



Research Paper

Exploration of Kaledo as Typical Food in Central Sulawesi, Indonesia

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ABSTRACT: *Traditional food as the typical food of the region is one of the cultural elements in Indonesia. One of traditional food in Indonesia is Kaledo. Kaledo is Central Sulawesi's typical clear broth soup which is made from ox leg meat and bone marrow. Reputedly, Kaledo is usually presented by a King in the valley of Palu for guest of honor (nobility). Local residents used to cook Kaledo with the traditional method by using large pan on a firewood. The whole ox leg is cooked directly without any cutting in traditional method. In modern way, cooking Kaledo is processed by using commonly used equipment, such as regular pan and stove. Meat is cut into pieces and served in a smaller portion. Sometimes, the leg meat is also replaced with more easily accessible meat part such as ribs. Both traditional and modern method are using raw tamarind as main seasoning because it provides the right amount of acid and the best flavor. Kaledo is also served with the bone marrow which has so many nutrients and good benefits for our health.*

Keywords -Central Sulawesi, culture, Indonesian food, marrow, Kaledo.

I. INTRODUCTION

Indonesia is the largest country in Southeast Asia, that consisting of various cultures, ethnic groups, and regional specialties [1]. The Indonesian Archipelago has more than 1,128 tribes living in this country that spreads over from Sabang to Merauke [2]. Indonesia is divided by 34 provinces and has more than thousands of islands. The islands are grouped into the Sumatera Island, Java Island, Kalimantan Island, Sulawesi Island, and Papua Island [3]. Each province in Indonesia has unique and diverse culture, one of the most interesting aspect is the traditional food. Traditional food is a reflection of the culture and traditions of Indonesian archipelago to attract the foreign tourists, because of their unique taste [4]. Each Indonesia's traditional food puts on some of herbs and spices in to the recipes. Herbs and spices are parts of country's assets and become superiority of Indonesia. Nevertheless, each region food has its own combinations, intensities and tastes such as spicy, pungent, sweet and sour.

Kaledo is one of Indonesia's regional delicacy that features rich in broth from vegetables and ox leg. Kaledo is one of Central Sulawesi, especially Palu's city typical food. Palu is capital city of Central Sulawesi that has total area about 395,06 km² and consists of 8 subdistricts such as *Palu Barat* (West Palu), *Tatanga*, *Ulujadi*, *Palu Selatan* (South Palu), *Palu Timur* (East Palu), *Mantikulore*, *Palu Utara* (North Palu), *Tawaeli* [5]. Kaledo has become Palu's culinary icon and makes Palu is usually called by Kaledo City. Nearly all restaurants at Palu provide Kaledo in their menu. The word 'Kaledo' itself was derived from the native language Kaili which mean 'not hard' or tender. It formed from the syllable 'Ka' means hard and the word 'Ledo' means not. Based on that, the meaning of the word Kaledo refers to the tender and soft ox leg that served in the dish. However, some people often understand the word 'Kaledo' as an abbreviation of the words 'Kaki Lembu Donggala' (Donggala's ox legs). Kaledo is Sulawesi's typical soup which is made from meat and ox bone marrow and mostly Kaledo is warmly served with boiled cassava. Boiled corn, rice cake, rice, and *ketupat* can also be Kaledo's complementary food [6]. Kaledo's spicy soup become the identity of this traditional food. The color of Kaledo broth is transparent brown which is made from simple ingredients such as chili, salt, lime and raw tamarind.



Fig 1. Kaledo Soup.

Initially, Kaledo used only ox leg bones as the main raw material. On the other hand, the demand for market and seller of Kaledo continue to increase as the time goes by, causing the difficulty in finding the leg bones. One of the solution Kaledo's seller often do is to make use of other parts of the ox. Besides the delicious taste of Kaledo, it has medical values can be value-added for Kaledo as traditional food. Kaledo is believed by local can prevent several diseases such as anemia, diabetes, increasing red blood cells, improving skin health, and preventing heart attacks [7]. The benefits are inseparable come from the main nutritious ingredient of Kaledo which are ox bone marrow. Kaledo is known as typical traditional food at Palu, Central Sulawesi. Kaledo is rarely found at another city in Indonesia because it has a difficult traditional cooking method as using old times stove or fireplace. The modern method is needed to improve Kaledo's cooking technique, in order to increase the market targets of Kaledo as traditional food at Indonesia. This improvement can make Kaledo available in another province around Indonesia.

