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Effect of Pressure-Cooking Time Method on the Characteristics of *Abon Entok*

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ABSTRACT

Abon is a dry meat-based product typically made from beef, chicken, or other types of poultry, including entok. In the production of *abon*, the boiling stage is critical, as it determines the tenderness of the meat, which directly influences the shredding process and the overall quality of the final product. However, conventional boiling methods often require extended cooking times to achieve the desired tenderness. To address this limitation, high-pressure cooking using a pressure cooker has become a common alternative due to its ability to significantly reduce cooking time without compromising product quality. Therefore, the objective of this study was to evaluate the effect of cooking time on the physical, chemical, and sensory characteristics of *abon entok*. This study employed a single independent variable, namely boiling time, which was applied in three treatment durations (15, 25, and 35 minutes). Based on the results of the analysis of the physical, chemical and sensory parameters of abon entok, it was found that boiling time had no significant effect on the physical parameters (pH and cooking loss) and certain sensory attributes (aroma, taste, and overall acceptability). In contrast, it had a significant effect ($p<0.05$) on the sensory attributes of color and texture. However, the multiple attribute Zeleny analysis identified the 15-minute boiling time (treatment A) as the best overall treatment, producing pH of 6.20 ± 0.07, cooking loss of 42.99 ± 1.50%, colour score of 3.60, aroma score of 4.07, texture score of 3.37, taste score of 3.77, and overall appearance score of 3.97.

INTRODUCTION

Blitar Regency is a region undergoing continuous development across various sectors, including the livestock sector. This sector remains a prominent choice among local communities seeking to establish businesses that not only generate economic profit but also fulfil nutritional needs. The growing population and increased awareness of the importance of consuming animal-based proteins have further driven the demand for livestock products, such as meat and eggs (Santoso, 2022). According to data from Badan Pusat Statistik (2025), the agricultural sector which encompasses the livestock subsector recorded the highest percentage contribution to the Gross Regional Domestic Product (GRDP) in 2024, reaching 29.66% compared to other business sectors. This indicates that the sector made the largest contribution to the overall economy of Blitar Regency during that period.

Among the various livestock commodities, poultry specifically the Muscovy duck (*Cairina moschata*) presents promising potential. This waterfowl species is known for its adaptability to environmental conditions, resistance to disease, and its ability to produce meat, eggs, and feathers (Iriyanti & Hartini, 2020). Muscovy duck meat is rich in essential nutrients such as protein, iron, and phosphorus, and it contains lower fat levels compared to other types of poultry (Soeparno, 2015). Nevertheless, its relatively tough texture tends to limit consumer acceptance, thereby necessitating appropriate processing techniques to enhance its palatability (Lase & Lestari, 2020).

Meat processing serves as a strategic approach to enhance the added value of livestock products, extend their shelf life, and diversify the range of meat-based products that are acceptable to consumers (Susanti et al., 2021). One such processed product that enjoys widespread popularity is *abon*, a dry meat-based product typically made from beef, chicken, or other types of poultry, including *entok* (Muscovy duck) (Purnomo, 2012). In the production of *abon*, the boiling stage is critical, as it determines the tenderness of the meat, which directly influences the shredding process and the overall quality of the final product.

However, conventional boiling methods often require extended cooking times to achieve the desired tenderness. To address this limitation, high-pressure cooking using a pressure cooker has become a common alternative due to its ability to significantly reduce cooking time without compromising product quality. Several previous studies have demonstrated the effectiveness of pressure cookers in tenderizing various types of meat, including beef, chicken, duck (*Anas platyrhynchos*), and fish (Alamsyah & Aviana, 2013; Grahandhika et al., 2011; Pratiwi et al., 2015; Saparudin et al., 2016). Nonetheless, to date, no study has specifically investigated the effect of boiling duration using a pressure cooker on Muscovy duck (*entok*) meat and its implications for the final *abon entok* product. Therefore, the objective of this study was to evaluate the effect of cooking time on the physical, chemical, and sensory characteristics of *abon entok*.

