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CHARACTERISTICS OF NATIVE CHICKEN BREAST MEAT SOAKING IN JUICE OF PINEAPPLE HUMP AND CHAYOTE FRUIT

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ABSTRACT

Kampong or native chicken has an important role in providing meat for the people of Indonesia. Special treatment is needed to increase the tenderness of native chicken meat which has a tough of texture. This study aims to evaluation the physical, chemical, and sensory characteristics of native chicken meat soaked in a combination of pineapple hump juice and chayote juice. The study was conducted experimentally using a completely randomized design with a factorial pattern. The first factor was soaking pineapple hump juice which consisted of 4 concentrations and second factor was 4 the concentration of chayote juice. The results showed that the soaking of native chicken meat in pineapple and chayote hump juice significantly (P<0.05) decreased the total collagen content, water holding capacity, increased tenderness, cooking loss, and favorite sensory characteristics of color, aroma and taste of native chicken meat. Chayote can be used as a meat tenderizer, either independently or in combination with other tenderizers. Based on the tenderness data and the preferred sensory characteristics of color, aroma and taste, the combination of soaking native chicken breast meat in 7.5% pineapple hump and 5.0% chayote is the most optimal.

1.Introduction

Native or kampong chicken has an important role in the provision of meat in Indonesia and is claimed to have low cholesterol content with a savory meat taste. However, special treatment is needed before cooking because native chicken meat has a tough texture. Texture, especially tenderness, is an attribute of meat quality and is an important selection criterion used by consumers when buying meat (Fanatico *et al*., 2007).

Tenderization of native chicken meat can be done by adding protease enzymes that can hydrolyze protein peptide bonds into simpler compounds such as dipeptides and amino acids (Naidu, 2011). The use of protease enzymes from plants for the purpose of tenderizing meat is still limited to the use of papain from papaya (Mamboya and Amri, 2012) and bromelain from pineapple (Ketnawa *et al*., 2011). Protease enzymes derived from plants such as papain, bromelain and ficin are widely used as meat tenderizers and are the most important enzymes in several food industries which account for 60% of the total market share (Gaur *et al*., 2010). Papain and bromelain are the two main protease enzymes in the food industry which take up 8% of the market demand (Adulyatham and Owusu-Apenten, 2005).

The use of papaya to tenderize meat can produce a bitter taste (Gerelt *et al*., 2000) or lead to the undesirable appearance of mushy flesh

(Ashie *et al*., 2002). The use of bromelain enzymes from pineapple extract can reduce the texture of the meat to become too tender, due to the broad substrate specificity, and cause an unpleasant taste (Manohar *et al*., 2016). Diversification of meat tenderizers is needed to provide more options for the food industry.

Chayote (*Sechium edule*) is an annual vegetable plant containing several bioactive compounds, polyphenols component, vitamins and carotenoids (Vieira *et al*., 2019). Chayote production in Indonesia in 2019 reached 407,962 tons (Badan Pusat Statistik Indonesia, 2019). Most of the chayote is used for vegetable food, but has not been used as a meat tenderizer. Chayote can be used as a source of meat tenderizing protease enzymes that are easy to obtain and safe for consumption (Okfrianti, 2011). The crude chayote extract is reported to contain protease enzymes (Ratnayani and Kusumaningrum, 2015). Documentation and scientific publications on the use of chayote as a meat tenderizer, either independently or in combination with other tenderizers, are still limited. This study aims to evaluate the chemical, physical and sensory characteristics of native chicken meat breast soaked in pineapple hump juice and chayote juice.

2. Materials and methods

This study was also conducted using a completely randomized design with a factorial pattern consisting of 4 levels of pineapple hump juice concentration (0.0, 2.5, 5.0 and 7.5%) and 4 levels of chayote juice concentration (0.0, 2.5, 5.0, 7.5%). Each treatment of meat soaking was repeated 20 times.

2.1. Preparation of pineapple hump juice and chayote juice

A total of 65 kg of ripe pineapple (*Ananas comosus* queen variety) from local supermarket was peeled, cleaned and the hump part was taken. A total of 49.5 kg of pineapple hump were divided into 3 parts of 8, 17.5 and 24 kg, respectively, then each portion was divided into 12. Meanwhile, 50 kg of chayote (*Sechium edule*) obtained from a local supermarket were peeled, cleaned, washed and as much as 49.5 kg was divided into 3 parts of 8, 17.5 and 24 kg, then each portion was divided by 12. Pineapple hump, chayote and each mixture of pineapple hump and chayote, put in a glass beaker (1.5 L) containing 1 L of water, crushed with a blender for 2 minutes, squeezed and filtered using a flannel cloth. The combination of soaking treatment with pineapple weevil juice and chayote juice consists of;

P_0C_0 = soaking in distilled water (0% pineapple hump juice and 0% chayote juice)

