

Canned Kapurung: Traditional Food from North Luwu, East Sulawesi

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ABSTRACT

Kapurung is one of the traditional foods in North Luwu District, South Sulawesi Province, made from sago. After processing, kapurung must be consumed quickly because it does not last long, especially sago balls. Because not everyone can make sago balls or cooking kapurung, the north Luwu people outside the area such as Java, Kalimantan and Sumatra are having getting a kapurung their tastes, so a technology that makes the kapurung durable and ready to eat when needed only the technology is canning. Research has been carried out on kapurung packaging by the canning method. Sterilization used in the process of canning is 121°C for 15 minutes (1 hour after the ON device), then the final product in canned kapurung analyzed in physics, chemical, microbiology, nutritional fact analysis and stability test (expire). The study produced a figure of heat sufficiency (sterility value) of 4.38 minutes. The results of analysis of physics, chemistry, microbiology of canned kapurung are water activities (aw) 0.93, total plate count (TPC), thermophilic aerobic bacteria forming spores and thermophilic anaerobic bacteria are <10 colonies/gram, while *C. perfringens*, *Salmonella*, *staphylococcus aureus* were not detected (negative), proximate analysis produced water content 89.4%, ash 0.90%, protein 2.15%, fat 2.98%, carbohydrate 4.57%, Sodium 152 mg / 100gram and calories for serving amounts of 300 grams is 160 calories. The results of the expiration test using the Accelerated Shelf Life Testing (ASLT) method at 30 °C were obtained for 12.63 months of shelf life. Based on Regulation of the Head of the Food and Drug Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Commercial Sterile Food Requirements, Chapter III Requirements for Sterile Commercial Foods Article 3, paragraph 2 that sterility value (F0) is at least 3.0 minutes calculated against *Clostridium botulinum* spores. Canned kapurung can be declared safe for consumption by consumers.

Keywords: *canned kapurung, traditional food, sterility value (F0), Accelerated Shelf Life Testing (ASLT)*

I. INTRODUCTION

North Luwu District is one of the Level II Regions in South Sulawesi Province with its capital city Masamba which was formed under Law No. 19 of 1999 with an area of 7,502.58 km². The population of North Luwu Regency is 302,687 people (151,993 men and 150,694 women). Most (80.93%) of the population earn a living as farmers.

Kapurung is one of the traditional foods in South Sulawesi based on sago should be preserved. In its presentation, kapurung is usually served with vegetables, so the taste is unique and delicious. The nutritional content of kapurung comes from various types of vegetables such as corn, long beans, eggplants, melinjo (*G. gnemon*) leaves and kecombrang (*E. elatior* flower).

The weakness of kapurung is that it does not last long, especially sago balls (too long in the water to be white), not everyone can make sago balls or cook kapurung so that the Palopo people who are outside areas such as Java,

Kalimantan and Sumatra have difficulty getting kapurung according to taste. One technology that can be used is canning.

Canning is a way of preserving food in tightly closed containers (hermetic) and hot-disposed. This way of preservation is the most common way to do it because it is free from decay, and can maintain nutritional value, taste and attractiveness [1]. Because Hermetic canned foods can be protected against rot, changes in water content, oxidation damage or changes in taste [2].

Several studies on the effect of heat treatment on nutrient reduction as carried out by namely the heating process affect the decrease in vitamins, protein and color of many foods [3]. This decrease in nutrients varies depending on the type and food product [4].

The food canning process consists of the first several stages, namely the preparation of ingredients including washing, cutting and processing before canning. The next

step is the process of blanching vegetables which aims to remove air from the tissues, soften the ingredients and facilitate filling in cans and activate enzymes. Blanching is usually done at a temperature of 90-100 °C [5].

The process of filling the ingredients in the can is done quickly and uniformly. Material that is ready must be filled immediately in the can so that it is not contaminated. Filling in cans is done regularly and uniformly in order to maintain uniformity of the air cavity (Headspace). The function of the headspace is as a spare room for product development during sterilization so as not to press the can. The next process is air venting or exhausting. Exhausting is the process of expelling air in the package so that the pressure in the can is reduced during heating. The next process is the process of closing cans by using a double seaming machine [5].

The next process is sterilization which is the most important process in canning. The purpose of sterilization is to destroy spoilage and pathogenic bacteria and make products more mature. The temperature and time of product sterilization depend on the ingredients of the product. The main seafood product uses 240 °F for 15-30 minutes [6].

