THE QUALITY OF SOAKING LAMB MEAT WITH BATAK ONION EXTRACT (*Allium chinense* G. Don)

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ABSTRACT

This study aims to determine lamb meat quality with Batak onion extract (A. chinense G. Don). The samples used in this study were Batak onions (A. chinense G. Don) and lamb. This study used an experimental method with a factorial completely randomized design with a 4 x 3 x 2 pattern. Factor A was the concentration of Batak onion extract (BOE), namely A0: without treatment, A1: 10% and A2: 20%, while factor B is the length of immersion, namely B0: 0 hours, B1: 1 hour and B2: 2 hours. Parameters observed in this study were water content, cooking loss and total bacterial colonies of lamb. The results obtained in this study showed that the analysis of variance for each variable was very significantly different (P<0.01) so it was continued using the Duncan Multiple Range's Test (DMRT) further test. Further test results showed a significant interaction (P<0.05) between Batak onion extract and soaking time on the observed parameters. The best values of water content, pH and total colony were in treatment A2B1 with a value of 76.92%, 6.9 and A2B1 6 x 10^3 CFU/g, while the best cooking loss value was in treatment A1B1 with a value of 48%.

Keywords: Lamb Meat, Batak Onion Extract, Moisture Content, pH, Cooking Loss

INTRODUCTION

Food is a living thing that is needed every day for growth and development. In addition, this material also contains good nutritional value and comes from plant or animal products. Vegetable food products are sources of protein, fat, fiber, vitamins, minerals or amino acids, as well as animal foods. These foodstuffs are food ingredients obtained from healthy livestock and are suitable for consumption such as milk, eggs or meat.

Meat is one of the animal foods that have high nutritional value, especially protein and amino acids. The nutrients contained in meat include water. The high content of these complex nutrients makes this animal product very easily damaged, especially by microbial contaminants. Bacteria are the contaminants that most often contaminate livestock products, thereby reducing the nutritional value contained therein. In addition, storage also greatly affects the quality and durability of livestock products. Livestock products such as meat have a very short shelf life when stored at room temperature (37^{o}C). This temperature is the optimal temperature for the growth of microorganisms. The storage technique used is usually cold storage at a temperature of <4^{o}C, namely using a refrigerator or freezer. In addition, the preservation technique used can use natural preservatives.

Natural preservatives can use natural ingredients such as plants. The preservation process can be carried out using antimicrobial or antioxidant substances that aim to inhibit the growth of microorganisms so as to minimize product damage. One of the natural ingredients that can be used is Batak onion (*Allium chinense* G. Don). Batak onion (*A. chinense* G. Don) is one of the endemic plants found in the province of North Sumatra. This plant is usually used by the community as a spice for several types of cuisine. This plant has good antioxidant and antimicrobial content as researched by Naibaho, Bintang and Pasaribu (2015) and Rubiatik, Sartini, Lubis (2015) regarding antimicrobial activity that can inhibit the growth of several types of microbes such as *Eschericia coli, Staphylococcus aureus*, *Salmonella thypii*. and others. The ability of Batak onion (*A. chinense* G. Don) to inhibit the growth of microorganisms can be used as a basis for use as a natural preservative for food, especially animal products which tend to have high water and protein content, such as meat.

LITERATURE REVIEW

Meat

Soputan (2004) stated that meat as part of slaughtered animals used by humans as food, in addition to having an attractive appearance, is also a source of high quality animal protein. Soeparno (2015) states that the definition of meat is all animal tissues and all products resulting from the processing of these tissues that are suitable for eating and do not cause health problems for those who eat them. Based on the physical condition, meat can be grouped into: (1) fresh meat withered or without withering, (2) fresh meat withered and then chilled (cold meat), (3) fresh meat withered, cooled and then frozen (frozen meat), (4) cooked meat, (5) smoked meat, (6) processed meat.