$P_0C_{2.5}$ = soaking in pineapple hump juice 0% and chayote juice 2.5%

$P_0C_{5.0}$ = soaking in pineapple hump juice 0% and chayote juice 5.0%

$P_0C_{7.5}$ = soaking in pineapple hump juice 0% and chayote juice 7.5%

$P_{2.5}C_0$ = soaking in pineapple hump juice 2.5% and chayote juice 0%

$P_{2.5}C_{2.5}$ = soaking in pineapple hump juice 2.5% and chayote juice 2.5%

$P_{2.5}C_{5.0}$ = soaking in pineapple hump juice 2.5% and chayote juice 5.0%

$P_{2.5}C_{7.5}$ = soaking in pineapple hump juice 2.5% and chayote juice 7.5%

$P_{5.0}C_0$ = soaking in pineapple hump juice 5.0% and chayote juice 0%

$P_{5.0}C_{2.5}$ = soaking in pineapple hump juice 5.0% and chayote juice 2.5%

$P_{5.0}C_{5.0}$ = soaking in pineapple hump juice 5.0% and chayote juice 5.0%

$P_{5.0}C_{7.5}$ = soaking in pineapple hump juice 5.0% and chayote juice 7.5%

$P_{7.5}C_0$ = soaking in pineapple hump juice 7.5% and chayote juice 0%

$P_{7.5}C_{2.5}$ = soaking in pineapple hump juice 7.5% and chayote juice 2.5%

$P_{7.5}C_{5.0}$ = soaking in pineapple hump juice 7.5% and chayote juice 5.0%

$P_{7.5}C_{7.5}$ = soaking in pineapple hump juice 7.5% and chayote juice 7.5%

2.2. Meat soaking

A total 320 carcasses from 8-month-old native chicken with an average weight of 650 g per carcass obtained from a local chicken slaughter house in Surabaya, East Java, Indonesia. Each carcass was taken at random and each was soaked in the juice of pineapple and chayote and the mixture for 60 min at a temperature of 25°C. After soaking, analysis of the total collagen content, tenderness, pH, water holding capacity, cooking loss and sensory characteristics of color, aroma, and taste of native chicken meat breast were carried out.

2.3. Determination of total collagen

Determination of the total collagen of native chicken meat was soaked in various combinations of pineapple hump juice and chayote juice using the method described by Fang *et al*. (1999) and Moon (2018). Briefly, 10 g of thigh meat from each treatment were crushed, put into a 50 mL centrifuge tube containing 24 mL of Ringer's solution and then stirred. The mixture was then incubated in a water bath at a temperature of 77°C for 65 min with a stirring interval of 15 min. After incubation, the mixture was centrifuged for 10 min at 4000 g. The supernatant was taken and collected, while the precipitate was mixed with 8 mL of Ringer's solution and centrifuged again for 10 min. The precipitate was rinsed, the supernatants from the two centrifugation stages were combined. The supernatant and precipitate of all samples were hydrolyzed separately in 30 mL 6 N sulphuric acid (H_2SO_4) at 110°C for 16 h. The hydrolyzate was diluted to 250 mL with Ringer's solution. The absorbance of the hydrolyzate was then measured at 560 nm and recorded. Standard curves were made with concentrations of 0.0, 0.1, 0.2, 0.3 0.4, 0.5, 0.6, 0.8, 0.9 and 1% using hydroxyproline which had been neutralized with a solution of 4.37 mL of 1 M sodium hydroxide (NaOH). The total collagen content was calculated from the sum of the hydroxyproline concentrations in the precipitate and supernatant using a conversion factor of 7.25 (Goll *et al*., 1963) and expressed as mg/g wet weight.

2.4. Determination of tenderness

Meat tenderness was measured using a penetrometer according to Hinnergardt and Tuomy (1970) method. Briefly, as much as 10 g thigh meat with a size of 2.5x2.5 cm from each soaking treatment were placed on the bottom of the penetrometer. The pointer needle was set in contact with the surface of the meat sample and the needle scale shows zero. The base of the needle is loaded with 50 g, the penetrometer lever was pressed for 10 s, released and the penetration scale of the penetrometer needle is read as mm 10/s/50 g.

2.5. Determination of meat acidity

Determination of the acidity (pH) of meat was done using a pH meter. A total of 10 g thigh meat from each immersion treatment was added with 10 mL of distilled water, stirred until homogeneous, then the pH of the homogenate was measured with a pH meter that was calibrated at pH 4.0 and 7.0 in phosphate buffer solution.

2.6. Determination of water holding capacity

Determination of water holding capacity (WHC) is determined by the Hamm method (Chaurasiya *et al*., 2015) with modification. Briefly, a 10 g thigh meat from each soaking treatment was finely chopped and put into a 100 mL centrifuge tube containing 50 mL of distilled water. The tube was centrifuged at 3000 rpm for 20 min. After centrifugation, the volume of the supernatant was measured and the water holding capacity of the meat was calculated using the formula WHC (%) = (volume before centrifuge - volume of supernatant)/volume before centrifuge) x 100

2.7. Determination of cooking loss

Determination of cooking loss of meat is done using the method according to the AOAC International 950.46 method (AOAC, 2005). Briefly, as much as 100 g thigh meat from each immersion treatment was put in plastic, tightly closed, then boiled in a water bath with a temperature of 60°C for 60 min. The liquid part on the surface of the meat was absorbed using tissue paper and the boiled part of the meat was weighed. Cooking loss was calculated as the percentage of the raw weight lost, based on the weights of all steaks before and after cooking. The mass changes were expressed as a percentage of the initial mass (w/w, wet basis).

