THE EFFECT OF THE MIXING RATIO OF LEAN PORK AND LARD, SPICES, AND RIPENING TIME ON THE QUALITY AND SENSORY VALUE OF PANGASIUS SALAMI

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Abstract

Effects of mixing ratio of lean pork and lard, spices, and ripening time on quality and sensory value of Pangasius Salami were studied. Pangasius Salami was researched and processed to produce a supremely nutritious product with high sensory value. Research results show that the mixing ratio between lean pork and lard compared to pangasius meat was 35% and 20%, respectively, the ratio of salt 2%, sugar 10%, and the ripening time of 7 days made the best quality, sensory-value product.

Keywords: *Lard, lean pork, Pangasius, ripening, Salami.*

ẢNH HƯỞNG CỦA TỶ LỆ PHỐI TRỘN THỊT LỢN VÀ MỠ LỢN, GIA VỊ, VÀ THỜI GIAN Ủ CHÍN ĐẾN CHẤT LƯỢNG VÀ GIÁ TRỊ CẢM QUAN CỦA SALAMI CÁ TRA

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Tóm tắt

Ảnh hưởng của tỷ lệ phối trộn thịt lợn và mỡ lợn, gia vị và thời gian ủ chín đến chất lượng và giá trị cảm quan của Salami cá tra đã được thực hiện. Sản phẩm Salami cá tra được nghiên cứu và chế biến để tạo ra sản phẩm có giá trị dinh dưỡng và cảm quan cao. Kết quả nghiên cứu cho thấy tỷ lệ phối trộn giữa thịt lợn và mỡ lợn so với thịt cá tra lần lượt 35% và 20%, tỷ lệ phối trộn muối 2%, đường 10% và thời gian ủ chín 7 ngày cho sản phẩm chất lượng tốt nhất và đạt giá trị cảm quan cao nhất.

Từ khóa: *Mỡ lợn, thịt lợn, cá Tra, ủ chín, Salami.*

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1. Introduction

Salami is a block-shaped sausage created by fermenting and drying animal flesh. Depending on the location and country, salami can be manufactured using either one or many combined types of meat. However, the most common are pork and beef. They have a long shelf life of 30-40 days when kept at room temperature and properly preserved (Giuliani et al., 2014).

Farmed catfish (*Pangasius hypophthalmus*), sometimes referred to as *pangasius*, is a catfish species from the *Pangasiidae* family found in the Mekong River basin, distributed in all four nations of Laos, Vietnam, Cambodia, and Thailand. Catfish is extensively farmed in Vietnam, particularly in the Mekong Delta. It is the most farmed and exported freshwater fish in recent years, outpacing other freshwater aquatic species, successfully supporting Vietnam's seafood export business (Nguyen, 2016). Pangasius is prevalent and recognized for its white meat that has no odor. After cooked, it is delectable and may be processed in various cuisines. Pangasius meat, in particular, is much nutritious and healthy for humans. Catfish flesh has no cholesterol and is high in vitamins A, D, and E, as well as vital unsaturated fatty acids such as Monounsaturated fatty acids (MUFA), Polyunsaturated fatty acids (PUFA), and, most notably, Omega 3, Eicosapentaenoic acid (EPA), and Docosahexaenoic acid (DHA), which are structural components of the human brain. Consuming catfish helps prevent heart disease, cancer, nourishes the eyes, promotes healthy skin, and alleviates pain and inflammation. Catfish fat also provides other vital saturated fatty acids for the body (Sudirman et al., 2018).

Pork accounts for the majority (72.6%) of meat production in Vietnam, followed by poultry (18%), beef (6.3%), and buffalo meat (1.8%), all of which stem from Vietnamese people's culinary culture (Dinh, 2017). Pork is rich in protein, a variety of vitamins, and minerals. Lean pork is an excellent complement to a balanced diet. It provides all the necessary amino acids required for physical development and upkeep. Pork, like red meat, has an equal amount of saturated and unsaturated fat. Pork contains vitamin B12 necessary for blood production and brain function. Vitamin B12 deficiency may result in anemia and nerve cell damage (Seong et al., 2014). Otherwise, lard is commonly utilized in regular meals and notably during Vietnamese traditional Tet celebrations. Pigs' back and neck fat has the lowest unsaturated acids compared to other fats, thus minimizing rancidity (Oroian & Petrescu-Mag, 2017). The addition of lean pork and lard to Pangasius Salami contributes to the product's harmonic structure, neither overly soft nor friable. Additionally, it gives the product's vibrant color and delectable flavor.