The nutritional content in meat has different benefits. Protein plays an important role in building tissues in the body, making natural antibodies for the body that work well so that it can prevent the body from disease, iron also plays an important role in the health of the body, which can prevent the body from symptoms of anemia, and vitamins (A, D and B) which provides assistance to the nervous system and is also good for eyesight, bones, skin, and teeth. The composition of meat varies and is influenced by the type of livestock, age, food while the cattle are still alive, and the breed of livestock (Soeparno, 2015). According to Aberle et al. (2001) the chemical composition of meat is 65-80% water content, 16-22% protein and 1.5-13% fat. Protein is a chemical component that is dispersed from meat.

According to Suhardi (1998) the protein content in meat is around 20-22%. The chemical composition of other meat is fat with a composition of 1.3-13%. Differences in the characteristics of fat in meat are caused by the short length of the carbon chains that make up the fat and the level of saturation of fatty acids. The higher the level of saturated fatty acids, the tougher the meat will be (Burhan, 2003). The chemical quality of meat is influenced by factors before and after slaughter. Factors before slaughter that can affect meat quality are genetics, species, breed, type of livestock, sex, age, feed and additives (hormones, antibiotics, and minerals), and stress conditions. The chemical composition of meat according to Afiati (2015); Cavali, et al. (2006); Subagyo, et al. (2015) consists of 56-80% water, 15-22% protein content, 5-34% fat, 3.5% dissolved non-protein substances including 1% carbohydrates, organic salts, dissolved nitrogen substances, minerals, vitamins (B complex and C) and a normal pH value of 5.4-5.9. High protein in meat contains complete and balanced essential amino acids needed for growth, development and maintenance of health. In addition, it also contains energy generated from intracellular fat in muscle fibers and contains relatively lower cholesterol than the viscera and viscera.

Bacterial Growth in Meat

The initial contamination of meat comes from microorganisms that enter the bloodstream at the time of slaughter, if the equipment used for phlebotomy is not sterile because the blood is still circulating for some time after slaughter, further contamination can occur through the surface of the meat during meat preparation operations, namely the process of carcass cleavage, cooling, freezing, refreshing frozen meat, cutting carcass or meat, the process of making meat products, preservation, packaging, storage and distribution (Soeparno, 2015).

Bacterial contamination of meat immediately after being cut, blood still circulates throughout the animal's body so that the use of an unclean knife can cause microorganisms to enter the blood (Gustiani, 2009). Bacteria have a large surface area in accordance with the ratio of their body volume. Therefore, bacteria will quickly obtain food from their environment, either by diffusion or through active transport mechanisms. There are several factors that affect the growth of bacteria, namely, food availability, pH, ionic concentration, and oxygen, especially for obligate aerobic bacteria (Sudjadi and Laila, 2006).

Factors that affect the growth of microorganisms in meat are divided into two groups, namely: (1) internal factors (intrinsic), including the nutritional value of meat, moisture content, pH, oxidation-reduction potential, and the presence or absence of barrier or inhibitory substances, and (2) external factors (extrinsic), such as temperature, relative humidity, the presence or absence of oxygen, and the shape or condition of the meat (Soeparno, 2015).

Preservation

Preservation is to inhibit or limit enzymatic, chemical reactions and physical damage to meat and processed meat (Soeparno, 2015). This activity is an alternative to overcome damage to meat from pathogenic bacteria, inhibit or limit enzymatic, chemical, microbiological reactions, and physical damage so as to extend its shelf life (Sudarmawan, 2010). Preservation of meat has many methods that are often used, namely 1) heating is done for solid materials, 2) cooling is done by putting it in the refrigerator, 3) freezing by lowering the temperature to below the freezing point of water, 4) smoking, which is a combination of salting and drying techniques. for long-term preservation of meat.

Preservatives are food additives that can prevent or inhibit the work of spoilage bacteria in food, both pathogenic and non-pathogenic, extend the shelf life of food, do not reduce nutritional quality, color, taste and smell (Hadriyati, 2017). According to the Joint Committee of Experts FAO (Food and Agriculture Organization) and WHO (World Health Organization) a food additive is a non-nutritive substance added to food intentionally, generally given in small amounts and aimed at improving the appearance, taste, texture or storage properties (Surjana, 2001). Preservatives in food are made to make food look more quality, durable, attractive, and have a more perfect taste and texture (Siaka, 2009).

