

## Product quality of kaledo, a local food of Palu City Indonesia

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### Abstract

Food safety is an important issue in the incidence of foodborne diseases in society. Kaledo is one of the “must-try” traditional foods of Palu City, Indonesia. The main ingredients used for making this dish are beef and cow’s trotters, which are highly susceptible to microbiological, physical, and chemical contamination. This cross-sectional study aimed to analyze the Good Manufacturing Practice (GMP) and Hazard Analysis Critical Control Point (HACCP) in one of the culinary businesses in Palu City. The GMP assessment was carried out using the self-assessment questionnaire developed by Food Supplements Europe. The results of this study indicated that Kaledo X Food Stall still had not implemented GMP. However, HACCP analysis showed a critical control point (CCP) in the cooking process of Kaledo, i.e., at the time of boiling the meat and bones.

## 1. Introduction

Food safety is one of the critical public health issues related to the incidence of foodborne diseases in the community (Webb and Morancie, 2015). The Foodborne Disease Burden Epidemiology Reference Group (FERG) estimated that 31 cases of foodborne diseases caused more than 600 million illnesses and 420,000 deaths worldwide from 2007 to 2015 (WHO, 2015).

America estimated 9.4 million cases of foodborne diseases annually, which caused 1,351 deaths in the country (Scallan *et al.*, 2011). There were more than 150 million people infected by foodborne diseases and over 175,000 deaths in Southeast Asia (WHO, 2015). Data from the Directorate of Environmental Health and the Public Health Emergency Operation Center (PHEOC) of the Indonesian Ministry of Health in 2017 recorded 163 cases of food poisoning outbreaks and 7132 cases with a 0.1% Case Fatality Rate (CFR) (MoH RI, 2017).

Besides being a source of nutrients for humans, food may also act as a medium for microbial growth and development, the spread and cause of diseases. Meat is one of the media that causes many foodborne diseases around the world. The pathogens that cause this infection are usually zoonotic. The infection can occur starting from the time the animals are being raised, slaughtered

until the meat is consumed (Urahn and Coukell, 2016).

Hazard Analysis Critical Control Point (HACCP) is a food control prevention system that can control contamination dangers if properly implemented. The HACCP analysis part of food hazards involves a systematic study of ingredients, food products, processing conditions, handling, storage, packaging, distribution, and consumers (Pearson and Dutson, 2012). Effective HACCP implementation should also pay attention to several basic requirements, such as applying Good Manufacturing Practice (GMP) to business units. GMP is the minimum sanitation and processing requirements needed to ensure healthy food production (Mendis and Rajapakse, 2009).

Kaledo is one of the traditional foods in Palu City, Indonesia, which consists of beef and bones as the main ingredients. One of the famous food stalls in Palu that serves this dish is Kaledo X. This place has received a permit from the Palu City Health Office and the Tourism Office, and thereby many people use this food stall as a reference for themselves and others.

Based on these descriptions above, the GMP and HACCP investigations were carried out in this study on Kaledo products at Kaledo X Food Stall to ensure the products were safe and healthy for consumption.

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2. Materials and methods

This research was a descriptive observational study that aimed to analyze the application of GMP and HACCP in one of the restaurants that sold Kaledo, traditional food in Palu City, Indonesia. Kaledo X food stall was the sample used in this study. This study observed all production steps based on the GMP and HACCP aspects. The GMP assessment used the self-assessment questionnaire on good manufacturing practices published by Food Supplements Europe and was rated based on the Gutman scale. This research was located at Kaledo X Food Stall, one of the traditional culinary businesses of Palu City that was famous as one of the places tourists visited. The average Kaledo production of Kaledo X Food Stall could reach 300 servings daily.

3. Results

Kaledo X Food Stall was a culinary business specializing in selling traditional food in Palu City with Kaledo as the main menu. Besides Kaledo, the food stall also provided other menus such as free-range chickens, traditional cakes, and several types of drinks. Kaledo X Food Stall currently had three branches.

