Water Content and pH Value of Lamb Marinated Using *Moringa Leaves*

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Abstract
The aim of this research was to determine the effect of adding moringa leaves (*Moringa oleifra*) on the nutritional value of lamb nuggets. Moringa leaves (*Moringa oleifra*) are a tropical plant that is easy to grow in tropical areas such as North Sumatra. This plant contains anticancer and antioxidants which can be used as a natural ingredient that can maintain and improve the quality of lamb nuggets. In this research, Moringa leaves and lamb meat were processed into nuggets. This research used an experimental method with a completely randomized design with 4 treatments and 4 replications. The results showed that giving Moringa leaves to make nuggets had a significant effect ($P<0.05$) on the water content and pH value.

Keywords: Lamb meat, Moringa leaves, water content, pH value

Introduction

Food is the most basic and primary human need, and can be a key factor in realizing the quality of human resources that support national development, namely how food is processed to make it more valuable. Based on Global Food Security Index (GFSI) data, Indonesia's food security in 2021 is weaker than in previous years. GFSI noted that the Indonesian Food Security Index reached 61.4% in 2020. However, in 2021 it fell to 59.2%. One of the superior food commodity products that is acceptable to the public is meat.

Meat is an animal food that has high nutritional value. The high nutritional content of this product makes meat very popular with all ages. This animal product is preferred whether it is processed directly or made into processed products such as nuggets.

Nuggets are a processed meat product, namely meat that is processed through grinding, seasoning, coating with flour (liquid flour and bread flour), frying, freezing and frying. This product is a processed food product that is very popular and accepted by the public, especially teenagers and children. In a portion per 100 grams, nuggets contain 15 grams of protein, 31 mg calcium, 1.2 mg iron and 26 mg magnesium. The nutritional value of livestock products can be increased through food diversification processes such as fortification.

Fortification is an additional attribute to increase certain nutrients in food with the aim of improving food quality so that it can be beneficial for health. such as the Food Fortification Approach to Overcome Micronutrient Deficiency Problems [1]. To add to this fortification,

ingredients are needed that are rich in minerals, vitamins and phytochemical content, have varying chemical content, leaves and seeds and flowers such as Moringa leaves.
Moringa leaves (*Moringa oleifra*) which contain active antioxidant and anti-bacterial substances are considered capable of improving performance and preventing damage to internal organs, thereby providing a good effect in increasing metabolism and absorption of nutrients in the body so that it can trigger growth. Based on previous research, it was found that of the parts of the Moringa plant, the best nutritional and phytochemical content is found in Moringa leaves [2,3].

The innovation in making lamb nuggets with the addition of Moringa leaves is thought to be able to improve the quality of processed products which are rich in benefits as functional food. Based on the description above, the author is interested in conducting research on testing the nutritional content of lamb nuggets using Moringa leaves.

Literature Review

Meat

Meat is one of the agricultural commodities needed to meet protein needs, because meat contains high quality protein, which is able to contribute complete essential amino acids. [4] states that meat is part of slaughtered animals used by humans as food, apart from having an attractive appearance, it is also a source of high quality animal protein. Meat is all parts of livestock that have been cut from the animal's body except for the horns, hooves, bones and fur. Thus the liver, spleen, brain and stomach contents such as intestines are also meat. [5] states that meat is defined as all animal tissue 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 that is withered or without withering, (2) fresh meat that is withered then cooled (chilled meat), (3) fresh meat that is withered, cooled then frozen (frozen meat), (4) cooked meat, (5) smoked meat, (6) processed meat.

[4] states that muscle tissue, fat tissue, connective tissue, bone and cartilage are the main physical components of meat. Muscle tissue consists of transverse muscle tissue, smooth muscle tissue, and special muscle tissue, while fat tissue in meat is differentiated according to its location, namely subcutaneous fat, intermuscular fat, intramuscular fat, and intracellular fat. The important connective tissues are collagen fibers, elastin fibers, and reticulin fibers. In general, the structure of meat consists of one or more muscles, each of which is composed of many muscle groups, so muscle fibers are the basic unit of meat structure.

Nugget

[6] in SNI 01-6683-2014 defines chicken nuggets as processed chicken products that are printed, cooked, made from a mixture of ground chicken meat which is coated with or without the addition of other food ingredients and food additives. allowed. According to [7], nuggets are usually made from chicken meat, eggs, tapioca flour, bread flour while additional ingredients and supporting ingredients (seasonings) are salt, garlic, onions, pepper and nutmeg. The purpose of adding spices is to stimulate the taste, salt together with phosphate compounds will help the chicken protein gel to form properly, so that the resulting nuggets have a dense

texture. Apart from that, the addition of eggs and tapioca flour can also function as a binding agent.