2.8. Enumeration of total aerobic plate count

Aseptically, 25 g of chicken thigh meat samples with skin from each immersion and replication treatment were put in a sterile stomacher bag containing 225 mL of a sterile 0.1% peptone solution and homogenized in a stomacher for 2 min at room temperature. The mixture was transferred to a test tube and followed by serial dilutions to 10^{-6} dilutions. From each dilution, 0.1 mL was taken with a sterile micropipette, dripped and spread with a glass hokey stick on nutrient agar media. The agar medium was then incubated at 28°C for 48 h in an inverted position. Bacterial colonies were counted using a colony counter.

2.9.Determination of sensory characteristics

The sensory characteristics of color, aroma, and taste of breast meat breast from each soaking treatment were observed by 20 trained panelists with a taste threshold of 0.5% sugar content in tea water, not color blind and not smoking. A total of 320 breast meat from each soaking treatment was steamed at a temperature of 60°C for 60 min. Panelists were asked to evaluate the color, aroma and taste of the meat using a linkert scale, namely 1 very poor, 2 for poor, 3 for neutral, 4 for good, and 5 for very good.

2.10. Data analysis

All observational data were analyzed using analysis according to a completely randomized design with a two-way factorial pattern at a significance level of 0.05. Prior to the analysis of variance, the sensory characteristics of color, aroma and taste were first transformed into log+0.5 numbers and data on the number of bacteria were transformed into log numbers 10. Further tests to see the location of the differences between treatments were carried out using the Tukey test at a significance level of 0.05 if there were significant differences between treatments in the analysis of variance. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 22 software.

3.Results and discussions

3.1.Total collagen

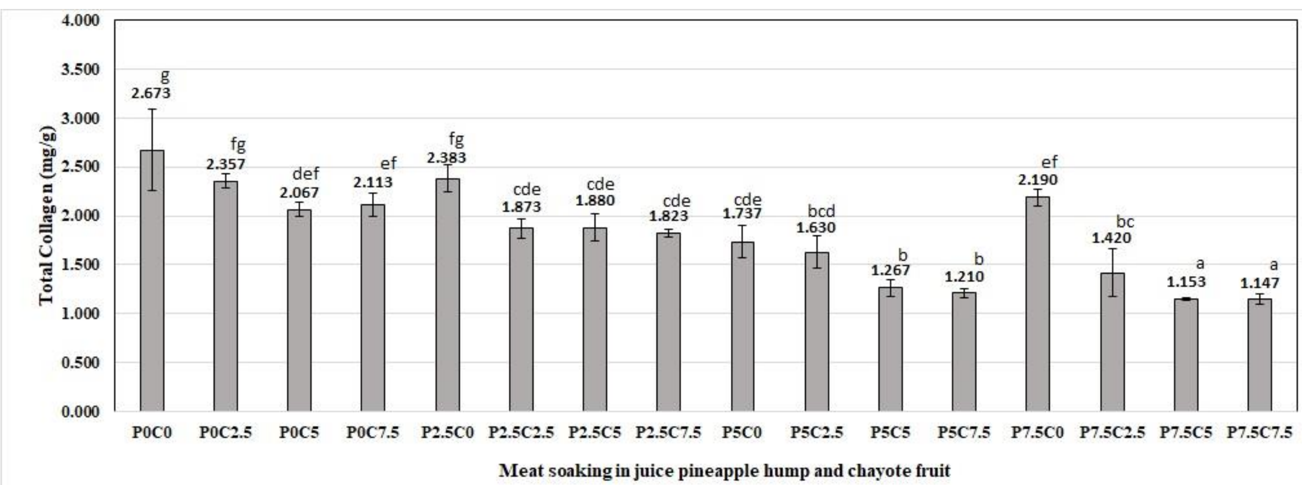

Figure 1. Total collagen of native chicken meat breast soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The mean values which are not the same are significantly different ($p<0.05$).

The results of this study (Fig. 1) indicated that soaking in pineapple hump juice at concentrations of 5.0 and 7.5% (P_5C_0, and $P_{7.5}C_0$), chayote juice at concentrations of 5.0 and 7.5% (P_0C_5 and $P_0C_{7.5}$) and the combination of the mixtures were significant ($p<0.05$) decreased the total collagen content of native chicken meat breast. However, in the independent treatment, the concentration of pineapple hump was 2.5% ($P_{2.5}C_0$) and the concentration of chayote 2.5% ($P_0C_{2.5}$) have no significant effect ($p>0.05$) on the total collagen content of meat. The results of this study also showed that the lowest total collagen content of native chicken meat breast was found in the combination treatment of soaking 7.5% pineapple weevil juice and 5.0% chayote juice and 7.5% pineapple hump juice and 7.5% chayote juice ($P_{7.5}C_{5.0}$ and $P_{7.5}C_{7.5}$).