This study aimed to produce a high-nutrient-value product, diversify pangasius products on the market, and, most significantly, strengthen the Vietnamese pangasius value chain.

2. Materials and methods

2.1. Material

Pangasius was farmed in freshwater ponds in My Hoa Hung commune, Long Xuyen city, An Giang province and purchased from Long Xuyen market, An Giang province.

Lean Pork and lard were purchased from the Co-opmart supermarket in Long Xuyen city, An Giang province.

Grain salt was bought from Thanh Phat IOD Salt Production Service Trading Company Limited.

Sucrose was purchased from Bien Hoa pure white granulated sugar (Bien Hoa Sugar Joint Stock Company).

MSG (monosodium glutamate) was bought from the Ajinomoto Vietnam Company.

Black pepper was purchased from Nguyen Bao Import-Export Trading Co., Ltd.

Collagen shell (100% collagen) Viscofan - originated from Germany.

2.2. Research equipment

The study was conducted at An Giang University's Department of Food Technology's laboratory (Room 319).

2.2.1. Texture Analyzer Brookfield Ametek - USA

The equipment was used to analyze the texture properties of food, such as chewiness, hardness, brittleness, and toughness.

Specifications include 0.1 mm resolution, 0.1 mm error, 0.1-10 mm/s stroke speed, and 001 mm/s speed error.

Made in the United States of America.

2.2.2. Color measurements

Colour assessments were performed with a CR-400 Konica Minolta (Osaka, Japan) by CIE Lab system (International Commission d'Eclairage). Results were expressed as L* (brightness), a* (redness), and b* (yellowness). Gauge head diameter: 8 mm.

2.2.3. Meat Grinder Machine MDMR-800

Capacity: 3 liters.

Power: 800 W.

Material: Inox 304 stainless steel.

Producer: Midimori Vietnam.

2.3. Methods

2.3.1. Technological method

a. Pangasius salami production process

Pangasius meat → Mixing (lean pork, lard) → Grinding → Mixing with spices (salt, sugar, pepper, monosodium glutamate) → Stuffing in collagen shell → ripening (fermentation) → Packing → Product.

Pangasius meat was weighed at a predetermined weight (100 g), and then lean pork and lard were added in the amounts specified as the experimental set-up. First, ground the mixture for about 3 to 5 minutes, or until it was a smooth and cohesive uniform consistency. Next, combine it with spices such as sugar, salt, monosodium glutamate, and black pepper; and then stuff it into a collagen shell with a diameter of 4 cm and a length of 12 cm. After that, the semi-finished product was ripened using the ripening time was arranged according to the experimental set-up under controlled temperature and relative humidity of 9°C and 85%, respectively (Joao & Miguel, 2016). The ripening time is subdivided into "fermentation" (carried out by lactic acid cultures) and "ageing" (formation of sensory value). It is considered one of the most essential stages in salami production because it primarily influences the physical, chemical, and microbiological characteristics of the final fermented product (Alamprese et al., 2016). Finally, the product was vacuum packaged and evaluated for compliance with the specified criteria.

b. Determining the effect of lean pork and lard ratio on the protein, lipid, chewiness, color, and sensory value of the product.

The experiment was conducted using a varied ratio of lean pork (30%, 35%, and 40%) to pangasius meat and a variable proportion of lard (10%, 15%, and 20%) to pangasius meat. The fixed components compared to the mixture were salt (2%), sugar (10%), monosodium glutamate (3%), and black pepper (2%). Then, the mixture was stuffed into a collagen shell with a diameter of 4 cm and a length of 12 cm. The semi-finished product was then ripened under controlled temperature and relative humidity of 9°C and 85%, respectively; ripening time was 7 days. Finally, the product was vacuum packaged and evaluated for compliance with the specified criteria.

c. Examining the influence of the ratio of salt and sugar added on the sensory value of the product

The experiment was conducted using a varied salt ratio (1.5%, 2%, and 2.5%) in comparison to meat-fish mixes and a sugar ratio (8%, 10%, and 12%) in comparison to meat-fish mixtures. The fixed components compared to the compound after mixing the spices were monosodium glutamate (3%) and black pepper (2%). Then, the mixture was stuffed into a collagen shell with a diameter of 4 cm and a length of 12 cm. The semi-finished product was then ripened under controlled temperature and relative humidity of 9°C and 85%, respectively; ripening time was 7 days. Finally, the product was vacuum packaged and evaluated for compliance with the specified criteria.

d. Examining the effect of ripening time on protein, lipid, chewiness, color, and sensory value of the product.