The research objective is to determine the optimization of packaging kapurung with cans through the value of sterility, chemical and physical properties, metal contamination and bacterial contamination as well as product stability during storage

II. METHODS

The research materials used Kapurung (sago), chicken meat and vegetables such as corn, long beans, eggplants, melinjo (*G. gnemon*) leaves, kecombrang (*E. elatior* flower) and spices. The research tools used cans size of 300x305 inch, digital balance, seamer, sterilizers (autoclaves), data storage devices (data loggers) and thermocouples.

The first step in the canning process is the preparation of kapurung. Preparation begins with making balls of kapurung, then do the preheating (blanching) of vegetables that have been cut, making broth by boiling chicken meat that has been cut in water until it boils, after boiling all the herbs and spices are put together.

The second step is to put the ingredients in the can. The first ingredient to be put into cans is 5 balls of kapurung, vegetables (3 pieces each), pieces of boneless chicken meat, finally we put the broth up to a can weight of 300 grams (usually a headspace with an average 0.5 cm left).

The third stage is to carry out the process of exhausting or vacuuming the can that has been filled at 90 °C for 20 minutes or the temperature of the material in the can reach 70°C, after that the cans are immediately closed and sterilized at 121 °C for 15 minutes then the cooling process is carried out. After that the product is quarantined for 14 days.

Sterility value analysis is carried out during the sterilization process to determine the adequacy of heat to the product. Other analyzes conducted on the final product include physical, chemical, metal and microbial contamination. Product stability analysis is also carried out to determine expiration. Here are the standards used for parameter analysis.

Table 1. The standards used for parameter analysis.

<i>Parameter</i>	<i>Refence</i>
Net weight	SNI 01-2891-1992 (point 2)
Nitrite (NO ₂)	SNI 01-2894-1992
Metal contamination	
Plumbum (Pb) and Cadmium (Cd)	MU/MO/10 (AAS)
Cuprum (Cu) and Seng (Zn)	AOAC 999.11 (9.1.09.2005)
Lead (Sn)	SNI 01.2896-1996 (point 5)
Mercury (Hg)	MU/MO/12 (Cold Vapor AAS)
Arsen (As)	MU/MO/13 (AAS)
Microbial contamination	
Total plate count (30°C 72 hour)	ISO 4833.2003 (E), ISO 7218.2012
Thermophilic aerobic bacteria forming spores	SNI 01-3775-1995 (point 6.9.1)
<i>Coliform</i>	BAM 2002 chapter 4
<i>Clostridium perfringens</i>	BAM 2001 chapter 16
<i>Salmonella</i>	ISO 6579-2002 (E)
<i>Staphylococcus aureus</i>	BAM 2001 chapter 12
Thermophilic anaerobic bacteria	Plate count agar, incubation 55 °C
Proximate	
Water, ash, protein, fat, texture, pH	SNI 01-2891-1992 (point 1,2; 5.1; 6.1; 7.1; 8.1 and point 16)
Sugar	SNI 01-2892-1992 (point 3.1)
Natrium (Na)	AOAC 985.35 (50.1.14.2005)
Expire date	
Mold and yeast	ISO 21527-2;2012
TVBN	SNI 2354.8:2009 (point 4)
Peroxide number	AOAC 965.33

III. RESULTS AND DISCUSSION

Sterilization is the most important operation in the food canning process. This process aims to destroy the decomposing microbes and pathogens, to make the product sufficiently ripe, texture and taste as desired. Therefore the sterilization process must be carried out at a temperature high enough to destroy microbes, but it should not be too high so as to make the product overripe [7,8]. If the heating is too high, the organoleptic value and nutritional value of food will be damaged so that food cannot be accepted by consumers [4].

The degree of sterility is usually represented as an F value, which is the time in minutes at 121°C that is needed to destroy microbes. This F value depends on the process

temperature and Z value (temperature change) where the microbes are destroyed by 1 log or 10ⁿ [9,10]. Along with the times, the term commercial sterility is known as the destruction which is intended only for pathogenic microbes, forming toxins and decomposition only. Some heat-resistant spores are still alive but cannot multiply and spoil food [10]. Canned kapurung sterilize value displayed at Figure 1.