II. LITERATURE REVIEW

2.1 History of Kaledo

Many people assume that the word Kaledo comes from the abbreviation from 'Kaki Lembu Donggala' or Donggala's ox leg. This information cannot be confirmed, so blaming that understanding will not be a wise action. By judging from the historical point of view, Kaledo is a word from the Kaili native language means 'not hard' or tender. Palu has an area filled with hills and forests, a habitat that strongly support the live of various types of animals. The most famous cuisine at that time was usually made from animal legs (legs of goats or wild boar) with a simple making process and seasoning like tamarind, salt, green chili, and *Tava Nusuka* which is a plant commonly found on the slopes of Palu. The cuisine is referred to as Kaledo by the Kaili tribe. But in the 16th century, after the teachings of Islam entered, the raw material of Kaledo turned into an ox leg bone.

Kaledo is usually presented by a King in the valley of Palu for the guest of honor (nobility) known as *Toma Oge* or *Toma Langgai* or *Langga Nunu*. One of the respected Kings who lived in his day was King Tombolotutu from the Moutong Kingdom (1877-1904). In the 18th century, the kingdom of Moutong is one of the big kingdoms that exist in the region of Central Sulawesi, precisely in Moutong Province. Kaledo is believed to be served in this kingdom as it was borders with the Donggala Province. In this royal period, Kaledo was presented in a container called *Dula Mpanganggu*. There are three types of banquets, namely for the kings, banquets is done inside the house (Rara Banua), for the royal courtiers are held on the terrace of the house (Ri Tambale), and for the ordinary people done in the yard (Ri Poumbu). There were some rules when doing a banquet. First *Toma Oge* should start the banquet, when *Toma Oge* has not finished eating, participants were not allowed to stop eating or they might stop eating but should not wash their hands. For any participants who break the rules there will be subject to sanctions at the price of farm animals or fines in accordance with the economic circumstances of participants [8]. The uniqueness of Kaledo is not only in flavorful taste but also in the way of serving. Kaledo is served using many eating tools like table knife, fork, chopstick, and pipette to take out the meat and marrow inside the bone marrow. As a typical food, the serving food at lunch or dinner is different than other food. Usually, Kaledo is served with *Kasubi* or boiled cassava which already known as staple food by locals in Palu, Central Sulawesi because of the perfect combination of flavor that can be achieved while consuming it with other heartwarming dishes such as Kaledo [9]. Kaledo can also enjoyed with a type of banana called *Loka Pagata* or known as pisang kepek in Javanese.

2.2 Kaledo Recipe

Kaledo is a simple dish that could be made at home. There are many recipes out there which show different steps of cooking Kaledo. These recipes tend to have slight differences from the original recipe by adding some other ingredients. Based on Hartati and Hasaballah [10], the materials and tools used in making the original Kaledo are as follows:

Table 1. Tools and Materials Used In Kaledo Making Process

Tools	Materials
Pan	500g ox leg
Knife	750g meat
Stove	5 segments of raw tamarind
Cutting Board	15 pieces of green cayenne pepper
	2L water
	2tbs salt

In general, the steps of making Kaledo are practically simple and easy. The only thing to be concerned is it takes a long time, reaching up to 60-120 minutes. The important first step in making Kaledo is to boil the meat and bone to produce nice flavorful broth. This boiling process is also intended to produce perfectly cooked meat with soft and tender texture. From this step, the meat will produce and release fat that will be taken away by replacing the cooking water with the new one. The cooking is then continue by adding the seasoning ingredients, including raw tamarind, green cayenne pepper, and salt. To complete the dish, Kaledo is served with fried shallots.