Experiments were conducted with varying ripening times (5 days, 7 days, and 9 days). The constant component was the temperature (9°C) and relative humidity (85%). Finally, the product was vacuum packaged and evaluated for compliance with the specified criteria.

2.3.2. Physicochemical analysis

a. Determination of protein content

The protein content was determined by the Kjeldahl method.

b. Determination of lipid content

The lipid content was determined by the Soxhlet method.

*c. Color measurement L*a*b**

L*a*b* color value was measured by CR-400 Konica Minolta.

d. Measuring texture

The texture was measured by the Texture Analyzer Brookfield Ametek.

Procedure: Salami was positioned on the plane of the texture measuring table (a Fixture Base Table required), and preset measurement parameters were established on the computer (the meter was connected to the computer): The probe model TA-SBA-WB-1 was measured at a speed of 1 mm/s.

2.3.3. Sensory analysis

Pangasius Salami sensory examination was used the QDA (quantitative Descriptive Analysis) approach. Evaluators were asked to rate a descriptive indication of color, taste from 1-5, and overall acceptance on a scale of 1-9.

Sensory assessment of indicators (texture, color, and taste) was used the descriptive approach and the Hedonic scale by 15 members (Ha Duyen Tu, 2010).

2.3.4. Statistical analysis

Each experiment was repeated three times to collect data for statistical analysis. ANOVA, Fisher t-test for assessing significant difference (LSD), and Pearson correlation coefficient at alpha = 0.05 were calculated using the statistical tool Stagraphics Centurion XV.

3. Results and discussion

3.1. The effect of lean pork and lard ratio on the protein, lipid, chewiness, color, and sensory value of the product

The proportion of lean pork added during the processing of Pangasius Salami was critical, as it affected the product's physicochemical properties and sensory value. Table 1 shows the proportion of lean pork added that affects the protein, lipid, chewiness, and color value of the product.

Table 1. Statistical analysis of the effect of the proportion of additional lean pork on the product's physicochemical value

Percentage of added lean pork (%)	Protein (%)	Lipid (%)	Chewiness (g/mm)	L*	a*
30	14.42[a]	1.61[a]	890.93a	36.28[a]	5.37[a]
35	**16.31[b]**	**2.34[b]**	**964.92[b]**	**37.95[b]**	**7.38[b]**
40	17.13[b]	2.23[b]	970.83[b]	39.09[b]	7.47[b]
	F=16.35	F=3.37	F=76.44	F=16.33	F=23.94
	P=0.0037	P=0.0138	P=0.0001	P=0.0037	P=0.0014

Nota bene: Statistics are significant per column. Values followed by the same digits indicate no statistically significant difference at the 5% significance level (p<0.05).

As seen in Table 1, the proportion of lean pork added increased the protein level. The sample with 30% mixed lean pork had the lowest protein level, whereas the sample containing 40% additional pork had the highest. However, at the 5% level of significance, there was no statistical difference between the supplemented sample with 35% and 40% lean pork percentages, respectively. Likewise, the addition of pork increased the lipid content. The sample with 30% lean pork had the lowest lipid content, a difference that was statistically significant at 5% when compared to the other two samples. Lean pork is defined as pork containing less than 4.5g or less of saturated fat, and less than 95 mg of cholesterol per 100g of product (U.S. Food and Drug Administration, 2011). Hence, the addition of lean pork to the product had little effect on the lipid content, owing to the relatively little quantity of fat, which readily resulted in modest data collecting errors. As a result, the change in lipid content caused by the addition of lean pork was not linear. Additionally, when the quantity of lean pork in the product increased, the product's chewiness rose due to the chewiness texture of pig compared to fish flesh (Nguyen Minh Dai, 2016). The sample added with 30% lean pork compared to fish meat resulted in the least chewiness, while the sample supplemented with 40% pork resulted in the most chewiness. In addition, there was no statistically significant difference between the 35 percent lean pork supplemented sample at the 5% significance level compared to the 40% supplemented sample. Otherwise, Table 1 demonstrates that the ratio of lean pork to pangasius meat added affected the product's color. Lean pork includes a high concentration of hemoglobin, which naturally tints the product red and darkens it when pork is added in increasing amounts. While the sample with 30% extra lean pork was distinct from the other two, the brightness and hue were unappealing. Samples with 35% lean pork added had an appropriate brightness and a pleasing, harmonious red hue.