RESEARCH METHODS

This research was conducted at the Meat Processing Engineering Laboratory, located in Laboratory Building of Community State of Putra Sang Fajar Blitar, from April to June 2025. The materials used in this study included Muscovy duck carcasses, shallots, garlic, ground coriander, galangal, candlenuts, ginger, turmeric, salt, granulated sugar, brown sugar, lemongrass, bay leaves, lime leaves, flavor enhancer, and cooking oil, all of which were sourced from local markets in Blitar. The equipment utilized comprised a pressure cooker, blender, frying pan, chopper, spoon, and stirrer.

The procedure for producing *abon entok* was adapted with modifications from the method developed by Dilla (2022). Initially, 1 kg of Muscovy duck meat was weighed, and the required spices were prepared, consisting of 45 grams of shallots, 45 grams of garlic, 18 grams of ground coriander, 45 grams of galangal, 45 grams of candlenuts, 24 grams of ginger, 45 grams of turmeric, 12 grams of salt, 30 grams of granulated sugar, 75 grams of brown sugar, 6 stalks of lemongrass, 9 bay leaves, and 6 lime leaves. All ingredients, both meat and spices, were washed thoroughly under running water to eliminate any adhering impurities. The duck meat was then boiled using a pressure cooker, with varying boiling durations according to the treatments outlined in Table 1. Upon completion of the boiling process, all spices were ground to a fine consistency and used in the subsequent stir-frying stage. The boiled duck meat was drained, then finely shredded or ground and pounded to achieve a suitable texture for *abon entok* production. The ground spices were sautéed until fragrant, followed by seasoning adjustment, and then mixed with the shredded duck meat. The mixture was dry-roasted for approximately 40 minutes until it reached a dry and golden-brown state, resulting in ready-to-eat *abon entok*. Finally, the finished product was packaged in clean, airtight containers to maintain its quality.

This study employed a single independent variable, namely boiling time, which was applied in three treatment durations with triplicate. Boiling time was measured after the pressure cooker emitted a sound indicating that full pressure had been reached, as detailed in Table 1.

Table 1. Variation Treatments of Boiling Time Using a Pressure Cooker

Treatment	Explanation
A	Boiling time of 15 minutes
B	Boiling time of 25 minutes
C	Boiling time of 35 minutes

The parameters analysed in this study included physical, chemical and sensory attributes. The physical parameter assessed in this study was cooking loss, the chemical parameter was pH, and the sensory parameters included colour, taste, texture, aroma, and overall acceptability. Measurement of pH and cooking loss was conducted following the method developed by Abubakar et al. (2021), whereas the sensory evaluation was based on the procedure described by Mardiana et al. (2023). This evaluation involved 30 semi-trained panellists who assessed the preference levels for colour, taste, texture, aroma, and overall appearance, using a five-point hedonic scale, where 1 indicated "dislike very much" and 5 indicated "like very much."

The observational data were analysed using a one-way analysis of variance (ANOVA) with Minitab 17 software. When significant differences were identified among treatments, post-hoc comparisons were performed using Tukey's test to determine specific differences between treatment groups. The best treatment was determined using the multiple attribute Zeleny method.

RESULTS AND DISCUSSION

a. The Result of Physical Evaluation

- **Cooking Loss**

The average cooking loss values ranged from 42.99 ± 1.50% to 45.77 ± 0.10%, as shown in Table 2. Results from the analysis of variance indicated that variations in cooking time did not significantly influence the cooking loss ($P \geq 0.05$). This lack of significant difference may be attributed to the relatively narrow range of cooking times, which may have been insufficient to induce substantial changes in mass loss. Cooking loss reflects the percentage of weight reduction during thermal processing and is a function of both time and temperature (Hadi, 2023). In general, lower cooking loss indicates better product quality, as less mass and consequently fewer nutrients are lost during processing.