The product descriptions made in the GMP and HACCP planning focused on Kaledo products, as presented in Table 1. Meanwhile, the flow of the Kaledo cooking process can be seen in Figure 1. The GMP analysis results in Table 2 showed that Kaledo X Food Stall was still lacking in the GMP implementation in its business units, based on the score obtained from the 15 GMP assessment indicators (28%). The score showed

that the implementation of GMP implementation was poor or in the bad category. One of GMP indicators (i.e., the quality of management) showed that Kaledo X Food Stall had implemented GMP sufficiently, with a score of 58%. Six other GMP indicators showed that the implementation of GMP in the food stall was still poor, with a score of 26%-50%. Meanwhile, the remaining eight indicators showed a score of  $\leq 25\%$ .

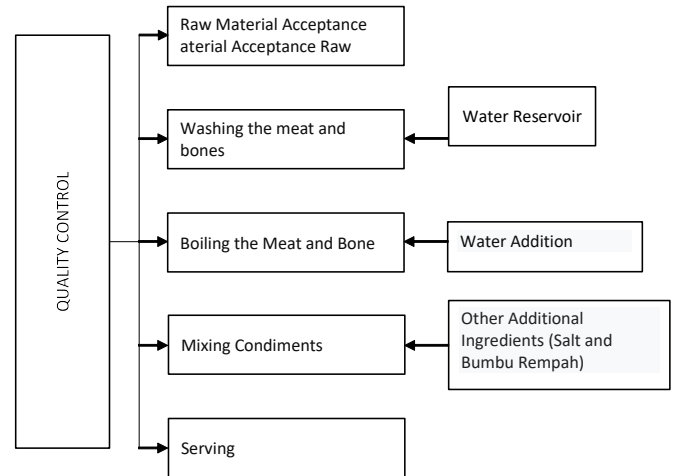


Figure 1. Process Flow of Cooking Kaledo at Kaledo X Food Stall

The Risk Index (RI) in this study was determined using matrix analysis, which was assessed by multiplying the potential hazard opportunities with the severity of the potential hazards that occurred during the preparation of food products. The result can be seen in Table 3 that shows that the RIs obtained from the 10 assessment stages were at the lower risk level ( $4 \geq RI \leq 8$ ), the increased risk ( $8 \geq RI \leq 12$ ), and satisfactory risk ( $RI \leq 4$ ).

Table 1. Product description and its usage

Product Description	
Company Name	Kaledo x Food Stall
Characteristic Summary	<b>Organoleptic Characteristic:</b>
	Texture/Physical: gravy solid
Product Description	Colour: brownish
	Fragrant: Meaty and Spicy
	Taste: Sour and Spicy
Composition	Beef, cattle foot bones, unripe Javanese tamarind, green cayenne pepper, salt, lime
Processing Unit Capacity	300 serving/day
Usage Requirements	The product must be served hot before consumption
Transport/Packaging Condition	The product is served hot in a bowl
Product Usage	This product can only be consumed by children who have teeth to adults who do not have a history of allergies to beef, a history of hypertension, and cholesterol.
Place of Sales	Kaledo X Food Stall
Rule of Law	556/076/VII/DISBUDPAR

Table 2. GMP analysis

Good Manufacturing Practices (GMP) Indicators	Number of Questions	Number of "Yes" Answers	GMP Score
<b>Primary Production</b>			
Production Process	29	6	$6/29 \times 100\% = 0.20 = 20\%$
Recovery and Rework	11	2	$2/11 \times 100\% = 0.18 = 18\%$
Food Product and Development Process	9	3	$3/9 \times 100\% = 0.33 = 33\%$
<b>Design and Facility</b>			
Room and Equipment Place	52	24	$24/52 \times 100\% = 0.46 = 46\%$
<b>Operation Control</b>			
Management Quality	17	10	$10/17 \times 100\% = 0.58 = 58\%$
Hazard Analysis Critical Control Points (HACCP)	6	0	$0/6 \times 100\% = 0 = 0\%$
Laboratory testing	11	0	$0/11 \times 100\% = 0 = 0\%$
Documentation	22	7	$7/22 \times 100\% = 0.31 = 31\%$
<b>Maintenance and Sanitation</b>			
Storage	18	7	$7/18 \times 100\% = 0.38 = 38\%$
<b>Personal Hygiene</b>			
Personal Inspection (self-check up)	4	0	$0/4 \times 100\% = 0 = 0\%$
<b>Transportation</b>			
Transport and Distribution	15	0	$0/15 \times 100\% = 0 = 0\%$
Product Information and Customer Awareness			
Complaint Procedures, Product or Food Withdrawals and Emergency Procedures	15	5	$5/15 \times 100\% = 0.33 = 33\%$
Stability and Storage Age	15	3	$3/15 \times 100\% = 0.2 = 20\%$
<b>Training</b>			
Personnel dan Training	23	7	$7/23 \times 100\% = 0.30 = 30\%$
Subcontract Operations (Cooperation Contract as Partner)	11	0	$0/11 \times 100\% = 0 = 0\%$
<b>GMP Warung × Results</b>	<b>258</b>	<b>74</b>	<b><math>74/258 \times 100\% = 0.28 = 28\%</math></b>