Apart from impacting the physicochemical properties, the proportion of added lean pork also affected the product's sensory value, as seen in Figure 1.

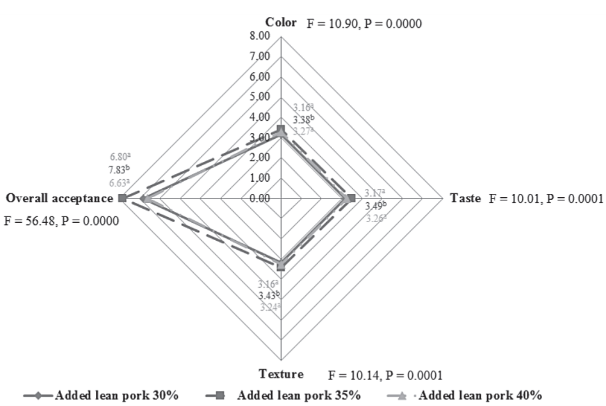

Figure 1. Graph illustrating the influence of the proportion of additional lean pork on the products' sensory value

According to the results of Figure 1, the sample with 35% lean pork added had the highest average score in color. In contrast, the sample with 30% lean pork had the lowest average score due to the pale color, as less pork should reduce the color of the meat, resulting in the product not having the desired color. According to statistics at the 5% level of significance, the 35% added lean pork sample was statistically significantly different from the other samples. Additionally, the taste was significantly impacted by the amount of pork added; the more significant the proportion of lean pork is, the more pork taste. Nonetheless, if too much lean pork was used, it masked the aroma of pangasius meat, thus lowering the taste score. As seen in Figure 1, the sample with 35% added lean pork received the highest score, as the proper mixing ratio resulting in a product with a harmonic scent, a combination of pig and catfish flesh. Thus, at the 5% significance level, the added 35% lean pork sample had a completely different taste score than the other samples. Regarding the product's texture, the samples were completely different in terms of statistical significance. The 35 percent lean pork supplement sample received the highest average score when the product's texture was precisely perfect, neither too dry nor too soft. In general, sensory evaluation results indicated that the sample with a 35% added lean pork content over catfish meat had an attractive, natural color, a harmonious taste between pork and catfish meat, and a moderate and homogeneous texture, thus having the highest overall acceptance.

The percentage of added lard that affected the protein, lipid, chewiness, and color value of the product is shown in Table 2.

Table 2 shows that the more significant the proportion of added lard, the higher the protein and lipid content. The 10% additional lard sample had the lowest protein and lipid content. In contrast, the sample with 20% added lard had the greatest ones with a statistically significant difference at the 5% significance level. Otherwise, lard was added to the mixture during the formation process to soften and enhance its stickiness (Nguyen Minh Dai, 2016). At the 5% level of statistical significance, the 10% additional lard sample was significantly different from the other two samples; this sample had the greatest chewiness due to the lowest added lard. In contrast, the sample with the most significant added lard (20%) exhibited an appropriate, moderate, and harmonic chewiness. When it comes to color value, the higher the added lard is, the brighter and redder the product becomes. According to the findings of

Table 2, the sample with a 20% added lard imparted a brilliant, eye-catching, and harmonious bright red and color to the product. By contrast, the 10% added lard sample for color was less bright, unattractive, and distinct from the two samples with increased lard content.

Table 2. Statistical analysis of the effect of the proportion of added lard on the product's protein, lipid, chewiness, and color value

Percentage of added lard (%)	Protein (%)	Lipid (%)	Chewiness (g/mm)	L*	a*
10	13.22[a]	2.23[a]	999.37[b]	30.46[a]	5.33[a]
15	13.61[a]	3.27[b]	855.07[a]	31.18[bc]	6.28[bc]
20	**15.47[b]**	**4.42[c]**	**860.67[a]**	**33.00[c]**	**6.95[c]**
	F=50.33	F=50.33	F=75.56	F=5.58	F=8.26
	P=0.0002	P=0.0002	P=0.0001	P=0.0428	P=0.0189

Nota bene: Statistics are significant per column. Values followed by the same digits indicate no statistically significant difference at the 5% significance level (p<0.05).