The decrease in total collagen of native chicken meat breast soaked in pineapple hump juice and chayote juice is thought to be due to the activity of the protease enzymes contained in both. Several investigators have reported the content of the protease enzyme bromelain in pineapple hump (Wuryanti, 2004; Monahar *et al*., 2016; Gul *et al*., 2021). While Ratnayani and Kusumaningrum (2015) reported that chayote contains protease enzymes. Protease enzymes found in fruits degrade myofibrillar proteins and collagen that can soften meat (Santos *et al*., 2020). Rawdkuen *et al*. (2013) reported that proteases derived from plants can hydrolyze collagen and elastin in meat.

3.2. Tenderness of meat

The results of this study (Fig. 2) show that the independent treatment of P_5C_0 and $P_{7.5}C_0$, P_0C_5 and $P_0C_{7.5}$ as well as the combination of the mixture significantly ($p<0.05$) increased the tenderness of native chicken meat breast. However, in the independent treatment $P_{2.5}C_0$ and $P_0C_{2.5}$ have no significant effect ($p> 0.05$) on the tenderness of meat. The results of this study also showed that the highest tenderness of native chicken meat was found in the combination treatment of $P_{7.5}C_5$ and $P_{7.5}C_{7.5}$.

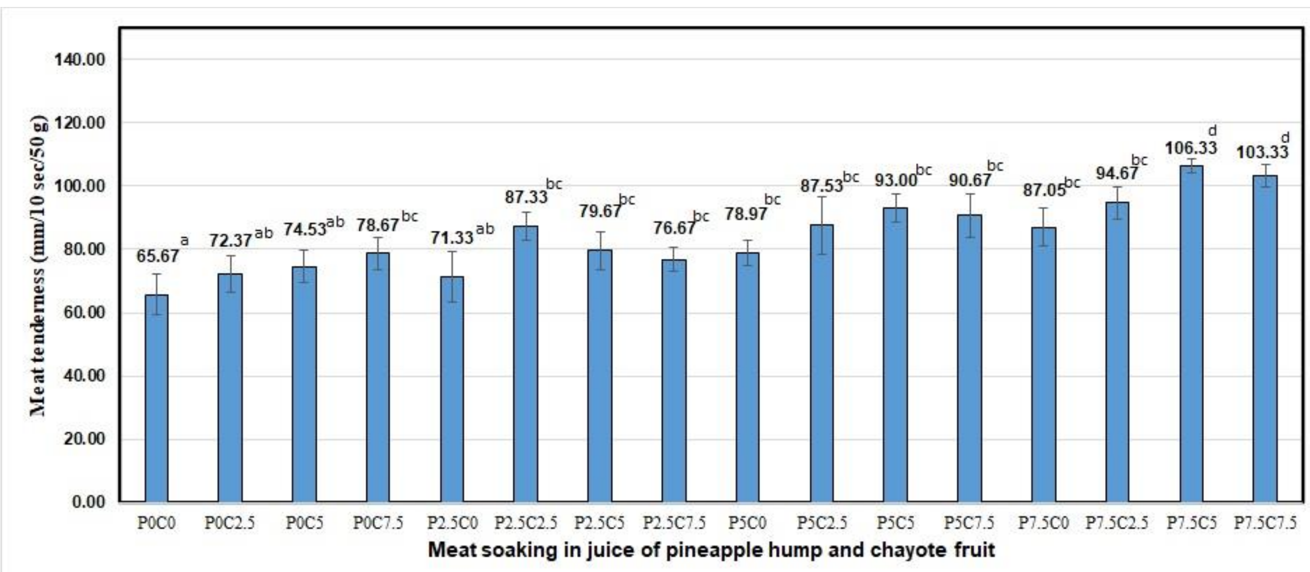

Figure 2. Tenderness of native chicken meat breast soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The notated mean values did not differ significantly ($p<0.05$).

The increase in tenderness of native chicken breast soaked in pineapple hump juice and chayote juice is thought to be due to the activity of the bromelain and protease enzymes contained in each fruit. Several investigators have documented the effects of protease enzymes on meat tenderness. Protease enzymes can cause the breakdown of the fibrous structure of the muscle and the fragmentation of collagen cross-links or split into smaller segments (Endalk *et al*., 2020). During the protease enzyme treatment process, there was hydrolysis of muscle fiber protein, binding weaves and changes occurred such as thinning and destruction of the sarcolemma, dissolution of the nucleus of muscle fibers and connective tissue and the release of muscle fiber attachments to produce soft tissue. Nadzirah *et al*. (2016) and Gerelt *et al*. (2000) reported that proteolytic enzymes increase the rate of myofibril fragmentation in meat and break down intramuscular connective tissue structures. Santos *et al*. (2020) suggested that bromelain affects the structure of actin and myosin filaments in meat myofibrillar proteins. Jahidin and Monica (2018) reported that soaking young pineapple extract can improve the texture and increase the tenderness of buffalo meat. Widiastuti *et al*. (2017) reported that antemortem injection of protease enzymes hydrolyzes proteins at cross-linkages between collagen and increases the tenderness of rejected laying hens.