The use of preservatives in food processing must still consider its safety. The requirements that must be met by a preservative to be used in an effort to extend the shelf life of food products are: (i) not changing the flavor, odor, color or texture of food ingredients, (ii) safe for consumers at concentrations that are effective as preservatives or safe for consumption. during a certain shelf life, (iii) preservatives must be easily recognized and the levels can be detected with certainty and must meet permitted (legal) requirements, (iv) the quality of food ingredients must not harm consumers, and (v) economical (Gumanti, 2006).

Batak Onion

Batak onion (*Allium chinense* G. Don) has a morphology like chives but with a longer stalk tip and tends to be white in color. So it looks like a small leek with long small leaves, and also looks like an onion, but its size is much smaller, but it is different from chives, usually used as a mixture of pickles or some dishes. Many people call this vegetable by the name of chive, but there are also those who call it Batak onion. This commodity is called Batak onion (*A. chinense*) because it is found in many Batak dishes, one of which is arsik. But along with the development of time. Lokio or Batak onions are also used in other dishes, such as ingredients for sauteing chicken, fish, or meat. Until now, Batak onions are only used in cooking (Septia, 2010).

Antioxidant

Antioxidants are substances that are able to neutralize or reduce the negative effects of free radicals. Free radicals are molecules that have an unpaired electron group in an outer circle. The benefits of antioxidants to counteract these free radicals that make antioxidants very much studied by researchers. Various research results have reported that antioxidants can slow down processes that can be caused by free radicals such as the presence of tocopherols, ascorbates, flavonoids, and the presence of lycopene (Andriani, 2007).

Antimicrobial

Antimicrobials are chemical substances produced by fungi and bacteria, these substances have the property or ability to kill/inhibit the growth of germs while the toxicity to humans is relatively small. The statement about the definition of antimicrobials according to Waluyo (2004), antimicrobials are chemical substances obtained/formed and produced by microorganisms, these substances have the power to inhibit the activity of other microorganisms, although in small quantities. Entjang (2003) in Rostinawati (2009) states that antimicrobial is a chemical substance produced by a microbe that has antimicrobial properties.

Water Content

Threshold water content of beef is 65 - 80% (Winarno and Koswara, 2002). The water content in fresh meat was recorded to have an average of 75%, for the normal range between 65 - 80% (Lawrie, 2003). The water content of meat is about 75.83% (Kuswati, 2006). The water content available in meat greatly affects the growth rate of microorganisms (Soeparno, 1994). The water content in meat is also influenced by the intramuscular fat content contained in the muscle (Nurwantoro et al., 2012). The water content in meat is not only influenced by intramascular fat in the muscles, but also by the age of the livestock, young cattle have a higher water content than the older ones because as age increases, intramascular fat deposition increases which causes a decrease in water content (Hidayat, et al., 2009). Rottenness in beef is related to the existing water content, with decay causing changes in the value of the water content (Suradi, 2012).

Cooking Loss

Cooking loss is one indicator of the nutritional value of meat related to the juice content of meat, namely the amount of water bound in and between muscle fibers. Meat juice is a component of meat that determines the tenderness of meat (Soeparno, 2005). Ma'arif (2009) stated that this indicator is a calculation of the weight lost during cooking or heating of meat. In general, the longer the cooking time, the greater the fluid content of the meat until it reaches a constant level. Factors that affect the percentage of cooking loss according to Bouton et al. (1986) namely the state of myofibril contraction. Shorter muscle fibers can increase cooking loss, on the other hand, increasing the age of livestock or fattening the longer can reduce cooking loss.