III. METHODOLOGY

The research was held from October until November 2017 in several cities at Indonesia. This study conducted by observing and interviewing some practitioners and academics who are working in this fields. Observation were carried out in Central Sulawesi speciality restaurant that serves Kaledo. Literature review were also used to support some theories. Interview notes, video-recorded and audio-recorded were taken during interviews and observation activities.

IV. FINDINGS FIGURES AND TABLES

4.1 Methods of Cooking Kaledo

Kaledo is a traditional food that has been known for a long time in Indonesia. In that particular time, the cooking techniques used are different from now by utilized simple equipment and traditional ingredients. However, in the present, those techniques are considered old school and require several changes. Therefore, there are two different ways to make Kaledo.

4.1.1 Traditional Method

Kaledo is an ox leg and bone soup dish. The cooks in the past have a slightly different way of treating the legs of the ox while compared to the current cooks. In the past, the natives specifically only used a local cattle called Lembu Donggala or known as a type of cattle that comes from their area. They cooked the whole ox leg directly without any cutting. Very large portion was served, consisting of a large leg bone with all the meat attached around it. The leg bones are separated and cleaned from the skin and then both meat and bone part is washed with water to remove impurities. To cook the Kaledo, first, pour water into a pan and let it cook until boiling. Then put the meat and bone of the ox leg into the pan. The leg bones that have been cleansed from the skin is only cooked if the water in the pan has boiled so that the leg bone does not smell fishy. Let it be cooked for a few moments based on the cook's instinct, then stop the cooking and drain. After the first batch of cooking, the meat and bone is cook again in another boiling water. This process needs to be done several times to reduce the fat that comes out in the broth.

To cook the spices, finely ground green cayenne pepper and salt is added to the pot after the water has boiled as well. In this recipe, tamarind or Asam Jawa is used and preferably using the raw ones to provide the right amount of sour flavor [11]. To get the tamarind extract, raw tamarinds are cooked first until soft and then peeled. Peeled tamarinds are squeezed and filtered. This extraction process is an important step because cooked tamarinds have similar appearance to the meat, yet have a bad taste if bitten. Therefore, it is better not to use them directly intact because it will be difficult to distinguish it from the meat. Beside those spices, the past cooks were believed to be using a special leaf called *Tava Nusuka* as a seasoning. Unfortunately, current researches have not been able to decipher and interpret this type of plant. There is no further explanation about this leaf. Other than the ingredients, the major difference between this ways of cooking than the modern style is the cooking utensil. In earlier times, Kaledo is cooked with simple cooking tools. All the ingredients are cooked

in a large pot and heated on firewood. Moreover, using firewood in cooking Kaledo would affect the flavor of the food. After that, the Kaledo is ready to be served with steamed cassava, corn, or rice cake.

4.1.2 Modern Method

Compared to the traditional one, the way of cooking Kaledo at this recent days has undergone several changes. These days, Kaledo is cooked with more modern technology which is also more suitable in this current circumstances. The ox meat and bone are firstly boiled several times while replacing the water until the water looks clean and clear from the fat. This time, the cooking process can be done with any regular pan that heated on a modern stove. The half cooked meat is then drained and cut into pieces. The cut meat is cooked again until tender. This process will cause the fat to come out and float to the surface of the water, then the broth is filtered from the fat to obtain clear soup. With this method, the portion served is much smaller than the old way. In addition, because of its availability, the meat and bones from the ox legs are often replaced with the meat and bone from other part, such as ribs.



Fig 2. Modern Method of Cooking Kaledo Using Regular Pan and Stove.

After obtaining good quality and clear soup, the meat and bone are cooked again in the pan. Salt, tamarind, and ground cayenne pepper are added to be cooked together with the meats and bones. Cook them together until all the seasonings are combined evenly and the ox is cooked perfectly. The spices and seasonings will give unique and delicious flavor to the dish. The last step is serving the Kaledo with fried shallots, ground chillies or sambal, and lime juice as condiments [6].