3.3. Meat acidity

The results of this study (Fig. 3) showed that the treatment of soaking in pineapple hump $P_{5.0}C_0$ and $P_{7.5}C_0$ significantly ($p<0.05$) reduced the pH of native chicken meat breast. Soaking in chayote juice $P_0C_{2.5}$, $P_0C_{5.0}$ and $P_0C_{7.5}$ had no significant effect ($p>0.05$) on the pH of native chicken meat breast. However, the combination of soaking in a mixture of pineapple hump juice and chayote juice significantly ($p<0.05$) reduced the pH of meat.

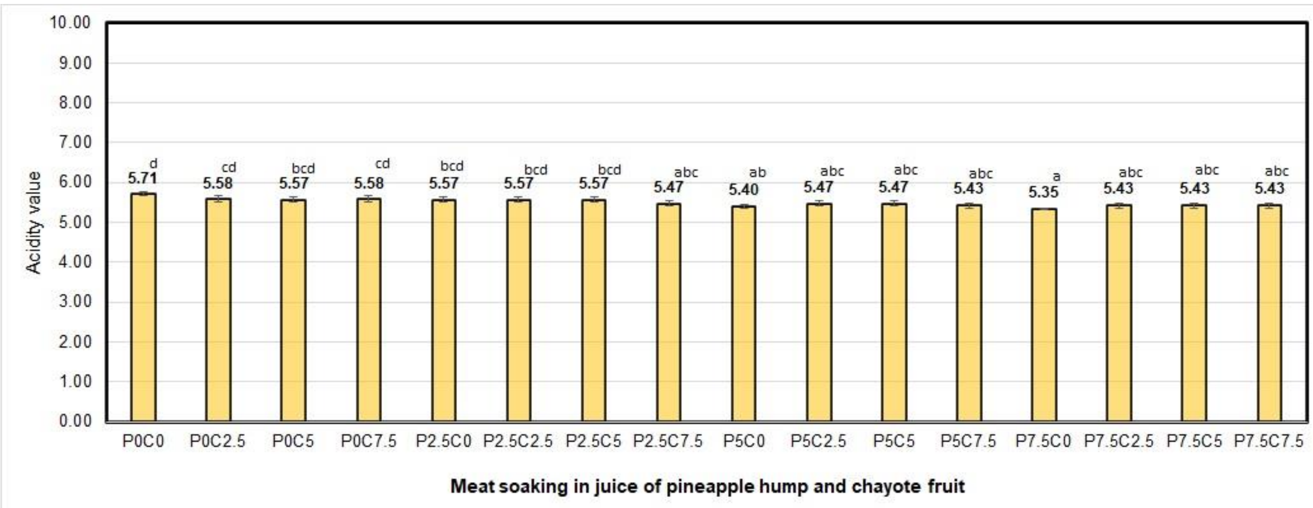

Figure 3. Acidity (pH) of native chicken meat breast soaked in various combinations of pineapple hump juice (P) and chayote (C). The mean values which are not the same are significantly different ($p<0.05$).

The decrease in the pH of native chicken meat breast soaked in pineapple hump juice is thought to be due to the organic acid components contained in the fruit. Pineapple was reported to contain organic acids such as citric acid, malic acid, succinic acid, and acetic acid. Meanwhile, chayote juice only contains ascorbic acid (Sangma *et al*., 2019). Ketnawa *et al*. (2011) reported that hydrolysis of bromelain in meat muscle can cause amino acid cleavage and lower pH.

3.4. Water holding capacity

The results of this study (Fig. 4) showed that the treatment of soaking in pineapple hump juice $P_{5.0}C_0$ and $P_{7.5}C_0$ and chayote juice $P_0C_{5.0}$ and $P_0C_{7.5}$ significantly ($p<0.05$) reduced the WHC of native chicken meat breast. The decrease in WHC of native chicken meat breast soaked in pineapple hump juice, chayote juice and their combination is thought to be the effect of protein hydrolysis activity of protease enzymes that break down myofibril and collagen proteins causing the volume of meat muscle fibers to expand and water holding capacity to decrease. Huff-Lonergan and Lonergan (2005) suggested that most of the water in the muscle is trapped in the cell structure, including the intra and extra-myofibrillar spaces, changes in the intracellular structure of the cell can affect the ability of muscle cells to retain water.