Total Bacterial Colonies

Meat is easily damaged by bacteria with marked changes in odor and mucus that usually occurs when the number of bacteria becomes millions or hundreds of millions of cells or more per 1 cm of meat surface area and the damage is caused by spoilage bacteria (Sa'idah et al., 2011). Sources of such pollution include: 1) animals (skin, nails, contents of innards), 2) workers/humans who contaminate livestock products through clothing, hair, nose, mouth, hands, fingers, nails, footwear, 3) equipment (knives, cutting tools/cutting boards, knives, boxes), 4) building (floor), 5) environment (air, water, soil), and 6) packaging (Gustiani, 2009). Factors that affect the growth of bacteria in meat are divided into two groups, namely internal factors and extrinsic factors. The initial contamination of beef occurs at the time of slaughter with non-sterile tools and contamination of beef worsens during distribution because beef from abattoirs has been contaminated with bacteria and has experienced bacterial growth (Arifin et al., 2008). All things that are in direct contact with meat such as tables, utensils, sellers, buyers, and the environment can be a source of contamination (Kuntoro et al., 2013). The requirements for microbiological quality of beef are appropriate (SNI, 2008). The requirements for microbiological quality of beef according to SNI are as follows:

Table 1. Quality Standard of Meat (SNI, 2008)

No.	Test Type	Unit	Requirements
1.	*Total Plate Count*	CFU/g	Maximum $1x10^6$
2.	*Coliform*	CFU/g	Maximum $1x10^2$
3.	*Staphylococcus aureus*	CFU/g	Maximum $1x10^2$
4.	*Salmonella sp.*	Per 25 g	Negative
5.	*Escherichia coli*	CFU/g	Maxiimum $1x10^1$

METHODS

Research Material

The research materials used were Batak onions (*Allium chinense* G. Don), fresh lamb, plate count agar, peptone water, aluminum foil, PE plastic, plastic wrap, aquades, technical ethyl acetate, alcohol 70, label paper and brown glass bottles. The tools used in this research are test tubes, bunsen, incubator, petridish, permanent pen, aluminum cup and oven.

Research procedure

Extraction of Batak Onion (*A. chinense* G. Don)

Batak onion bulbs (A. chinense G. Don) were cleaned of dirt and debris until they were clean. The tubers were sliced to a thickness of ± 5 mm, then dried in an oven at 50^{o}C for 6 hours to obtain a constant final weight. Batak onion tubers that have been dried are then mashed using a blender and filtered until they become powder (simplicia). Simplicia was extracted by maceration method using 70% ethanol (v/v) and distilled water for 3 days at room temperature. Then filtered and concentrated with a vacuum rotary evaporator at a temperature of 60^{o}C. The extract is ready to be used as a soaking treatment with fresh meat.

Observed Parameters

Water content

The empty aluminum cup was heated in an oven at 105oC for 30 minutes, then cooled in a desiccator and weighed. The cup drying procedure was repeated until a balanced weight was obtained. A sample of 2 grams in a dried cup was weighed, then heated in an oven at 105oC for 6 hours. After the cup was removed from the oven, it was cooled in a desiccator for 30 minutes. The drying process is repeated until a balanced weight of the material is obtained. The percentage of water content can be calculated using the following formula:

$$Kadar\ air(\%) = \frac{B_1 - B_2}{B_1} x\ 100$$

Information :
B1 = Weight of the initial material (g)
B2 = Weight of material after drying (g)

Cooking Loss

The cooking loss test procedure can be carried out by means of a sample of 20 grams wrapped in a plastic zipper then put into a measuring cup and cooked using a water bath for 15 minutes at a temperature of 70oC. After boiling, the samples were removed and cooled.

Next, the sample was dried using blotting paper without pressing, then weighed and recorded.

