

# Effect of long-time immersion in edible film solution from local chicken claw on the physical and chemical properties of chicken meat

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**Submission date:** 22-Jun-2023 11:03AM (UTC+0700)

**Submission ID:** 2120686218

**File name:** ng-time\_immersion\_in\_edible\_film\_solution\_from\_local\_chicken.pdf (674.75K)

**Word count:** 2495

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2

To cite this article: M Sompie *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **492** 012056View the [article online](#) for updates and enhancements.

## Effect of long-time immersion in edible film solution from local chicken claw on the physical and chemical properties of chicken meat

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**Abstract.** Gelatine is a denaturalized protein that is derived from collagen by acidic or alkaline hydrolysis and is an important functional biopolymer that has a very broad application in many industrial fields. This study was aimed to determine the effect of immersion time in edible film from local chicken claw on the physical and chemical properties of chicken meat. These research materials were used gelatine of local chicken claw, plasticizer glycerol, and chicken meat. This study used completely randomized design with different time of immersion in edible film solution (T1 = 0 minutes, T2 = 3 minutes, T3 = 6 minutes and T4 = 9 minutes) and four replications. The result of the study showed that the long-time of immersion in edible film solutions had a significant effect ( $p < 0.05$ ) on the water holding capacity, cooking loss, texture, protein content, and pH value of chicken meat. It was concluded that the chicken meat soaked in edible film solution for 3 minutes had the best physical and chemical properties.

### 1. Introduction

Poultry production can be considered as one of the most important sources of cheap protein, where the chicken meat is very cheap as compared with the red meat (cow meat). It was characterized by its high economic return due to its short production cycle. In poultry production, the capital cycle can be repeated seven times a year and needs a small area in comparison with other animals [1]. The role of using edible coatings on food products is widely developed, such as chicken meat. The edible coating is expected to maintain the quality of food products because it is a barrier to water vapor and the exchange of O<sub>2</sub> gas with CO<sub>2</sub> [2]. Food safety is a global issue that requires an integrated global response. Food chain approval is a complex process of farming where poultry, harvesting, transportation, slaughtering up to packaged, sold and consumed products [3]. Research on edible coatings on food has been carried out and proven to be able to extend shelf life and improve product quality [2]. Edible films from collagen have the good potential [3–5]. Collagen is the major component of skin, tendon, and connective tissues and it is the most prevalent and widely distributed fibrous protein in the animals. The main ingredient for making edible films is gelatine [6–8]. Gelatine is formed from the partial hydrolysis of collagen [9]. The purpose of this study was to determine the effect of the long-time immersion concentrates on the quality



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of chicken meat during storage. Approximately 70–80% of poultry meat in Indonesia is produced through a modern management system and the rest still use the traditional system, but 70–80% of poultry meat is marketed by the traditional system, not through slaughterhouses so there is often contamination in the production process [8]. Thus, the research has been done to study the effect of long-time immersion in edible film solutions on the quality of meat chicken.

16

## 2. Materials and methods

### 2.1. Materials

This research materials were used 3,000 g gelatine produced from the local chicken claw, plasticizer glycerol and chicken meat, acetic acid ( $\text{CH}_3\text{COOH}$ ), hydrochloric acid (HCl), glycerol, chicken meat, and distilled water.

### 2.2. Procedures

The first step, gelatine was prepared by the acid extraction method [9]. Acetic acid ( $\text{CH}_3\text{COOH}$  0.5M) diluted with water in 3% (v/v) was used as a treatment, then diluted HCl with water according to the treatment. The chicken claw was soaked on the acetic curing for 24 hours. After soaked, samples were neutralized to pH 6, weighed and extracted on water bath for 6 hours with temperature 60°C. Solubilised gelatin was separated from residual skin fragments by filtration through a nylon filter. The extracted gelatin was concentrated at 70°C for 6 hours and it was stored in the refrigerator 50°C for 30 minutes, then dried at 60°C for 24–36 hours until the solution dried. Gelatin sheets were milled and packaged in vacuum plastic and stored in a desiccator for the analysis process. The second step is preparing an edible film. Edible film is processed by the Sompie method [6] as follows: film-forming solution is prepared by dissolving 10 g of gelatine in 100 ml distilled water according to the treatment determined, then added 15% glycerol as a plasticizer (w/w) and then dissolving in a water bath at 50°C, stirred for 30 minutes until the gelatine was mixed. The next step was preparing the edible coating. The solution has been formed applied as a coating on fresh chicken meat. The meat was sliced with the same size (2 cm), then it was dipped in an edible film solution according to the time of treatment (0 minutes, 3 minutes, 6 minutes and 9 minutes) then removed and drained, put into polyethylene plastic, vacuum and analyzed the quality of chicken meat [7,9].

### 2.3. Data analysis

This study used completely randomized design with different times of immersion in edible film solution (T1 = 0 minutes, T2 = 3 minutes, T3 = 6 minutes, and T4 = 9 minutes and four replications). The data were analysed using ANOVA. The significant differences of the average were determined using Duncan's multiple range test at a 5% level [10].