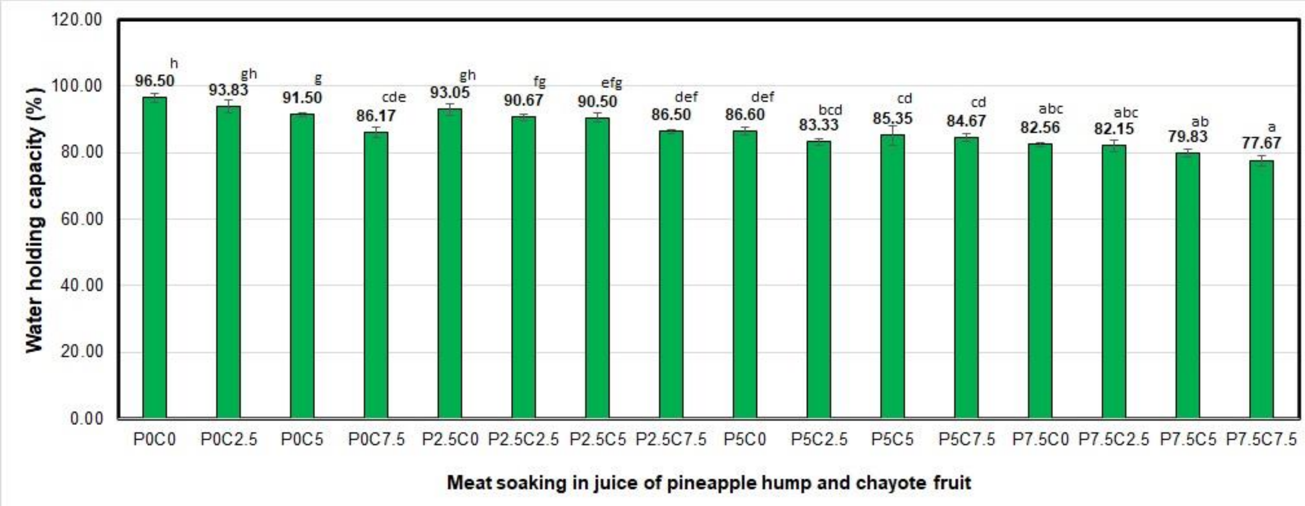

Figure 4. Water holding capacity of native chicken meat soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The mean values which are not the same are significantly different ($p<0.05$).

The effect of using plant-derived meat tenderizing enzymes on WHC differs between meat origin and type, origin of tenderizing enzyme, concentration and method of tenderization. Naveena *et al*. (2004) reported that the use of ginger homogenate for 48 h significantly increased the WHC of buffalo meat. Abdeldaiem *et al*. (2014) reported that the use of fresh ginger extract at concentrations of 15, 30 and 45% increased the WHC of camel meat. Gokoglu *et al*. (2017) reported that the use of bromelain and papain solutions as softeners did not significantly increase the WHC of squid muscles. Our study showed that soaking in pineapple hump juice and chayote juice reduced the total collagen of native chicken meat breast. Ha *et al*. (2012) suggested that the hydrolysis and breakdown of meat connective tissue varies between plant extracts, properties and concentrations. Woinue *et al*. (2001) suggested that the bromelain enzyme can denature myofibrillar proteins that play a role in air retention. Ketnawa and Rawdkuen (2011) suggested that myofibrils and the movement of water from the myofilaments space to the extracellular space due to enzymatic action can reduce WHC.

3.5. Cooking loss

Cooking loss is an important indicator of meat quality because it is related to the amount of water lost and water-soluble nutrients due to the influence of cooking. The results of this study (Fig. 5) indicated that the immersion in pineapple hump juice $P_{5.0}C_0$ and $P_{7.5}C_0$ was significant ($p<0.05$) and the immersion in chayote juice $P_0C_{5.0}$ and $P_0C_{7.5}$ was significant ($p<0.05$) respectively, increase the cooking loss of native chicken meat. This study also showed that the combination of soaking in pineapple hump juice and chayote juice significantly ($p<0.05$) increased the cooking loss of native chicken meat.

The increase in cooking loss of native chicken meat breast soaked in pineapple hump juice, chayote juice and their combination is thought to be due to the activity of protease enzymes that break down the muscle connective tissue of the meat. Several investigators have reported the effect of using enzymes and plant extracts on the cooking loss of meat. Nowak (2011) reported that a solution of pineapple extract was able to break down peptide bonds into soluble amino acids and increase the shrinkage of chicken meat. Abdeldaiem *et al*. (2014) reported that the use of fresh ginger extract at concentrations of 15, 30 and 45% increased the cooking loss of camel meat. Zhang *et al*. (2017) reported that the use of actinidin and papain enzymes as tenderizers caused high muscle cooking loss in rabbits due to the breakdown of more extensive muscle tissue at higher temperatures.

