Optimization of Indonesian Goat Satay Gridiron with Velocity Airflow Control at 40 Skewers Capacity

Endy Triyannanto[1], Muslim Mahardika[2], and Yudi Pranoto[3]
[1]Department of Animal Products Technology, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta
[2]Department of Mechanical and Industrial Engineering, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta
[3]Department of Food and Agricultural Product Technology, Faculty of Agricultural Technology, Universitas Gadjah Mada, Yogyakarta
Corresponding email: endy.triyannanto@ugm.ac.id

ABSTRACT

Effects of different airflow velocity at 2 m/s, 4 m/s, and 6 m/s on the quality characteristics of Indonesian goat satay were investigated. The purpose of this study was to prevent the quality deterioration caused by overcooking process on traditional satay machine which depend on it airflow velocity by using a new design of satay machine with 40 skewers capacity. The results of this study indicated that the use of new machine with controllable airflow can minimize textural quality loss caused by high airflow velocity than that of the conventional satay machine. The use of new satay machine with controllable airflow velocity at 2 m/s showed lower tenderness on the goat meat satay than that of the control ($P<0.05$). Airflow velocity at 2 m/s for 10 min resulted in the highest scores of lightness (CIE L*), lowest texture ($P<0.05$) among all treatments and better preference sensory evaluation than those of conventional method ($P<0.05$). Moreover, this study indicated that the higher airflow velocities apply to the Indonesian goat satay could result in harder texture of meat, darker colour, and also lower overall sensory scores in consumer acceptance.

Keywords: Goat satay, Velocity airflow, Tenderness, Colour, Overall sensory evaluation.

INTRODUCTION

With the opening of free trade area for ASEAN countries on 2015, the small and medium Indonesian food industry need to compete with other countries in case of diversity of food products. To compete with the franchise foreign restaurants which nowadays exist in Indonesia they need of improvement on the food quality itself. One of the popular foods which is existed in Indonesia is satay. Satay is popular in Middle East countries and Asia as traditional and medical food to be consumed. Satay is made from goat meat cubes and special seasoning before grill on the gridiron. One of the optimization part which is important is the optimization of capacity of the satay machine and also the quality of the product. On the small and medium restaurant in Indonesia the conventional cooking method was using a fan which resulted in various quality satay products. The outcome was the high browning process which affecting consumer acceptance. The maillard reaction which occurs in the satay as a result of overcooking is potentially harmful as carcinogens substance, non nutritional, and simply undesirable by the consumers Perez-Locas and Yaylayan (2010). To decrease the carcinogens effect which usually include in satay product as overcooked product a new machine need to be built with airflow velocity control to deal with the consumer. Moreover, the tenderness of satay

depends on the gridiron machine which related to the airflow velocity from the source.

This research will investigate score of overcooking colour/ lightness caused by airflow velocity of the satay machine. The research aimed to: (1) Investigate the effect of various airflow velocities on the tenderness and overcooking colour/ lightness of satay product, (2) Investigate the consumer preferences to products resulted in the satay machine with controllable airflow velocity.

MATERIALS AND METHODS

Materials

Conventional method by using fan compared to automatic satay machine with airflow velocity 2 m/s, 4 m/s, and 6 m/s and blower specification 2 inches, and the power 0.038 KW. The machine dimension was 156 cm height, 95 cm length and 97.5 cm width with 40 skewers capacity.

Methods

Examining the instrument of tenderness, lightness (CIE L*) score and also the overall sensory evaluation of each variety of airflow velocity compared with the conventional method.

Tenderness test. The tenderness of satay grilled with conventional machine was measured based on the standard grilling time for 10 min (primary data from the seller) by using device: Tenderness Universal Testing Machine (Zwick, Model DO-FBO.5TS, Germany).

Lightness test. The measurement of satay lightness was done by using colorimeter (CR-400, Konica Minolta Sensing Inc., Japan**).** CIE L* was measured with the method of Triyannanto and Lee (2015), with slight modification and directly performed on the surface of the satay after grilling process**.**

Overall sensory evaluation. The parameters of the overall sensory evaluation including the colour, taste, aroma, texture, firmness, and acceptability were tested by using scoring method by the panelists (Kartika, 1988).