Table 3. Hazard analysis and identification of CCPs

Process	Hazard (Biology (B)/ Physics (P)/ Chemistry (C))	Hazard Sources	Potential Hazard			Preventive measure	Decision Tree				CCP/Not CCP
			Probability	Severity	IR		Q1	Q2	Q3	Q4	
Raw material acceptance	<b>B:</b> <i>E. coli</i> , <i>Salmonella</i> sp., and <i>Staphylococcus</i> sp. <b>P:</b> foreign materials (Gravel, dust, hair)	Humans and raw materials	3	4	Increased Risk	Wash with clean and running water	N				Not CCP
		Humans and tools	1	1	Satisfactory Risk		N				Not CCP
Washing the meat and bones	<b>B:</b> <i>E. coli</i> , <i>Salmonella</i> sp., and <i>Staphylococcus</i> sp. <b>P:</b> foreign materials (Gravel, dust, hair)	Humans, meats, bones, and water	2	4	Lower Risk	Wash more than once with clean and running water	Y	N	Y	Y	Not CCP
		Human and tools	1	1	Satisfactory Risk		Y	N	N		Not CCP
Boiling the meat and bones	<b>B:</b> Residual Pathogens; <i>E. coli</i> , <i>Salmonella</i> sp., and <i>Staphylococcus</i> sp	Humans, meats, bones, water, cooking utensils	2	2	Satisfactory Risk	Cook the meat and bone until boiling and cook evenly, using clean water	Y	Y			CCP
Mixing condiments	<b>B:</b> <i>Staphylococcus</i> sp., <i>Listeria monocytogenes</i> <b>C:</b> Food additives usage that exceeds the recommended levels	Cooking utensils	2	2	Satisfactory Risk	Using clean cooking utensils	Y	N	N		Not CCP
		Food additives	2	4	Satisfactory Risk	Do not use Food Additives excessively	Y	N	N		Not CCP
Serving	<b>P:</b> foreign materials (hair)	Humans	1	1	Satisfactory Risk	Checking back the cleanliness	Y	N	N		Not CCP

Table 4. HACCP plan data sheet

STEP/ CCP Principle 2	Hazards (B/C/P) Principle 1	Parameter of CCP	Critical Limit Principle 3	Target Value	Monitoring Principle 4	Corrective Action Principle 5
Boiling the Meat and Bones	B: Residual Pathogens; <i>E. coli</i> , <i>Salmonella sp.</i> , and <i>Staphylococcus sp.</i>	Temperature and Time	100°C for 1 -2 hrs	100°C for 2 hrs until the meat and bones are cooked evenly	What: Biological Hazards, How: Recording temperature and When: the time of the boiling process Who: Workers on duty	Boil again until the meat and bones cook evenly

Based on Table 4, this study showed that the stage of boiling meat and bones was a CCP. The CCP at that stage was the temperature and duration used to boil the ingredients (i.e., 100°C for 1 -2 hrs).

#### 4. Discussion

This study aimed to determine the GMP and HACCP at one of the well-known Kaledo X Food Stall in Palu City to ensure that the Kaledo sold was safe for consumption. The study results showed that the Kaledo X Food Stall had implemented GMP sufficiently in its business units, with a score of 58% in the management quality analysis. However, there was still poor implementation, such as the absence of ISO accreditation and the absence of quality assurance procedures. A company must plan and implement a system to monitor performance, product, and process quality to ensure the conditions are controlled and maintained properly (FDA, 2011). GMP is implemented to decrease the risk that cannot be controlled by testing the product, prevent contamination and cross-contamination (Ahmed, 2009).

