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Shelf-Life Test of Kebab Kebuli Al 'Aqoh for Fulfiling Product Quality of Small Medium Enterprise

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Abstract. Al 'Aqoh Drink & Snack, an SME of PKH ITS, participated in a mentoring program in 2021. A series of long-term test storage, microbial contamination tests, and nutritional content tests were conducted for Kebab Kebuli, a product of Al 'Aqoh Drink & Snack, as an implementation of Halal Assurance System (SJH) and Good Manufacturing Practice (GMP). The test results inferred the hygiene of the Kebab Kebuli production process. Freshly made Kebab Kebuli had a total mold value of 2.00 x 101 CFU/g and Escherichia coli of 6.00 x 101 CFU/g. However, other parameters, such as Salmonella sp. and Staphylococcus aureus, were not detected. Although a few mold numbers were detected, ca. 2.00 x 101 CFU/g, an awareness still needs to be applied. Moreover, a non-pathogenic *E. coli* bacterium, ca. 6.00 x 101 CFU/g, was detected. *E. coli* can be minimized with good process and post-production sanitation. Therefore, the cooking and reheating process of Kebab Kebuli at 65°C and subsequent chilling at 4 oC should have been applied. It may have been enough to suppress the growth of *E. coli*. Hence, it is necessary to process the Kebab Kebuli according to the serving suggestions and to ensure food safety, i.e., avoiding diarrhea.

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1. Introduction

A data logger is an electronic device designed to automatically store or record data from various measuring instruments over a specific period. The purpose of constructing a data logger is to achieve accurate data collection continuously without direct human intervention. Characteristics of a data logger include integrated sensors, an automatic data recording device, storage media, power supply systems, and interfaces for configuration. Additionally, data loggers are typically designed to be portable for easy transportation and relocation.

Nutritional aspects of food alone are inadequate as a high-quality food indicator for the next generation. Prior to consumption, food has to meet food safety criteria, such as being free from

contaminants that pose a health risk. Food to be consumed must also meet sanitation and food hygiene requirements.

Over years of technological developments, food industries have intensified food product diversification to satisfy a broad range of consumer needs and capture ever-changing economic opportunities. In 2019, the coronavirus (COVID-19) pandemic raised consumers' awareness of food quality and hygiene. The Indonesian government has regulated food safety since the COVID-19 pandemic to protect consumers and producers with healthy, safe, and halal food via Regulation No. 18 of 2012 and Guidelines for the Production and Distribution of Processed Food during COVID-19 health emergency status (Anonymous, 2017; Anonymous, 2021). Fresh and processed food products are of particular concern in order to prevent COVID-19 surging. Approximately 92.47% of Small-Medium Enterprises (SMEs) are engaged in the food and beverage (F&B) sectors (Inderawati, et al., 2021), and most of these SMEs are still surviving amidst economic pressure occurring since the beginning of the pandemic.

The hygiene of food products is one of the determining factors apart from appearance, taste quality, and competitive prices, which consumers assess in determining their choices. Hygiene is associated with efforts to maintain and increase food health levels. Food hygiene applies to all food producers, including household industrial food or SME-produced food. The Good Food Production Methods (CPPB) are to meet quality standards or safety requirements regulated by the Food and Drug Supervisory Agency of the Republic of Indonesia (BPOM). Regulation No. HK.03.1.23.04.12.2206 of 2012 of BPOM regarding CPPB for Home Industries (Industri Rumah Tangga/IRT). Via CPPB, food industries should produce foods with the necessary qualities for safe consumption; hence, the customers can avoid quality deviations and hazards threatening health.

Food quality is a food security criterion from the perspective of the food safety aspect. Determination of food quality requires a combination of several food attributes, which may be assessed organoleptically. Characteristics of food quality are grouped into two, namely: (1) physical/visible characteristics, including appearance (including color, size, shape, and physical defects); kinetics (consisting of texture, viscosity, and consistency); flavor (consisting of the sensation of a combination of smell and taste), and (2) hidden characteristics which are nutritional value and microbiological safety.