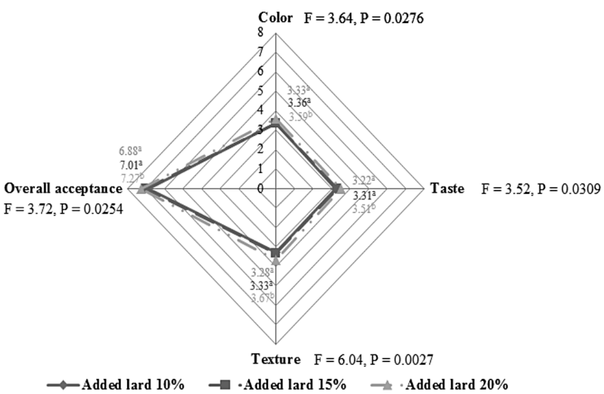

Figure 2. Graph illustrating the influence of the proportion of added lard on the products' sensory value

As seen in Figure 2, the sample with 20% additional lard had an entirely different sensory value than the other samples. The color in the 20% added lard sample had the highest average score, owing to the high proportion of added lard, contributing to the product's vibrant, stunning hue. The difference was statistically significant at the 5% significance level compared to the other two samples. Likewise, the 20% added lard sample imparted a pleasant scent and harmony while the product's texture had a reasonable chewiness. This leads to the overall acceptance of the 20% added lard sample reaching the highest value, different from the other two samples.

The addition of 35% lean pork and 20% lard to pangasius meat resulted in high physicochemical parameters while achieving the highest sensory scores for color, taste, texture, and overall acceptance. Hence, these samples were selected as optimal.

3.2. The effect of the ratio of salt and sugar added on the sensory value of the product

During the processing of Pangasius Salami, spices such as salt and sugar played a crucial role, significantly impacting the product's sensory value.

Salt is a time-honored seasoning that has been used in the preparation of salami for centuries. Salt aids in the activation of the protein increases the product's flavor and helps firm the product's texture. The high salt concentration aids in spoiling prevention and alters the product's texture (Le, 2016). As seen in Figure 3, the amount of salt added affected the product's sensory value.

The findings from Figure 3 indicate that the ratio of mixed salt had a significant effect on the taste. A sample with 2% salt added was examined for the highest taste score, as this salt content was appropriate, assisting the product in having a harmonious flavor that was neither too salty nor too light. Thus, at the 5% significance level, the sample with 2% salt added was statistically significantly different from the other two samples.

Besides, as salt was added in increasing amounts, the product's texture became firmer since salt provided a solid framework for the product. Because the amount of mixed salt was small, the sample with 1.5 percent salt had a less solid texture. In contrast, a sample with a 2.5% salt addition caused the product to become over firm because of the excess salt. Meanwhile, the 2% salt added sample scored highest on the sensory texture assessment than the other two samples, owing to the moderate quantity of added salt, contributing to the product's desired firm texture and chewiness. At the 5% level of significance, this sample showed a statistically significant difference from the other two samples.

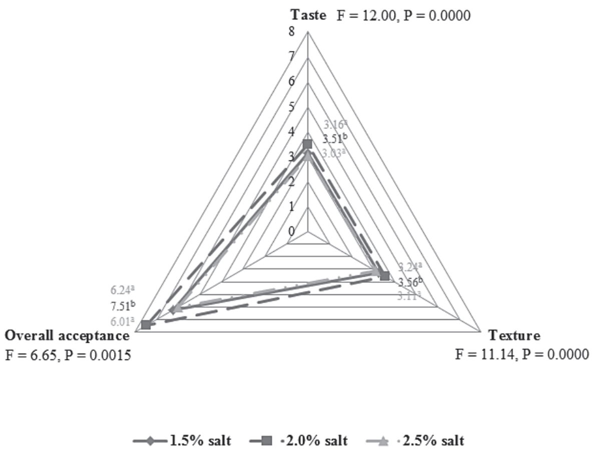

Figure 3. Graph illustrating the effect of the proportion of salt added on the products' sensory value

According to the above assessment findings, the sample with 2% salt added had the highest overall acceptance score since the product's texture, and taste were superior to the other two samples and, therefore, selected as the optimal sample.

Apart from that, as seen in Figure 4, the proportion of added sugar also affected the product's sensory value.