Bacterial Colony Total Test

The calculation of the total bacterial colonies contained in the curd is by using the Standard Plate Count (SPC). According to Fardiaz (1989) the calculation is as follows All equipment needed such as: petri dish (petridish), test tube, erlenmeyer, micro pipette tip, hockey stick, sterilized in an autoclave at 121ºC for 15 minutes with a pressure of 15 lbs. The medium used was 22.5 g of PCA Oxoid dissolved in 900 ml of distilled water, then heated until homogeneous and divided into each petridish, after which it was sterilized in an autoclave. One gram of curd sample is taken, then put into an erlenmeyer which already contains 9 ml of sterile peptone solution, mixed for 5 minutes until evenly distributed. This result is a dilution of 10^{-1}. From the results of the dilution, 0.1 ml was taken and put into the first test tube which already contained 0.9 ml of peptone solution. This is a 10-2 dilution. This is done until the dilution of 10. To calculate the Total Bacterial Colonies, the sample taken was at a dilution of 10^{-5}, namely 0.1 ml of the sample was taken and put into the medium and leveled with a hockey stick until it was completely evenly distributed. To calculate the Total Bacterial Colonies, the sample taken was at a dilution of 10^{-5}, namely 0.1 ml of the sample was taken and put into the medium and leveled with a hockey stick until it was completely evenly distributed

Growing colonies were counted using the Quebec Colony Counter tool.
Total of Colony (CFU (*Colony Forming Unit*)/g)
= Total of Colony x (1/dilution) x (1/sample)

Data Analysis Method

This study uses an experimental method with the design used is a completely randomized design (CRD) factorial pattern 3 x 3 with 2 replications.

Factor A is the concentration of Batak onion:

A0 : 0% (control)
A1 : 10% Batak onion extract
A2 : 20% Batak onion extract

Factor B is the immersion time;
B0 : 0 hours
B1 : 1 hour
B2 : 2 hours

The mathematical model used is in accordance with the design used according to Steel and Torrie (1995), namely:

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta) ij + \varepsilon ijk \qquad [1]$$

Description:
Yijk = Observation results for factor A level I, factor B level j, on the k-th test
μ = General average
i = Effect of factor A at level i
j = Effect of factor B on j level
(αβ)ij = Interaction between A and B at factor A level i, factor B level j
ijk = Experimental error for the i level of factor A, j level of factor B on the k test

If the data obtained in the ANOVA table shows a significant or very significant difference, further tests will be carried out. The further test used will be determined by calculating the coefficient of data diversity.

RESULTS AND DISCUSSION

Research result

Water content

The water content of lamb meat by soaking using Batak onion extract (Allium chinense G. Don) is shown in Table 2. below.

Table 2. Water Content (%)

A (Concentration)	B (Soaking Time)		
	B0	B1	B2
A0	78,15^{b}	77,43^{b}	77,53^{c}
A1	78,49^{a}	79,62^{b}	77,94^{b}
A2	77,00^{b}	76,92^{b}	77,87^{b}

Description: Each different letter indicates a significant interaction (P<0.05) with each treatment

The results of analysis of variance showed that the combination of treatment between Batak onion extract and soaking time had a very significant effect (P<0.01) and a significant interaction (P<0.05) was found between each treatment and the sample. The results of further tests using Duncan Multiple Range's Test (DMRT) showed that the treatment that showed the lowest water content in lamb was the A2B1 treatment with a value of 76.92%.

Cooking Loss

Cooking shrinkage of lamb by soaking using Batak onion extract (*Allium chinense* G. Don) as shown in Table 3. below.

Table 3. Cooking Loss (%)

A (Concentration)	B (Soaking Time)		
	B0	B1	B2
A0	58,8^{g}	55,9^{d}	54,7^{c}
A1	56,7^{e}	48,0^{a}	53,2^{b}
A2	58,0^{f}	55,9^{d}	53,2^{c}

Description: Each different letter indicates a significant interaction (P<0.05) with each treatment

The results of analysis of variance showed that the combination of treatment between Batak onion extract and soaking time had a very significant effect (P<0.01) and a significant interaction (P<0.05) was found between each treatment and the sample. Further test results using Duncan Multiple Range's Test (DMRT) showed that the treatment that showed the highest cooking loss value in lamb was the A0B0 treatment with a value of 58.8%.

Total Bacterial Colonies

The total colonies of lamb meat by soaking using Batak onion extract (*Allium chinense* G. Don) are as shown in Table 4. below.