Food quality tests include physical, chemical, physico-chemical, microbiological, microanalytical, and histological tests. Monitoring food products' shelf-life requires a correlation between sensory and quality tests using tools or instruments. Measuring quality using tools reveals hidden characteristics of food. In general, sensory test results highly correlate with physical test results. Physical test covers color, volume, texture, viscosity, consistency, softness and plasticity, and specific gravity test (Pudjirahayu, 2017). Food quality tests are essential for marketed food products. Food quality test results are closely related to food safety. Contamination of food products may occur during production due to either unhygienic production facilities or raw material contamination. Therefore, the application of CPPB to food producers is critical. Food safety affects the health of people consuming the food and determines the economic value of the food itself.

Kebab Kebuli is a ready-to-eat product produced by Al 'Aqoh, a SME. It is a Home Industry Food product (P-IRT). Kebab Kebuli Al 'Aqoh already has a market share for ready-to-eat food products, but this business has not tested its product qualities. Hence, to meet food quality standards, the length of shelf life, the absence of microbial contamination, and the nutritional content of Kebab Kebuli Al 'Aqoh needed to be analyzed. The analysis results, furthermore, were used to redesign the Kebab Kebuli food label to meet the requirements for good food labels according to BPOM requirements.

2. The Methods

Physical characteristics of Kebab Kebuli Al 'Aqoh were tested through a shelf life test (subsection 2.1), while the hidden characteristics of the product were tested through a nutritional content test (subsection

2.2) and a microbial contamination test (subsection 2.3). Both characteristics represent food quality tests for Kebab Kebuli Al 'Aqoh.

2.1. Shelf-life test of kebab

The Kebab Kebuli Al 'Aqoh shelf-life test was carried out by varying the temperature storage: at room temperature (±30 ^{o}C) and refrigerator temperature (±17 ^{o}C). The shelf-life test was conducted for five days for each variable of temperature. Five pieces of freshly made Kebab Kebuli were used for each temperature. Observations were collected every 1x24 hours, the color, aroma, taste, and physical appearance of the Kebab were recorded.

2.2. Nutritional test of kebab

The tested nutritional contents were fat, protein, carbohydrate, water/moisture, ash, and crude fiber. Calculations and calories from fat per 100 g are included for nutritional information. All nutritional parameters were tested at the Food Quality and Safety Testing Laboratory, Department of Agricultural Product Technology, Faculty of Agricultural Technology, Brawijaya University, Malang.

2.3. Microbial contaminant test of kebab

Microbial contamination tests include total plate number, total mold, *Escherichia coli, Salmonella sp., Staphylococcus aureus*, and *Pseudomonas aeruginosa* (Anonymous, 2012a). These test parameters were carried out on freshly made Kebab Kebuli, stored 1x24 hours at room temperature (±30 ^{o}C), and in the refrigerator (±17 ^{o}C). Microbial contamination tests were conducted at the Testing Service Unit (ULP), Faculty of Pharmacy, Airlangga University, Surabaya.

3. Result and Discussion

Regulation No. 33 of 2014 mandates Halal Product Guarantee (*Jaminan Product Halal*/JPH) article 4 states that any products entering, circulating, and trading in Indonesian territory must be Halal certified. Food certificates for products include the following paradigms: (1) FIT for consumption by consumers, (2) SAFE for consumption by consumers, and (3) HALAL for consumption by Muslims. Thus, halal certification of a product also guarantees product quality, which is a primary need of consumers for satisfaction.

Producers applying for Halal Certification must fulfill and implement 11 Halal Guarantee System (*Sistem Jaminan Halal*/SJH) criteria under HAS 23000. The criteria are (1) Halal Policy, (2) Halal Management Team, (3) Training, (4) Materials, (5)) Products, (6) Production Facilities, (7) Written procedures for critical activities, (8) Traceability, (9) Handling of Products that do not meet the criteria, (10) Internal Audit, and (11) Management Review. Quality standards or safety requirements under BPOM regulations, The Good Food Production Methods (CPPB), are included in the 11 HAS 23000 SJH criteria. So, by fulfilling and implementing HAS 23000 properly, producers also have implemented Good Food Production Methods (CPPB).

The Halal Center of Institut Teknologi Sepuluh Nopember (PKH-ITS) assists SMEs in accelerating the realization of Regulation No. 33 of 2014, significantly articles 4. Not later than 17th October 2024, all the F&B products entering, circulating, and trading in Indonesian territory must be Halal certified—this coincides with the Minister of Religion Regulation No. 26 of 2019. The role of PKH-ITS in assisting the SMEs through SJH services covering several activities such as (1) coaching the SMEs and Large Enterprises to obtain distribution permits and halal certificates, (2) providing consultation and testing of product safety and halalness, and (3) Utilization of halal tracking information systems in the supply chain.