Making nuggets includes five stages, namely grinding (accompanied by mixing spices, ice and additional ingredients), molding, coating with flour adhesive and breading, initial frying and freezing [8]. In general, the additional ingredients used in making nuggets are ground meat with the addition of binders, fillers, corn oil, bread flour and spices [9].

The main raw material used to produce chicken nuggets is chicken meat. The meat used should be ground chicken, the aim is to make the mixing or blending process easier so that a smooth and even chicken nugget mixture is obtained. Complementary ingredients for chicken nuggets are water and ice cubes, ground spices (pepper, garlic, nutmeg) and salt [10].

Moringa Leaves

Moringa (*Moringa oleifera*) is a plant that originates from the plains throughout the sub-Himalayan region, namely India, Pakistan, Bangladesh and Afghanistan. Moringa is a type of long-lived herbaceous plant in the form of a bush or tree with a height of 7-12 meters. The stems are woody (lignosus), erect, dirty white, thin-skinned and break easily. The branches are sparse with upright or oblique branching directions and tend to grow straight and elongated [11]. Moringa leaves are egg-shaped, the fins are imperfect, the leaves are odd, arranged in a compound on one stalk, and are only the size of a fingertip. Moringa leaf blades are green, the tip of the leaf is blunt, the base of the leaf is rounded, the edge of the leaf is flat, the arrangement of the bones is pinnate and measures 1-2 cm [12]. Moringa flowers appear in the leaf axils, have a distinctive aroma and are yellowish white in color. Moringa fruit is triangular in shape, about 20-60 cm long and green. Moringa has a tap root, is white in color, looks like a radish, has a sharp odor and spicy taste [12].

Research Methodology

pH Value

A 25 g meat sample was added to 50 mL of distilled water, then blended until homogeneous. The pH value is determined using a pH meter. Before taking measurements, the pH meter needs to be calibrated first using pH 4 and 7 buffers. After calibration, the sample is measured by dipping the electrode into the solution until a stable reading is obtained

Results

pH Value

The pH value of lamb nuggets with the addition of Moringa leaves is as shown in Table 1 below.

Table 1. pH Value of Lamb Nugget

Treatments	pH Value
P0	6,8
P1	6,6
P2	6,3
P3	6,2

The results showed that the highest pH value of lamb nuggets was in the P0 treatment with a value of 6.8, while the lowest pH value was in the P3 treatment with a pH value of 6.2. The highest pH value was shown in treatment P0 which did not add Moringa leaves. The results of

data analysis using the ANOVA table showed that the addition of Moringa leaves did not have a significant effect (P>0.05) on each treatment. The results of this research are different from research conducted by [13] which stated that the pH value of lamb was the lowest with a value of 6.6, namely soaking lamb in Batak onion extract for 2 hours. The pH value in the study decreased with each increase in the amount of extract added, in line with [14] also found that the pH of beef soaked in garlic juice decreased from 6.54 to 6.31 with a marination time of 5-20 minutes.

In this research, making lamb nuggets with the addition of Moringa leaves will also have a different effect on the results. The use of a combination of these plant extracts can also affect the pH value. [15] emphasized that the longer the marination time causes the water holding capacity to increase and the pH value of meat samples to decrease when using theobromine. [16] found a decrease in the pH value of cull chicken meat by administering guava extract.

The decrease in pH value was caused by the administration of ascorbic acid so that an isoelectric pH was achieved. This pH is the pH when negative ions from proteins and positive ions have the same amount. H+ ions will increase with the administration of ascorbic acid. The more H^+ ions there are, the pH value will decrease due to reactions with negative ions. [17] emphasized that the addition of acid results in the addition of H^+ ions so that they can neutralize proteins and reach isoelectric pH.

The results of this research are supported by research by [18] which states that food ingredients with a pH close to neutral have more microbes in the form of bacteria than other types of microbes. Reinforced by [19] that this microbial growth will take place and the ideal pH for microbial growth will be achieved, namely neutral pH. Apart from that, the antioxidant content in the two extracts used causes the pH value to decrease. In line with [20] that the phenol content as an antioxidant and antimicrobial can act as a softener, so that glycolytic enzymes in the anaerobic glycolysis process can be stopped.

Conclusion

The conclusion obtained in this research is that the addition of Moringa leaves to making nuggets has an effect on the quality of lamb meat.

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