Data analysis. The data were analyzed statistically by using analysis of variance (ANOVA) and the differences between means were tested by Duncan's new multiple range test (Steel and Torrie, 1993).

RESULTS AND DISCUSSION

The tenderness of satay grilled with conventional method and controllable airflow machine.

Table 1. Relationship between airflow velocity with the tenderness of satay

Variable	Velocity airflow	Values (kg/cm^2)
Tenderness	Conventional method	1.65±1.02^{c}
	2 m/s	1.50±0.78^{d}
	4 m/s	1.90±1.00^{b}
	6 m/s	2.26±1.08^{a}

^{abc}Different superscripts at the same row indicated significant differences (P<0.05).

The relationship between the airflow velocity with the satay tenderness, initially the satay tenderness blown with standard fan scored 1.65 kg/cm^2 then that of controllable airflow velocity machine at velocity 2 m/s resulted in tenderness 1.50 kg/cm^2; went up to 4 m/s scored

1.90 kg/cm^2; and at 6 m/s scored 2.26 kg/cm^2. Meaning, the higher the airflow velocity on the controllable airflow velocity machine, lead to be tougher the texture of satay, it was because of the received temperature became higher, according to the values of the machine temperature (Data not were shown). According to Winarno (1992) the temperature and longer drying time resulted in lower water level compared to that of temperature and short drying time which affect the tenderness.

The lightness of satay grilled with conventional method and controllable airflow machine.

Table 2. Relationship between the airflow velocity with the lightness (CIE L*) of satay

Velocity airflow	Lightness (CIE L*)
Conventional method	21.80±0.21^d
2 m/s	35.42±0.25^a
4 m/s	31.13±0.31^b
6 m/s	22.94±0.29^c

^{abc} Different superscripts at the same row indicate significant differences (P<0.05).

Table 2 showed that satay grilled with conventional machine resulted in lightness 21.80; after the airflow velocity was changed into 2 m/s the lightness score went up and showed the highest lightness score at 35.42; while that of 4 m/s went down to 3.13; and went down again at 6 m/s. It means the lightness of satay at 6 m/s was the lowest with controllable airflow velocity machine. The lightness with conventional machine resulted in the lowest score compared to that of 2 m/s, 4 m/s, 6 m/s. It related to the grilling temperature received by satay on the machine that was more increasing at 2 m/s was 112.2 °C, 4 m/s was 150.6 °C, and 6 m/s was 179.4 °C (Primary data). This finding is in agreement with Zaifbio (2009), that the use of heat level and time during the food materials heating will affect the food. Several kinds of food materials such as vegetables, milk, peas, and meats are very sensitive to high temperature as it can damage the colour and taste.

Overall sensory evaluation

Table 3. Overall sensory evaluation of satay

Overall sensory evaluation	Average scores
Conventional method	2.60±0.24^b
2 m/s	3.45±0.11^a
4 m/s	3.30±0.20^a
6 m/s	3.25±0.17^a

^{abc}Different superscripts at the same row indicate significant differences (P<0.05).

Table 3 showed the highest overall sensory evaluation of the satay according to all panelist at airflow velocity 2 m/s was 3.45 and the lowest at conventional machine was 2.60, while 4 m/s was below 2 m/s, 6 m/s below 4 m/s. Overall, the result of satay grilled with controllable airflow velocity machine was more acceptable than that of conventional with the highest preference at 2 m/s airflow velocity, even though insignificant compared to others airflow velocity (P>0.05).

The score of overall sensory evaluation with ANOVA showed that there was no effect between the four variables on firmness; however the overall sensory evaluation score indicated that there was effect between the four airflow velocities on the colour (Data not shown). The score for aroma test was not significant, as well as for the taste test (Data not shown). The overall sensory evaluation score for the whole overall sensory evaluation indicated a significant effect both conventional satay products and controlled airflow velocity (P<0.05).

CONCLUSIONS

There was effect of airflow velocity on tenderness of goat satay grilled with controllable airflow velocity machine compared to the conventional method. The higher airflow velocity, lead to be the tougher the textures score. The lowest overcooking was at 2 m/s, and moreover the overall sensory evaluation showed that there was significant effect between conventional satay and controllable airflow velocities for the whole preferences.

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