The Kebab Kebuli produced by Al 'Aqoh just started production when the COVID-19 pandemic hit Indonesia, particularly in mid-2020. During that period, many layoffs happened, shifting to micro businesses, which aligns with economic pressure and the decline in people's purchasing capacity (Gainau et al., 2021; Inderawati et al., 2021). Economic survival at the individual level is one way to

achieve national economic recovery (Gainau et al., 2021). Therefore, to attract consumers with a broader market share, Al 'Aqoh wishes to apply for halal certification with the assistance of the PKH-ITS team. The Kebab Kebuli Al 'Aqoh packaging is shown in Figure 1.

Figure 1. Kebuli Al 'Aqoh Kebab product packaging.

Kebuli Kebab is a ready-to-eat food. It is not included in the list of processed foods that must be registered with BPOM (Anonymous, 2021b). It is considered that Kebuli Kebab has a shelf life of fewer than seven days. However, Kebab Kebuli Al 'Aqoh must have food labels that fulfill the BPOM requirements. As shown in Figure 1, the Kebab Kebuli Al 'Aqoh packaging label did not have an appropriate label of processed food according to BPOM regulations.

A good label of Processed Food must contain information such as the product names, brand names (if any), serving suggestions (according to the product), manufacturer's names and addresses, distribution permit numbers (BPOM RI/PIRT), expiry dates (suitable for use before), and net weights. Meanwhile, additional information needed to be on the label was compositions, methods of preparation/use (according to the product), nutritional value information (if any), and production codes. Therefore, the characteristic tests will determine the product quality and shelf life. Moreover, the microbiological contamination test (subsection 2.3.) was also essential to conduct. The microbiological test results were used to predict food's shelf-life and as an indicator of food sanitation or food safety (Yenrina, 2015).

Figure 2. Organoleptic observation on Kebab Kebuli Al'Aqoh (top for room temperature and bottom for refrigeration temperature below 20 °C: from left to right, 26th September 2021, 28th September 2021, 30th September 2021, 2nd October 2021, and 4th October 2021.

Table 1 shows the results of organoleptic observations to determine the shelf life of Kebab Kebuli Al 'Aqoh, while shelf life documentation is shown in Figure 2. The organoleptic observations showed that Kebab Kebuli only lasted and remained suitable for 1x24 hours when stored at room temperature (±30 ºC). On the second day of storage, Kebab Kebuli experienced a change in taste (Table 1). On the contrary, when stored in the refrigerator (Table 2), Kebab Kebuli can still be consumed for up to two

days, but the distinctive aroma of the Kebab begins to diminish. On the fourth day of storage, the surface texture of the Kebab began to harden due to reduced water content; this may reduce the enjoyment of eating the Kebab. However, consuming Kebab Kebuli Al 'Aqoh as soon as possible after receiving it is highly recommended.

Table 1. Organoleptic observation on Kebab Kebuli Al'Aqoh at room temperature

Date	Temperature (°C)	Color	Smell	Taste	Surface
26th September 2021	28	Normal	Normal	Normal	Normal
28th September 2021	27	Normal	Slightly Stink	Slightly Sour	Normal
30th September 2021	27.5	Pale	Stinky	Slightly Sour	Normal
2nd October 2021	26	Pale	Very Stinky	Sour	Moldy
4th October 2021	26	Pale	Very Stinky	Sour	Moldy

Table 2. Organoleptic observation on Kebab Kebuli Al'Aqoh at refrigeration temperature

Date	Temperature (°C)	Color	Smell	Taste	Surface
26th September 2021	19	Normal	Normal	Normal	Normal
28th September 2021	18	Normal	Normal	Normal	Normal
30th September 2021	18	Normal	Reduced Kebab Smell	Normal	Normal
2nd October 2021	17	Normal	Reduced Kebab Smell	Normal	Normal
4th October 2021	17	Normal	Reduced Kebab Smell	Normal	Normal

The results of the microbial contamination test (Table 3) also corroborated the organoleptic observations (Table 1 and 2). Microbial contamination is food contamination from microbes that can be detrimental and endanger human health (Anonymous, 2012a). Freshly made Kebab Kebuli had a total number of molds of 2.00 x 10^1 CFU/g and *Escherichia coli* 6.00 x 10^1 CFU/g. Other required microbial parameters (Anonymous, 2012a; SNI-7388-2009, and BPOM Regulation No. 13 of 2019) were not detected for *Salmonella sp*. and *Staphylococcus aureus*.