Thermal treatment causes the release of water and soluble compounds from the meat. As cooking temperature and time increase, fluid loss also increases until reaching a plateau. However, the protein content of the meat plays a critical role in minimizing cooking loss. According to (Sherina et al., 2023), meat with higher protein content tends to exhibit lower cooking loss due to the hydrophilic nature of proteins, which allows them to bind water more effectively. This water-binding capacity is associated with the formation of hydrogen bonds between protein molecules and water, reducing the amount of fluid lost during cooking.

Table 2. The Result of Physical and Chemical Evaluation

Treatment	pH	Cooking Loss (%)
A	6.20 ± 0.07^{a}	42.99 ± 1.50^{a}
B	6.21 ± 0.04^{a}	44.16 ± 1.34^{a}
C	6.20 ± 0.02^{a}	45.77 ± 0.10^{a}

* Expressed values were mean±SD; a same rows containing means with the same superscript letters are not significantly different ($p < 0.05$).

b. The Result of Chemical Evaluation

- **pH**

pH value is a key indicator used to assess meat quality, as it significantly influences the physical, chemical, and functional properties of meat during processing (Kurniawan et al., 2014). As shown in Table 2, the average pH values of *abon entok* ranged from 6.20 ± 0.02 to 6.21 ± 0.04. The analysis of variance revealed that differences in boiling duration had no significant effect on the final pH of the product ($P \geq 0.05$). This finding aligns with the study by Purwasih & Azzahra (2019), who reported that cooking time does not significantly influence the pH of meat, particularly when using short cooking time. However, other processing techniques, such as high-pressure cooking, have been associated with pH alterations due to conformational changes in meat proteins, which reduce the number of acidic groups present (Şayin Sert & Coşkun, 2022). pH also plays a crucial role in determining cooking loss quality. A higher pH value is generally associated with greater water-holding capacity, resulting in lower moisture loss during cooking (Hadi, 2023). For comparison, the average pH value of fresh duck meat is approximately 6.49 (Roswandono et al., 2021), whereas the pH of fresh muscovy duck (*entok*) meat ranges from 5.8 to 6.0 (Falahudin et al., 2019). These findings suggest that the boiling treatments applied in this study did not significantly alter the chemical characteristics of the raw material.

c. The Result of Sensory Evaluation

Sensory analysis plays a crucial role in determining consumer acceptance of a food product. This analysis typically includes the evaluation of several parameters, namely color, taste, aroma, texture, and overall acceptability

- **Color**

Color is one of the key aspects influencing initial consumer perception of food product quality. In addition to serving as an indicator of freshness, color plays a significant role in attracting consumer interest and stimulating appetite. While color undoubtedly impacts consumer acceptance, it does not solely determine the level of preference (Sipahutar et al., 2020). Based on the sensory evaluation results presented in Table 3, the mean scores for the color attribute ranged from 3.60 ± 0.81 to 4.10 ± 0.75. Statistical analysis indicated that the variation in boiling duration had a significant effect ($P \leq 0.05$) on the final color of the product.

Generally, a longer boiling time resulted in higher color scores, up to an optimum point. Subsequently, the color evaluation tended to decrease, likely due to the color becoming excessively dark or uneven. This finding aligns with research by Muhlisin et al. (2013), which indicated that extended cooking can increase panelists' preference scores for the color attribute. This color change is closely linked to the heating process, which triggers protein denaturation and hydrolysis, subsequently enabling the Maillard reaction to occur. The Maillard reaction, a reaction between reducing sugars and amino acids that takes place during heating, is a primary cause of brown color formation in food products. Agustini (2017) found that the longer the heating duration, the higher the intensity of brown color produced as a result of this reaction. In this study, Product B was rated the most visually appealing, exhibiting a uniform dark brown color that appeared slightly dark but not burnt, thus providing an appetizing appearance.

The browning observed is presumed to result not only from the Maillard reaction but also from caramelization, particularly when the cooking temperature approaches or exceeds the melting point of sucrose, approximately 160°C. The addition of sugar during the production process further contributed to the enhancement of brown coloration. This is supported by the findings of Gaga et al. (2022), who stated that the uniform and characteristic brown color formed through the Maillard reaction can serve as an indicator of the quality of shredded meat products such as *abon*.