The findings of Figure 4 indicate that the percentage of added sugars had a significant effect on the product's taste. The sample with an additional sugar content of 8% received the lowest sensory score since this ratio resulted in an unscented and imbalanced taste. Meanwhile, when the proportion of sugar was increased to 10% and 12%, the products had a harmonious taste, which was characteristic of Salami products. These two samples were statistically different at the 5% significance level compared with the 8% sugar supplement sample.

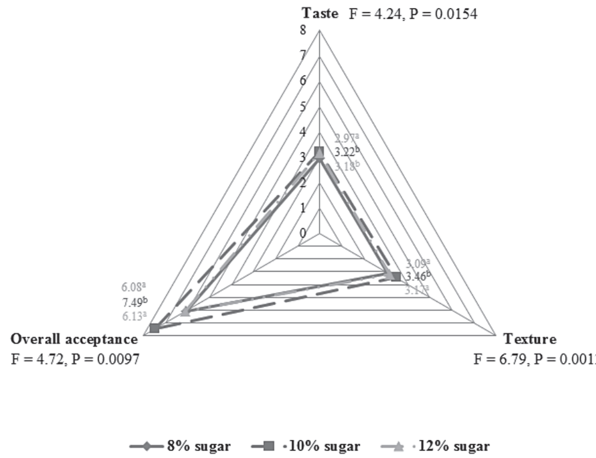

Figure 4. Graph illustrating the effect of the proportion of sugar added on the products' sensory value

Meanwhile, when the product's texture is evaluated, the addition of sugar softens it and results in consistent adhesion (Tran & Huynh, 2013). A sample with an additional sugar ratio of 8% had a less soft texture and lacked elasticity as a result of the low sugar content, making it impossible to build the completed structure. On the contrary, a sample with 12 percent added sugar resulted in an excessively mushy texture and lacked the product's typical firmness. Meanwhile, the 10% added sugar sample received the highest sensory score; the product had a balanced and appropriate texture, neither too firm nor too mushy.

According to the above evaluations, the sample with 10% added sugar had the highest overall acceptance score, which was statistically significantly different from the other two samples at the 5% significance level.

As a result, samples with 2% added salt and 10% added sugar with the highest taste, texture, and overall acceptance ratings were chosen as ideal samples.

3.3. The effect of ripening time on protein, lipid, chewiness, color, and sensory value of the product

The effect of ripening time on protein, lipid, chewiness, and color value of the product is shown in Table 3.

Table 3 demonstrates that the longer the ripening time (9 days) lasts, the lower the protein and lipid content is. Since the product was adhered to ice crystals and frozen throughout the low-temperature ripening phase (9^0C), when thawing, nutrients such as proteins and lipids were lost due to fluid leakage. Reasonable ripening time, neither too long nor too short (7 days), contributed to the product's maximum protein and lipid content and was the sample with different statistical significance at the 5% level of significance compared to the other two samples.

Table 3. Statistical analysis of the effect of ripening time on the product's physicochemical value

Ripening time (days)	Protein (%)	Lipid (%)	Chewiness (g/mm)	L*	a*
5	13.32[b]	2.48[b]	1234.51[a]	30.67[a]	7.47[a]
7	**16.31[c]**	**3.90[c]**	**1543.23[b]**	**37.28[b]**	**9.00[b]**
9	11.50[a]	2.10[a]	1231.17[a]	28.71[a]	6.92[a]
	F=26.26	F=23.73	F=46.36	F=12.50	F=24.54
	P=0.0011	P=0.0014	P=0.0002	P=0.0002	P=0.0000

Nota bene: Statistics are significant per column. Values followed by the same digits indicate no statistically significant difference at the 5% significance level (p<0.05).

The time factor is critical for the texture of salami products to remain stable. When the ripening time is prolonged, a reduction in pH enhances the product's capacity to reduce water, resulting in some moisture being removed from the salami (Tran & Huynh, 2013). When appropriately ripened, a product develops a firm, chewy texture while retaining its state, color, and taste. However, the ripening time is short, leading less chewy texture since the acidity is low. In contrast, a prolonged ripening time causes the product to seep nutrients out since the ice crystals adhered heavily to the product, resulting in an unfavorable chewy texture (Tran & Huynh, 2013). The findings of Table 3 indicate that the 5-day and 9-day ripening samples had poor chewiness values since the ripening period was either too short or too lengthy, resulting in a soft, less hard, and fragmented product texture. Meanwhile, the sample ripened for 7 days owing to the moderate ripening period, resulting in the product with the highest chewiness. There was a statistically significant difference between the two groups at the 5% significance level.