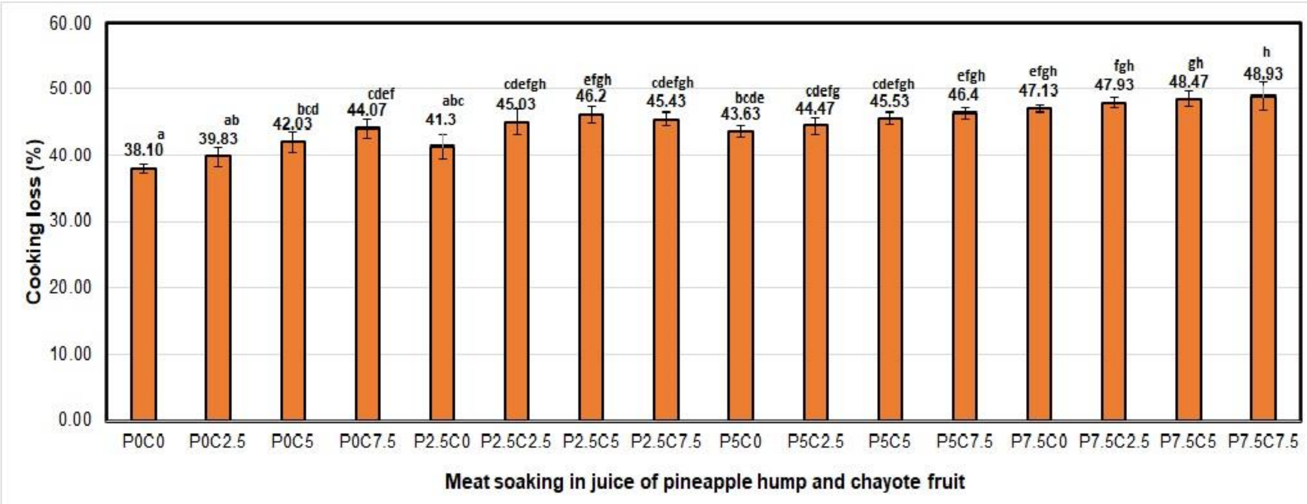

Figure 5. Cooking loss of native chicken meat soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The mean values which are not the same are significantly different ($p<0.05$).

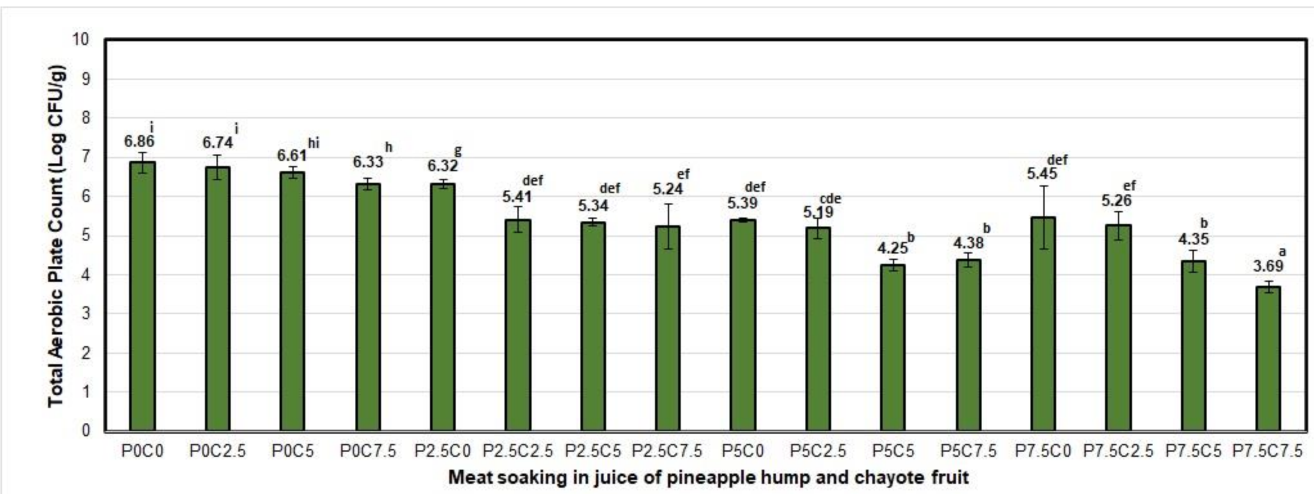

Figure 6. Total aerobic plate count of native chicken meat soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The mean values which are not the same are significantly different ($p<0.05$).

3.6. Total aerobic plate count

Assessment of sanitation quality, sensory acceptability and conformity to good manufacturing practices in general can use aerobic plate count (Kim *et al.*, 2018). The results of this study (Fig. 6) indicate that soaking chicken meat in chayote juice independently or in a mixture with pineapple hump juice significantly ($p<0,05$) reduce APC and the lowest APC was found in meat soaked in the treatment combination $P_{7.5}C_{7.5}$. The decrease in APC in chicken meat soaked in pineapple hump juice and chayote, either independently or in combination, was thought to be due to the antibacterial activity of the components contained in pineapple hump and chayote. Several investigators have reported that pineapple hump extract can inhibit bacterial growth. Pineapple hump was confirmed to contain alkaloids, flavonoids, and saponins (Soulissa *et al*., 2021; Liliany *et al*., 2018). Meanwhile, Sibi *et al*. (2013) reported that the alkaloids, flavonoids, saponins and terpenoids contained in the chloroform and methanol extracts of chayote fruit could inhibit the growth of *Escherichia coli*, *Salmonella typhimurium* and *Shigella flexneri* bacteria.