- **Aroma**

Aroma plays a crucial role in enhancing appetite by stimulating the olfactory senses through the release of volatile compounds. These compounds are typically formed during food processing as a result of enzymatic activity. As shown in Table 3, sensory evaluation results indicate that panelists assigned average scores for aroma attributes ranging from 4.07 ± 0.30 to 4.23 ± 0.67. Statistical analysis revealed that variations in boiling duration did not significantly affect the aroma of the final product ($P \geq 0.05$). This lack of significant difference is likely due to the standardized use of spices during the *abon* preparation process, which may have masked any potential variation in aroma caused by different boiling times. Despite this, panelists exhibited a strong preference for the *abon entok*, as reflected by the consistently high hedonic scores for aroma.

These findings suggest that the uniform seasoning contributed to the product's overall aromatic appeal, regardless of cooking duration.

According to Rasman et al. (2018), the aroma of *abon* products is significantly influenced by both the spice composition and the frying process. During frying, oil oxidation generates unstable peroxide compounds, which contribute to aroma formation. Mustar (2013) further states that the roasting process also triggers physical and chemical changes, including water evaporation, volatile compound formation, carbohydrate caramelization, protein denaturation, and the generation of oxidation gases like CO_2, all of which produce the characteristic *abon* aroma. The addition of ingredients such as sugar, coconut milk, and various spices during processing also intensifies the resulting aroma. Kasmiati et al. (2020) additionally note that incorporating aromatic ingredients like shallots, garlic, and other spices plays a crucial role in enhancing the intensity and complexity of *abon*'s aroma.

- **Texture**

Texture represents a physical interaction that consumers perceive through the sense of touch. It plays a crucial role in determining food quality and strongly influences consumer appeal (Rasman et al., 2018). Based on the sensory evaluation in Table 3, panelists assigned mean texture scores ranging from 3.37 ± 0.72 to 3.90 ± 0.71. The analysis revealed that varying the boiling duration significantly affected ($P \geq 0.05$) the texture of *abon entok*. This finding is consistent with the results reported Muhlisin et al. (2013) which demonstrated that increasing both cooking time and temperature alters the contribution of connective tissue and myofibrillar structures to the meat's shear-force values. This modification ultimately leads to improved tenderness and overall texture quality.

Among the various cooking stages, boiling and frying have a particularly strong influence on the final texture of *abon*. When the meat is boiled thoroughly until it becomes tender, it can be shredded more easily, producing fine meat fibers that are well-suited for *abon*. This finding aligns with research by Costa (2015), who emphasized that despite being considered a basic technique, boiling is a decisive factor in determining the final quality of *abon*. In contrast, insufficient boiling or undercooking hinders the shredding process and results in a suboptimal product.

In addition to boiling, the frying process contributes significantly to texture development by reducing the product's moisture content. Mustar (2013) noted that the shredded structure of the meat increases the surface area, thereby accelerating the drying process during frying. This leads to a drier and crispier texture, which is characteristic of high-quality *abon*. Kaliky (2022) further emphasized that meat texture substantially impacts sensory quality and directly influences the preference of panelists for processed meat products.

- **Taste**

Taste is a critical quality attribute that strongly influences consumer acceptance of food products. According to the sensory evaluation results presented in Table 3, panelists gave average scores for the taste attribute ranging from 3.77 ± 0.82 to 4.20 ± 0.76. Statistical analysis confirmed that variations in boiling duration did not significantly affect the taste of *abon entok* ($P \geq 0.05$). This lack of significant difference is likely due to the consistent use of spices during the product formulation, which may have masked the influence of different boiling times on flavor development.