The results also showed that eight GMP indicators indicated that Kaledo X Food Stall was not implementing GMP in its business units, with a score of  $\leq 25\%$ . The food stall received a score of 0% on five indicators, i.e., HACCP indicator, laboratory tests, personal inspection, transportation and distribution, and sub-contract operations. Laboratory tests are indispensable for food business units to prevent contamination (Rudiyanto, 2016; Wulandari, 2016). The restaurant inspection system should be examined to identify the methods to ensure food safety (Jones *et al.*, 2004).

Several GMP indicators had a score below 25%, one of which was the production process because there was no special recipe, no proper implementation of procedure facilities, improper periodic checks, no written procedure for each tool, no special specifications for the raw ingredients, no available certificate of analysis (CoA) on raw ingredients, and the product packaging that used plastic. In the US, more violations significantly occurred

in restaurants experiencing an outbreak. Most of the violations were related to contamination of facilities, the environment, and food handling procedures (Petran *et al.*, 2012)

HACCP was used to ensure to the risk obtained was minimized to the maximum possible level since the risk could bring infection, sickness, and injuries (Teplická *et al.*, 2011). Unfortunately, Kaledo X Food Stall had not implemented HACCP in running its business unit. Several types of biological, physical, and chemical contamination could be found during the production process. Meat contamination had usually occurred since the slaughter of livestock and from workers (Abadi, 2012). However, the HACCP analysis in this study was carried out by the researchers. Hazard identification consisting of biological, physical, and chemical hazards in Kaledo X Food Stall products can be seen in Table 3. Identification started from the initial stage (reception of raw ingredients), the second stage (washing meat and bones), the third stage (boiling meat and bones), the fourth stage (mixing condiment), to the final stage (serving).

At the boiling meat stage, it was possible to kill biological hazards (e.g., *Salmonella sp.*, *E. coli*, and *Staphylococcus sp.*). *Salmonella sp.* that can grow at 6.7°C -45°C was confirmed to die during boiling because the boiling temperature was estimated to be around 74°C to 100°C (Wang, 2010).

The results showed that the physical hazards found were foreign objects (e.g., gravel, dust, and hair) that had existed since the reception of raw ingredients. The food stall should wash the raw ingredients more than once with clean and running water and double-check before serving as a preventive measure. Such physical hazards can be eliminated by washing with clean and running water (Salim *et al.*, 2017).

Besides that, there was a chemical hazard at the condiment mixing stage, i.e., the presence of food additives in the form of monosodium glutamate (MSG). MSG is one of the most used food additives, which was

used to improve food taste. MSG has a toxic effect on the human central nervous system, hepatic and adipose tissue, and reproductive organs (Husarova and Ostatnikova, 2013). Therefore, the addition of MSG in food should pay attention to the recommended safe limit (120 mg/kg/day) (NADFC RI, 2013).

The analysis results showed that one of the five stages was dangerous, namely the reception of raw ingredients. These results were based on the risk index's determination, which showed that these stages fell in the increased risk category. This category was determined based on the level of chance of contamination and the severity of the resulting impact. The chance of contamination at this stage was very high due to a lack of cleanliness, which raised microbiological, physical, and chemical hazards. Meanwhile, in terms of severity, the dangers would cause serious digestive diseases if they were not controlled.

The process of boiling meat and bones was categorized as CCP because it was an effort to reduce and eliminate harm to the product. The identification of the CCP needs to be followed up by ensuring that there are control measures, which are designed and implemented effectively. In this case, the control can be performed by correcting temperature and time during the heating process (Syarifah and Novarieta, 2015; Wicaksani and Adriyani, 2018). Some microbes are not resistant to high temperatures, and they tend to die. This control is necessary for the safety of the Kaledo products produced.

This research provided some information about the quality of well-known traditional food, especially from the food stall that was in great demand by the visitors. This study was still limited to GMP and HACCP observations without any laboratory examination of food safety. However, the general description of the preventive food control system could be implemented at a low-cost level.

#### 4. Conclusion

GMP and HACCP had not been properly implemented in the Kaledo Food Stall. However, in the HACCP study, one process was categorized as CCP (i.e., boiling meat and cow's leg bones). Therefore, the application of GMP should be enhanced in the Kaledo X food stall; thereby, the food produced did not become a medium for disease transmission for consumers.

#### Conflict of interest

The authors declare no conflict of interest.

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