3.7.Sensory characteristics

Table 1. Sensory characteristics of color, aroma and taste of native chicken meat breast soaked in various combinations of pineapple hump juice (P) and chayote juice (C). The mean value given not the same in the direction of the column is significantly different (p<0.05).

Soaking treatment	Panelist assessment		
	Color	Aroma	Taste
P_0C_0	3.75 ± 0.46^{ab}	3.13 ± 0.35^{a}	2.50 ± 0.53^{a}
$P_0C_{2.5}$	3.75 ± 0.46^{ab}	3.13 ± 0.35^{a}	2.75 ± 0.71^{ab}
P_0C_5	3.63 ± 0.52^{ab}	3.25 ± 0.46^{ab}	3.25 ± 0.46^{c}
$P_0C_{7.5}$	3.13 ± 0.35^{a}	3.25 ± 0.46^{ab}	3.38 ± 0.52^{c}
$P_{2.5}C_0$	3.63 ± 0.52^{ab}	3.38 ± 0.52^{abc}	3.88 ± 0.35^{cd}
$P_{2.5}C_{2.5}$	3.50 ± 0.53^{ab}	3.50 ± 0.53^{bc}	4.03 ± 0.11^{d}
$P_{2.5}C_5$	3.50 ± 0.53^{ab}	3.63 ± 0.52^{bc}	4.04 ± 0.12^{d}
$P_{2.5}C_{7.5}$	3.63 ± 0.52^{ab}	3.75 ± 0.46^{bc}	4.00 ± 0.00^{d}
P_5C_0	4.25 ± 0.46^{bc}	4.03 ± 0.11^{bc}	4.00 ± 0.00^{d}
$P_5C_{2.5}$	3.63 ± 0.52^{ab}	4.13 ± 0.35^{c}	4.13 ± 0.35^{d}
P_5C_5	3.75 ± 0.46^{ab}	4.25 ± 0.46^{c}	4.13 ± 0.35^{d}
$P_5C_{7.5}$	3.88 ± 0.35^{abc}	4.25 ± 0.46^{c}	4.25 ± 0.46^{de}
$P_{7.5}C_0$	4.25 ± 0.52^{bc}	4.50 ± 0.53^{cd}	4.50 ± 0.53^{e}
$P_{7.5}C_{2.5}$	4.13 ± 0.42^{bc}	4.25 ± 0.46^{c}	4.25 ± 0.46^{de}
$P_{7.5}C_5$	4.63 ± 0.35^{c}	4.75 ± 0.46^{d}	4.50 ± 0.53^{e}
$P_{7.5}C_{7.5}$	4.45 ± 0.46^{c}	4.65 ± 0.48^{d}	4.88 ± 0.35^{e}

The results of this study (Table 1) showed that soaking in pineapple hump juice and a mixture of pineapple hump juice with chayote juice significantly (p<0.05) increased the preference for color, aroma and taste of native chicken breast meat. Soaking in chayote juice independently have no significant (p>0.05) effect on color and aroma, but significantly (P<0.05) increased the taste of native chicken meat breast at concentrations of 5.0% ($P_0C_{5.0}$) and 7.5% ($P_0C_{7.5}$). In this study, the color, aroma and taste of native chicken meat soaked in a combination of pineapple hump juice and chayote juice $P_{7.5}C_{5.0}$ and $P_{7.5}C_{7.5}$ were the most preferred. The increase in preference for the color of native chicken meat breast soaked in pineapple hump juice and chayote juice is thought to be due to the activity of protease enzymes and the components contained in pineapple hump and chayote.

Botinestean *et al.* (2018) reported that meat tenderized with protease enzymes increased consumer acceptance, although it could decrease yields. Dewanto *et al.* (2017) suggested that the bromelain enzyme enters the meat causing the myoglobin bonds to break down and change the color of the meat. Zulfahmi *et al.* (2013) reported that immersion in pineapple peel extract caused a change in the color of rejected duck meat from white to yellowish. Ismanto

(2017) reported that soaking in pineapple extract increased the aroma of rejected parent stock chicken meat because the pineapple fruit aroma was quite strong. Zhao *et al*. (2020) reported that treated of proteinase papain, bromelain and flavour enzyme causes the changes in volatile compounds and odors of beef longissimus dorsi. Okfrianti *et al*. (2011) reported that the addition of protease enzymes from pineapple extract caused the flesh to be quite sweet, typical of pineapple, because pineapple contains high glucose.

4. Conclusions

This study concluded that soaking native chicken meat breast in pineapple hump juice and chayote juice for 60 minutes at 25°C independently and/or in combination could increase tenderness and cooking loss, reduce total collagen content and water binding capacity, but did not change pH. The use of pineapple hump juice and its combination with chayote juice as a meat tenderizer can increase consumer preferences. Referring to the tenderness data and sensory characteristics, we concluded that the combination of 7.5% pineapple hump juice and 5.0% chayote juice was the most optimum concentration. Chayote has the potential to be used as a meat tenderizer, either independently or in combination with other tenderizers. Identification and characteristics of protease enzymes in chayote need to be investigated further.

5.References

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