Table 4. Total Colony of Microbia (x 10^3 CFU/g)

A (Concentration)	B (Soaking Time)		
	B0	B1	B2
A0	31^c	81^b	100^a
A1	26^d	16^g	18^f
A2	20^e	6^h	19^f

Description: Each different letter indicates a significant interaction ($P<0.05$) with each treatment

The results of analysis of variance showed that the combination of treatment between Batak onion extract and soaking time had a very significant effect ($P<0.01$) and a significant interaction ($P<0.05$) was found between each treatment and the sample. Further test results using Duncan Multiple Range's Test (DMRT) showed that the treatment that showed the lowest total bacterial colonies in lamb was the A2B1 treatment with a value of 6 x 103 CFU/g.

Discussion

Water content

The results showed that the interaction between EBB and soaking time had an inverse relationship, namely the more the amount of Batak onion extract (EBB) added, the lower the water content of the lamb, while the longer the sample soaked in EBB, the water content increased compared to the control. . This is because the water content of the Batak onion reaches >10%. In accordance with the results of Sipayung's research (2020) which found the water content of Batak onions was 12.72%. Based on the results obtained, it can be seen that the longer the product is immersed in EBB, the higher the water content will be. In addition, the amount of water content in a product is also influenced by the condition of the livestock. In accordance with the opinion of Tilman (1989) that the water content decreases with increasing age of livestock, on the contrary the fat content tends to increase until the maturity stage is reached. The water content of meat reaches 75% in the body of livestock, also influenced by the treatment of livestock. Soeparno (2005) added that meat has a small amount of carbohydrates in the form of glycogen. Microbes will break down carbohydrates with large molecules such as polysaccharides into glucose (monosaccharides) or maltose (disaccharides). Monosaccharides in the glycolysis process will be converted into pyruvic acid, then converted into tricarboxylic acid in the Krebs cycle and finally split into CO2 and H2O, so that the water content increases.

Cooking Loss

The results showed that as the Batak onion extract was added, the cooking loss value also decreased. According to Tambunan (2009), the higher the water holding capacity, when the water is heated, less nutrient liquid will be wasted so that the mass of the meat is reduced, the low water holding capacity affects the cooking loss value.

The results of this study were higher than Dina et al. (2017) who obtained a cooking loss value of 37-41% in a 6-hour observation that examined the immersion of beef in the extract of the kecombrang flower (*Etlingera elatior*). The lowest cooking loss value in this study was still within normal limits. In accordance with the opinion of Lawrie (2003) which states that the normal cooking loss value of beef ranges from 1.5-54.5%. Soeparno (2015) added that the cooking loss value of meat ranges from 15-40%. The best meat cooking loss was in the A1B1 treatment with a value of 48%. In accordance with the opinion of Komariah et al. (2008) that meat with smaller cooking losses has better quality than large cooking losses because during cooking, less nutritional value is lost.

Total Bacterial Colonies

Table 5 shows that the administration of 20% EBB gave better results with a lower total value of bacterial colonies with 1 hour of immersion in open space. This is because the Batak onion extract has antibacterial properties that can affect microbial growth. This is in line with the research of Naibaho et al. (2015) which stated that all extracts used could inhibit microbial growth at a concentration of 1000 mg/ml.

In addition, the content of the extract used as a preservative also affected the total bacterial colonies observed in the sample. In accordance with the research of Naibaho et al. (2015) that Batak onions are positive for saponins, flavonoids, triterpenoids and steroids. These antimicrobial properties have the potential to inhibit the growth of microorganisms in the sample. The results also showed that the smell of lamb for 3 hours of immersion in EBB was not as strong as rotten meat. This is in line with Naidu (2000) that triterpenoids are compounds that have a carbon skeleton derived from six isoprene units and are biosynthetically derived from acyclic hydrocarbons, namely squalene. The general effect of saponin activity on bacteria is cell leakage so that cells lose proteins and enzymes.

CONCLUSION

The conclusions obtained in this study were the best values of water content, pH and total colony in treatment A2B1 with values of 76.92%, 6.9 and A2B1 6 x 103 CFU/g, while the best cooking loss value was in treatment A1B1 with a value of 48%.

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