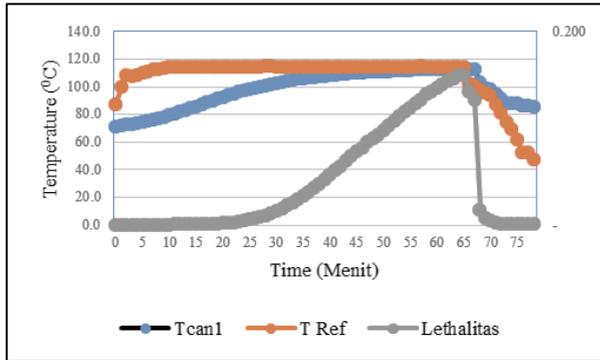


Figure 1. Canned kapurung Sterilize value at 4.38 minutes

Table 2. Result of physic and chemical analysis, metal and microbial contamination of canned kapurung.

Parameter	Unit	Result
Can condition	-	Normal
Water activity	-	0.93
Net weight	%	73.4
Nitrite (NO ₃)	mg/kg	0.00
Metal contamination		
Plumbum (Pb)	mg/kg	<0.034
Cadmium (Cd)	mg/kg	<0.007
Cuprum (Cu)	mg/kg	<0.008
Seng (Zn)	mg/kg	1.57
lead (Sn)	mg/kg	<0.8
Mercury (Hg)	mg/kg	<0.005
Arsen (As)	mg/kg	<0.013
Microbial contamination		
Total plate count 30°C 72 hour	colony/gram	<10
Thermophilic aerobic bacteria forming spores	colony/gram	<10
Coliform	APM/gram	<3
<i>Clostridium perfringens</i>	colony /gram	0
<i>Salmonella</i>	/25gram	Negative
<i>Staphylococcus aureus</i>	colony /gram	0
Thermophilic anaerobic bacteria	colony /gram	<10

Based on the Regulation of the Head of the Drug and Food Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Commercial Sterile Food Requirements, that the Fo value of at least 3.0 minutes is calculated against the *Clostridium botulinum* spores [11]. The product tested under the above process conditions is declared commercially safe or sterile because it has a sterility value of 4.38 minutes

Result of physic, chemical analysis, metal and microbial contamination of canned kapurung displayed at Table 2.

Result of Proximate analysis canned kapurung displayed at Table 3.

Table 3. Result of product proximate

Parameter	Unit	Result
Water	%	89.4
Ash	%	0.90
Protein (Nx6.25)	%	2.15
Fat	%	2.98
Carbohydrate	%	4.57
Energy	calorie/100 gram	54
Sugar total	%	0.00
Natrium (Na)	mg/100 gram	152

Nutritional fact of canned kapurung displayed at Table 4.

Table 4. Nutritional fact of canned kapurung.

NUTRITIONAL FACT			
Serving size	:	300 gram	
Number of servings	:	1	
Total energy	160 calorie	Fat energy	80 calorie
		% AKG	
Total fat	9 g		13 %
Protein	6 g		10 %
Total carbohydrate	14 g		4 %
sugar	0 g		-
Natrium	456 mg		30%

The shelf life of food products is the period of time between food production and food consumed where food products are still in good condition based on the characteristics of appearance, taste, aroma, texture, and nutritional value according to the labeling on the packaging (Institute of food science and technology, 1974). In Indonesia, regulations relating to the shelf life of food are regulated in Law No. 7 of 1996 and PP No. 69 of 1999 concerning food labeling and advertising of each food industry must include the expiration date of a product on its packaging [12].

Factors that cause changes in food products as a basis in determining the critical point of shelf life. The critical point is determined based on the most dominant factor that can cause changes in product quality during distribution, storage until it is ready for consumption. The shelf life of a product can be determined by referring to a critical point. According to [5] determining the shelf life of a product conventionally requires a long time.

Determination of food expiry by the method of Extended Storage Studies (ESS) is done by storing a series of products in normal daily conditions while observing the decline in quality to reach the level of quality expiration. To accelerate the shelf lifetime, the Accelerated Shelf

Half-Life Testing (ASLT) method or the acceleration method are used [12].



Figure 2. canned kapurung from North Luwu, East Sulawesi

ASLT method has the advantage that the testing time is relatively short, but the accuracy and accuracy is high. Determination of product shelf life by the acceleration method can be done with two approaches, namely: 1) critical water content approach with diffusion theory using changes in water content and water activity as an expiration criterion, and 2) a semiempirical approach with the help of the Arrhenius equation, namely with the kinetic theory which generally use the zero or one order for food products [5]. For product canned kapurung can be used approach number 2.

The critical moisture content model simulates product damage that is triggered by-product water absorption. Quality change data during storage are changed in the form of mathematical models, then the shelf life is determined by extrapolating the equation under normal storage conditions.