Spices are known to contribute complex sensory profiles, including taste, aroma, color, and visual appeal. Their synergistic effects not only enhance the overall palatability of meat-based products but also help define a product's sensory identity (Azizah et al., 2021). Moreover, Maillard reaction products formed during cooking can contribute to flavor complexity (Bolkvadze et al., 2024). However, since the boiling times used in this study were relatively short and standardized across treatments, the extent of flavor compound development through Maillard pathways may have been limited and uniform. In such cases, the dominant role of spice composition likely outweighed any subtle flavor variations introduced by thermal treatment. Despite the absence of statistical differences, panelists consistently showed a strong preference for the *abon entok*, as reflected in the relatively high hedonic scores for taste.

- **Overall Appearance**

Appearance serves as the initial sensory attribute perceived by consumers and plays a pivotal role in shaping their expectations, stimulating appetite, and influencing product selection. Visual cues such as color, shape, size, gloss, and texture contribute to the perceived quality and acceptability of food, even before olfactory or gustatory evaluation occurs (Sharif et al., 2017). In the present study, sensory evaluation results (Table 3) show that panelists assigned average scores for the appearance of *abon entok* ranging from 3.97 ± 0.81 to 4.20 ± 0.76. Statistical analysis revealed that variations in boiling duration did not significantly affect the overall appearance of the product ($P \geq 0.05$). These findings suggest that the relatively narrow range of cooking times employed did not produce significant differences in the final product. The absence of notable variation may also be attributed to the standardized use of seasonings and the uniform application of a sequential processing method, in which the meat is first boiled, then shredded, and subsequently fried. This repetitive cooking process likely minimized visible distinctions among treatments, resulting in a generally consistent appearance across all *abon entok* samples.

Table 3. The Result of Sensory Evaluation

Treatment	Color	Aroma	Texture	Taste	Overall Appearance
A	3.60 ± 0.81^{b}	4.07 ± 0.74^{a}	3.37 ± 0.72^{b}	3.77 ± 0.82^{a}	3.97 ± 0.81^{a}
B	4.10 ± 0.76^{a}	4.10 ± 0.66^{a}	3.83 ± 0.83^{a}	3.97 ± 0.72^{a}	4.10 ± 0.76^{a}
C	4.00 ± 0.69^{ab}	4.23 ± 0.68^{a}	3.90 ± 0.71^{a}	4.20 ± 0.76^{a}	4.20 ± 0.76^{a}

* Expressed values were mean±SD; a same rows containing means with the same superscript letters are not significantly different ($p < 0.05$).

- **The determination of the best treatment**

The determination of the best treatment from all treatments and parameters was carried out using the Multiple Attribute Zeleny method (Zeleny, 1998). The parameters evaluated included pH, cooking loss (%), colour, aroma, texture, taste, and overall appearance. The results of the best treatment analysis are presented in Table 4.

Table 4. The results of the best treatment analysis

Treatment	pH	Cooking Loss	Color	Aroma	Texture	Taste	Overall appearance	Value
A	6.2	42.99	3.6	4.07	3.37	3.77	3.97	0.054*
B	6.21	44.16	4.1	4.1	3.83	3.97	4.10	0.019
C	6.2	45.77	4	4.23	3.9	4.2	4.20	0.013

Based on Table 4, the best treatment was treatment A, corresponding to a boiling time of 15 minutes, which produced a pH of 6.20 ± 0.07, cooking loss of $42.99 \pm 1.50\%$, colour score of 3.60, aroma score of 4.07, texture score of 3.37, taste score of 3.77, and overall appearance score of 3.97.

CONCLUSION

Based on the analysis of the physical, chemical, and sensory parameters of *abon entok*, boiling time did not have a significant effect on the physical parameters (pH and cooking loss) or on certain sensory attributes (aroma, taste, and overall acceptability). In contrast, it significantly affected ($p<0.05$) the sensory attributes of colour and texture. Furthermore, the best treatment analysis indicated that boiling for 15 minutes produced the most desirable physical, chemical, and sensory characteristics. These findings suggest that optimizing boiling time using a pressure cooker can enhance the textural and visual qualities of *abon entok* without compromising other quality attributes. The results of this study can be practically applied by small and medium scale meat processors or culinary entrepreneurs to produce higher-quality *abon entok* efficiently.

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