1.35±0.06	1.89±0.66	1.64±0.84	2.33±0.94	1.48±0.10	1.45±0.13
T	1.35±0.12B	1.83±0.15A	1.37±0.31B	1.58±0.22AB	1.54±0.14AB	1.56±0.31AB

The age of food depends on the amount and distribution of fat in the meat, the amount and composition of connective tissue, the chemical state, and the state of muscle fibers such as actin and myosin (Huang, 1998; Moon et al., 2001). In the case of frequently used muscles with high content of connective tissue such as elastin, there was a report that the shear was high (Kang et al., 1994).

5) Meat color

Table 5 shows the results of meat color measurement of sirloin from pigs fed with and without aloe.There was no significant difference in the L* value between the control and the control group, but the control group showed a significant increase at the 9th day ($p<0.05$). There was no significant difference between the control and experimental values in the same storage period. The a* value showed a tendency to increase in the control group ($p<0.05$). In the experimental group, no significant difference was observed in all sections. B* values were not significantly different in the storage period of the control. However, the values of b* values were significantly lower at the 9th day ($p<0.05$) in the experimental group and not significantly different in the remaining period. There was no significant difference between the control and experimental values in the same storage period.

Table 5. Changes in hunter color of longissimusdorsi from pigs fed different feeds during storage periods at 4±1 ℃

Treatments[1)]		Storage periods (days)					
		1	3	6	9	12	15
L*	C	55.64±1.26	56.64±1.96	57.70±2.16	56.75±2.89	55.45±2.41	58.07±2.65
	T	56.45±1.05AB	58.84±0.74A	59.57±2.01A	53.39±1.82B	61.34±5.13A	57.00±3.05AB
a*	C	7.73±0.57BC	7.77±0.94BCa	6.59±0.76Cb	9.81±0.29Aa	9.14±0.29A	8.62±0.86ABa
	T	7.02±0.67AB	5.28±0.74Bb	8.88±0.97Aa	7.00±0.92ABb	8.37±2.65A	6.41±0.19ABb
b*	C	4.35±0.61	3.65±0.32	4.25±1.03	4.77±2.23	4.68±1.73	5.44±1.13
	T	4.66±0.14AB	4.66±0.64AB	5.57±0.85A	3.38±1.49B	5.56±0.60A	4.58±0.38AB

A ~ B: Means with different superscript in the same row are significantly different($p<0.05$).
1) C: Pork feds without fermented aloe feed, T: Pork feds with fermented aloe feed.

It is reported that meat color is influenced by various factors, such as muscular dyed pigments and different kinds of muscles, reflecting different amounts of light reflected from the meat surface (Birth et al., 1978; Warriss et al., 1987). The optical properties of this meat are related to the meat quality, and the meat color changes depending on the storage temperature, and the meat color is improved due to the collapse of myofibers and the increase of

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oximyoglobin during aging. In addition, when the storage period elapses, the amount of myoglobin in the muscle increases and the color of the meat is faded. However, the content of myoglobin affects the natural color of the fresh meat recognized by the consumer (Benedict et al., 1975; Olleingrath et al., 1990). The results of this experiment are similar to those of Fermented Rice Bran feeding test reported in the previous studies.It is judged that the benefit of aloe does not significantly affect the change of color after slaughter.

CONCLUSION

After the breeding period, the meat quality test and the storage stability test were performed.

1. pH showed a tendency to increase in both the control and experimental groups, but there was no significant difference between the storage period and the control and experimental groups.
2. Juice loss rate tended to increase in both control and experimental groups, but no significant difference was observed.
3. Conservativity showed no significant difference in both control and experimental groups and showed a tendency to decrease.
4. Shear thinning showed no significant difference between the control and experimental groups, and showed a tendency to decrease.
5. L* value showed no significant difference. In the case of a* value, the control was significantly increased with storage period, but the difference was not significant between the control and experimental groups. There was no significant difference in the b* values except for the values that were significantly lower at the 9th day in the experimental group.

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