The principle of the Arrhenius model ASLT method is storing the product at extreme temperatures, so that product damage occurs faster. This method is used on products whose damage is caused by our reaction. Shelf life of the product is determined based on extrapolation to storage temperature. The simpler the model used to estimate the shelf life, the more assumptions used to determine the shelf life. Here are the assumptions used in estimating the shelf life of the Arrhenius model:

- Changes in factors are determined by one type of reaction
- There are no other factors that result in quality changes
- The process of quality change is not a result of processes that occurred before
- Temperature during storage is considered the same.

Identification of the product that has been carried out can be known quality factors that will be used as a kinetic parameter of the quality deterioration reaction, the data of the quality setback factor is plotted and then an exact kinetics parameter model is obtained. Food quality deterioration including zero and first order. Constant rate

(k) at several different temperatures can be made Arrhenius relationship graph where extrapolation with a straight line that states the relationship between $\ln k$ with $1/T$ to predict the reaction speed (k) of the various temperatures used.^[12] Determination of the shelf life of a product by limiting the storage temperature can be done with the kinetic reaction setback reaction Arrhenius quality. The kinetic reaction of Arrhenius's setbacks are of two similarities, namely the zero-order quality setback and the first-order setback.

There are two main types of fat damage, namely rancidity and hydrolysis. Rancidity occurs when components of the mind, taste and volatile odor are formed due to oxidative damage from unsaturated fat. These components cause unwanted odors and tastes & flavors. while oil and fat hydrolysis produce free fatty acid which can also affect the taste, taste and odor of the material. Hydrolysis can be caused by the presence of water in fat or oil or because of enzyme activities [13]

Result stability analysis of canned kapurung displayed at Table 5.

Table 5. result stability analysis of canned kapurung.

Parameter	Unit	Result	
		Early	End
ASLT (Arrhenius)	Month (30°C)	12.63	
Texture	-	Normal	More easily destroyed
Total plate count	colony/gram	<10	<10
Mold	colony/gram	<10	<10
Yeast	colony/gram	<10	<10
pH	-	5.425	5.245
TBVN	mg N/100 gram	0.000	0.000
Peroxide number	mg eq O ₂ /kg	0.000	0.000

TBA rates indicate the presence of malonaldehyde in the sample.^[14] Malonaldehyde is the result of secondary oxidation of fat. hydroperoxide which is the result of primary oxidation which is unstable so that it is easily degraded to malonaldehyde [15]

The shelf life of lime in the packaging needs to be known so that it is necessary to estimate the shelf life of lime in cans in order to fulfill the obligation to include the expiration period on food labels as stipulated in food law No. 7 of 1996 and PP No. 69 of 1999. The method that can be used to estimate product shelf life is the Accelerated Shelf-Life Testing (ASLT) method.

The Arrhenius model is usually used to estimate the shelf life of products that are easily damaged by chemical reactions such as fat oxidation. [12]. According to [13] the Arrhenius Model can describe the relationship between temperature and the speed of deterioration.

Food will experience a decline in quality during the storage process and processing. During the processing that uses heat will cause changes in product quality, nutrition and proximate changes in the product. [3]. Fats will experience a decrease in quality if exposed to heat, there are two main types of rancidity of fat loss, namely hydrolytic and oxidative. Oxidative rancidity is accelerated by the presence of heat, metal ions and light [13]

Damage to canned food can be seen from the physical form of the can and the aroma of the canned food. Spoilage in canned food is marked by the product becoming acidic

IV. CONCLUSION

The results of analysis of physics, chemical, microbiology of canned kapurung are water activities (aw) 0.93, total plate count (TPC), thermophilic aerobic bacteria forming spores and thermophilic anaerobic bacteria are <10 colonies/gram, while *C. perfringens*, *Salmonella*, *staphylococcus aureus* were not detected (negative), proximate analysis produced water content 89.4%, ash 0.90%, protein 2.15%, fat 2.98%, carbohydrate 4.57% , Sodium 152 mg/100gram and calories for serving amounts of 300 grams is 160 calories. The results of the expiration test using the Accelerated Shelf Life Testing (ASLT) method at 30 °C were obtained for 12.63 months of shelf life. Based on Regulation of the Head of the Food and Drug Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Commercial Sterile Food Requirements, Chapter III Requirements for Sterile Commercial Foods Article 3, paragraph 2 that sterility value (F0) is at least 3.0 minutes calculated against *Clostridium botulinum* spores. Canned kapurung can be declared safe for consumption by consumers.

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