Table 3. Organoleptic observation on Kebab Kebuli Al'Aqoh at refrigeration temperature

Parameters	Freshly Made	Storage (24 h)		Maximum Allowable Value*
		Room (±17 °C)	Refrigeration (±17 °C)	
Total plate number	ND	>10^7 CFU/g	1.58 x 10^5 CFU/g	10^5 CFU/g
Total mold	20 CFU/g	1.19 x 10^9 CFU/g	1.08 x 10^5 CFU/g	ND
E. coli	60 CFU/g	NN	NN	ND
Salmonella sp.	NN	NN	NN	NN/25 g
S. aureus	NN	NN	NN	100 CFU/g
P. aeruginosa	ND	NN	NN	ND

ND = not determined; NN = none

*In accordance with Anonymous (2012a) for the classification of mixed food products, kebab types, SNI-7838-2009 for the categories of processed meat and processed chicken meat (meatballs, sausages, nugget, and burgers) and BPOM Regulation No. 13 in 2019 for Maximum Limits for Microbial Contamination in Processed Food

The mold number indirectly indicates the application of CPPB during Kebab production. The mold or yeast in a food product can potentially cause food poisoning due to the toxins produced, even though only 2.00 x 10^1 CFU/g mold was detected in freshly made Kebab. Therefore, the hygiene of the process and post-production of Kebuli Kebabs must always be maintained and improved.

Non-pathogenic *E. coli*, 6.00 x 10^1 CFU/g, were detected in freshly made Kebab, which requires caution. *Escherichia coli* can cause diarrhea even at low doses, 10^1 – 10^2 CFU/g, especially for older adults and babies with low body immunity. *E. coli* can be minimized with good production processes and post-production sanitation. Apart from that, *E. coli* can be eliminated by cooking and reheating processed food to a temperature of 65 ºC and storing them at 4 ºC (Anonymous, 2012a). Hence, it is necessary to fry the Kebab Kebuli according to the serving recommendations before serving to ensure food safety and avoid the potential for diarrhea.

(a) (b)

Figure 3. Kebuli Al 'Aqoh Kebab food label (a) before and (b) after label redesign.

The redesigned label of the Kebab Kebuli following the BPOM requirements is shown in Figure 3. The label meets the requested information: product names, trade names, serving suggestions, manufacturer's names and addresses, expiration (in storage instructions), and net weight. Additional information included was compositions, methods of preparation/use (in the form of serving suggestions), nutritional value information, and production dates, filled in manually. The redesigned label shows that Kebab Kebuli Al 'Aqoh has carried out all three method tests as in section 2, ingredients and methods. Hence, it was expected that CPPB would be implemented by Al 'Aqoh, and hygiene was consistently implemented and carried out during the production process.

Conclusion

Acceleration of halal product guarantees as a mandate for implementing Regulation No. 33 of 2014 was carried out through assistance provided by the Center for Halal Studies of ITS to SMEs. Al 'Aqoh Drink & Snack, an SME of PKH ITS, has applied for halal certification through a mentoring program in 2021. Supporting the implementation of the SJH and Good Food Production Methods at Al 'Aqoh Drink & Snack, a series of long-term tests of Kebuli Kebab are carried out. They were shelf-life, microbial contamination, and nutritional content tests. The test results were applied to the newly designed Kebab Kebuli Al 'Aqoh food label, fulfilling the BPOM requirement for good food label design. The Kebuli Al 'Aqoh Kebab label has been redesigned. The new label includes product name, trade name, serving suggestion, manufacturer's name and address, expiration (in the form of storage instructions), and net weight, as well as additional information such as composition, preparation/usage method (in the form of serving suggestions), nutritional value information, and date. Moreover, the contamination test shows that the Kebab Kebuli is a hygienic product.

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