### 2.4. Parameters

The parameters of this research were water holding capacity, cooking loss, texture, protein content, and pH value of chicken meat.

21

## 3. Results and discussion

### 3.1. Water holding capacity

Statistical analysis showed that the time of immersion in the coating solution had a significant effect ( $p < 0.05$ ) on the water holding capacity (WHC) of chicken meat. Duncan test results showed that the

holding capacity of chicken meat water with edible coating immersion for 6 and 9 minutes was the same effect, but was significantly higher ( $p < 0.05$ ) compared to immersion in edible coating solutions of 0 and 3 minutes. It means Duncan test results showed that the holding capacity of chicken meat water with edible coating immersion for 6 and 9 minutes was the same effect, but was significantly higher ( $p < 0.05$ ) compared to immersion in edible coating solutions of 0 and 3 minutes. The decreased time of immersion caused by the WHC value is decreasing [15,29]. The WHC in meat was determined by the ability of meat protein to bind water. The decrease in water holding capacity is caused by the breaking of bonds between the constituents of the protein polymer. WHC is also related to cooking losses, this means the decrease in water holding capacity will increase the cooking loss, whereas an increase in water holding capacity will decrease the cooking loss of chicken meat. The highest WHC (38.27%) was obtained at 6 minutes-soaked treatment, while the lowest WHC was obtained at 0 minutes.

**Table 1.** The physical and chemical properties of meat chicken.

Immersion (minutes)	WHC (%)	Cooking Loss (%)	Texture (N)	Protein Content (%)	pH
0	31.00±0.96 <sup>a</sup>	4.39±0.11 <sup>a</sup>	6.50±0.18 <sup>a</sup>	18.75±0.24 <sup>a</sup>	6.17±0.12
3	38.27±1.36 <sup>b</sup>	4.27±0.42 <sup>ab</sup>	5.34±0.09 <sup>b</sup>	18.78±0.08 <sup>a</sup>	6.18±0.09
6	38.03±0.92 <sup>c</sup>	4.31±0.27 <sup>ab</sup>	6.26±0.26 <sup>a</sup>	19.47±0.48 <sup>b</sup>	6.20±0.13
9	38.10±2.00 <sup>c</sup>	3.75±0.49 <sup>c</sup>	4.39±0.21 <sup>c</sup>	19.51±0.22 <sup>b</sup>	6.26±0.14
average	35.60±3.29	4.18±0.41	5.62±0.89	19.13±0.22	6.21±0.11

Different letters in the same row indicated the significant differences ( $p < 0.05$ ).

### 3.2. Cooking loss

Statistical analysis showed that the time of immersion in the coating solution had a significant effect ( $p < 0.05$ ) on the cooking loss of chicken meat. The Duncan test results for the treatment showed that the cooking loss of chicken meat with control treatment was significantly lower ( $p < 0.05$ ) compared to the value of cooking loss of chicken meat. This means that the length of time the immersion process, the percentage of cooking loss of chicken meat decrease [17].

### 3.3. Texture

Statistical analysis indicated that the immersion time in the edible coating solution had a significant effect ( $p < 0.05$ ) on meat chicken. Duncan test results showed that the value of the texture of meat with a time of 0 and 6 minutes was significantly higher ( $p < 0.05$ ) compared with 3 and 9 minutes of immersion. The high value of tenderness in fresh meat without treatment is caused because basically, the meat is tender because the meat used is cut at a younger age. In general, older animals will have a harder tenderness value compared to cattle at younger slaughter age. According to [17] with increasing age, the proportion of salt and collagen dissolved in acid decreases, so that intra- and inter-molecular cross-linking between collagen polypeptide chains increases [16,17].

### 3.4. Protein content

Statistical analysis showed that the time of immersion in the coating solution had a significant effect ( $p < 0.05$ ) on the protein content of chicken meat (table 1). Duncan test showed that the protein content of the texture of meat with a time of 9 minutes was significantly higher ( $p < 0.05$ ) compared to 0,3 and 6 minutes of immersion [16,18].

### 3.5. pH

Statistical analysis indicated that the time of immersion in edible film solution had no significant effect ( $p < 0.05$ ) on chicken meat. The pH value is closely related to microbes that contaminate meat so that if the microbial content is low, the activity will be slow, and the ability to convert nutrients from meat to lactic acid will also slow [16,18].

#### 4. Conclusion

It was concluded that the chicken meat soaked in edible film solution for three minutes had the best physical and chemical properties (WHC 38.27%, cooking loss 4.27%, protein content 18.78%, and the value of texture in the range 5.34 N/m and pH value 6.18).

#### Acknowledgment

The research was funded by the Ministry of Research Technology and Higher Education of Indonesia based on Research Grant Implementation No. 199/UN12.13/LT/2019.

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