Between the samples, L* was different and statistically significant. The greater the value of L*, the brighter the sample; the lesser the value of L*, the darker the sample. 7 days of ripening resulted in the highest L* value, while 9 days resulted in the lowest L* value, since the extended ripening period caused the product to fluid leakage, resulting in a fall in brightness (Tran & Huynh, 2013).

There was a statistically significant difference between the a* values between the samples. The greater the a* value, the deeper the sample's red hue, and the smaller the a* value, the lighter the sample's red color. The findings of Table 3 indicate that samples ripened in 7 days had the greatest a* values, while those ripened 9 days had the lowest, owing to extended ripening, which resulted in fluid leakage, thus diminishing the product's red hue.

Otherwise, the ripening time also affected the sensory value of the product and is shown in Figure 5.

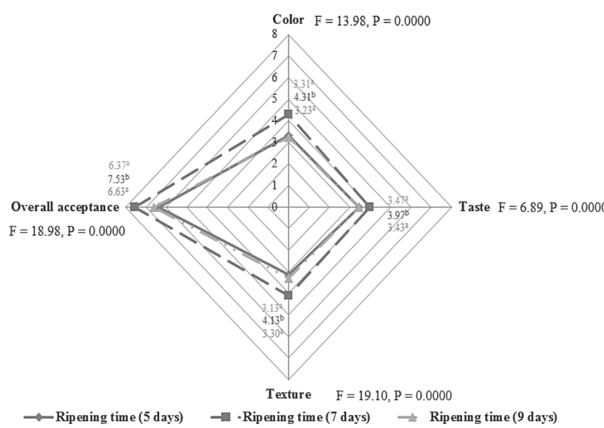

Figure 5. Graph illustrating the ripening time on the products' sensory value

Figure 5 demonstrates that the ripening time influenced the product's color. The samples with a 9-day ripening time had the lowest color sensory assessment ratings, as the longer the ripening period, the simpler it was for the product to be adhered to ice crystals, resulting in a reduction in color relative to the original natural hue. In contrast, a shorter ripening time (5 days) resulted in a lighter coloration of the product owing to inadequate time for ripening, resulting in a poor color perception score for the product. Meanwhile, the sample had a ripening period of 7 days, which allowed adequate time for the product to develop gorgeous and distinctive hues, earning it the best sensory score. At the 5% level of significance, this sample was statistically distinct.

When the taste was evaluated, the 7-day ripening time resulted in the highest sensory score and a significant difference from the other two samples since the taste of salami was produced and achieved its peak quality during this ripening time. The sample with a 9-day ripening time received the lowest sensory ratings owing to the prolonged period, product leakage, and the resulting unusual, disagreeable taste (Tran & Huynh, 2013). Meanwhile, because of the short ripening period, samples with a ripening duration of 5 days did not produce a harmonious and unique taste of the product.

For texture evaluation, the 5-day and 9-day ripening samples had short or too long ripening durations, resulting in a mushy and less chewy product texture, leading to lower sensory scores. Meanwhile, the 7-day ripening sample owing to the appropriate ripening period, thus contributed to achieving the highest sensory assessment, with a statistically significant difference at a 5% level of significance compared to the other two samples.

Regarding overall acceptance, the sample with a 7-day ripening time received the highest sensory score and distinguished itself from the other two samples due to its distinctive color, delectable, harmonious taste, and appropriate chewy texture.

Through protein, lipid, chewiness, color, and sensory assessment findings, it was determined that the ripening time of 7 days resulted in the highest quality product, and so was chosen as the optimal sample.

4. Conclusion

The following parameters were determined via the investigation and analysis of Pangasius salami's physicochemical and sensory characteristics:

Adding 35% lean pork and 20% lard to pangasius meat was regarded as optimum to achieve a high protein and lipid content, appropriate and consistent chewiness, harmonious color, and texture with a great overall acceptance.

To get a high sensory value for the product, adding 2% salt and 10% sugar to the combination (pork, lard, pangasius meat) was optimum since the product has a harmonious taste, homogeneous texture, and high overall acceptance.

The optimization of processing for this type of Salami should provide a ripening of 7 days under temperature (9°C) and relative humidity (85%) to obtain a high protein and lipid content, delectable chewiness, and high sensorial characteristics.

Figure 6. Pangasius salami after ripening time

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