Fig 3. Ground Chillies ‘Sambal’ and Lime as Condiments to Enjoy Kaledo

4.2 Specialty of Kaledo

Kaledo is a type of clear broth soup which is very rich in flavor. It uses ox leg bone and the meat as the main ingredients. The spices used in this food are very few and simple, including green cayenne pepper, raw tamarind, and salt. Mixture of these spices blends with the broth producing a delicious, aromatic, tasty, and

refreshing dish. It has a slightly smoky flavor with combination of salty, spicy, and sour taste. The use of raw tamarind is an important step and using other types of acid is not recommended as it will give different flavor.

4.2.1 Smoky Flavor on Kaledo Soup

Unlike the modern method, traditional method of cooking Kaledo utilized firewood to become the source of heat. Using firewood would release smoky flavor from the ingredients to the dish. Wood smoke was typified by wood moisture content and temperature of smoke. Most of chemical compound that were contained in wood smoke are carbonyls and phenols [12]. When food was exposed to volatiles compounds from wood, these compounds might chemically react with other food components and form new flavor compounds [13].

Dried hardwood has moisture around 5% and the remaining 95% constitute the following components: 40% cellulose, 40% hemicellulose, 19% lignin, 1% minerals [14]. Carbonyls compound were generated from cellulose, that result the color of components and sweet or fruity aromas. Wood also contain lignin component that might produce phenolic compound when burnt [15]. Phenols are a defined as a class of chemicals with a hydroxyl group bonded to a benzene ring (phenyl group). There are some Phenolic flavor compounds can be phenol, eugenol, guaiacol, dimethyl phenol, syringol vanillin, and o-Cresol. Guaiacol is the phenolic compound most responsible for the "smoky" taste, while syringol is the primary contributor to smoky aroma [14].

4.2.2 Role of Raw Tamarind

Tamarind or *Tamarindus Indica L.* is one of important seasoning in Kaledo. According to Van Den Bilcke et al. [16], tamarind is used to give sour taste because it has strong sour taste, but depends on where the tamarind grows. Generally, the composition of tamarind contains 8-14% tartaric acid, 30-40% sugar, and small amount of citrate acid [17]. Tartaric acid as shown in Figure 5 has been approved as acidic compound, pH control, flavor enhancer, and especially as preservative [18]. Tartaric acid contained in the tamarind is also believed to provide health effects for the body, one of which is to make quicker bowel movement and cure sore throat [19]. The tartaric acid preservative agent may be obtained due to the influence of antimicrobial activity arising from its strong acid properties. The pH produced from tartaric acid reaches a relatively low pH 4 so that microorganism activity can be suppressed.

It is important to use the raw tamarind instead of mature tamarind or other acidic compound such as vinegar, to maintain the specialty taste of Kaledo. Raw tamarind is preferred being used in Kaledo due to the sugar content. The more mature tamarind will have higher sugar content inside. The maturation of tamarind does not affect the levels of tartaric acid content contained in the fruit, it instead increases the level of sugar contained in the tamarind fruit. Using the mature tamarind in Kaledo will provides higher sugar content and makes the broth taste sweeter than sour [16].

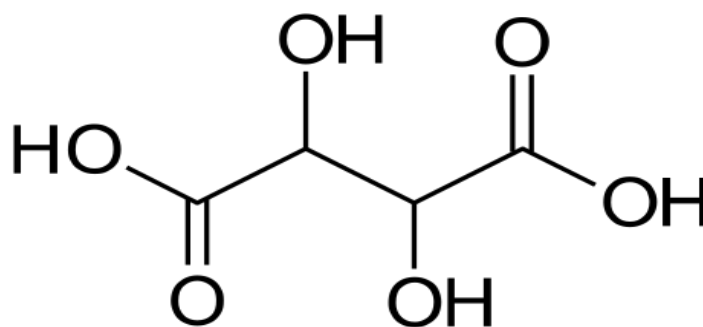


Fig 4. Chemical Structure of Tartaric Acid

Source: National Center for Biotechnology Information, 2017

In addition, another uniqueness from Kaledo is the use of ox leg bone which still contains the marrow as the main ingredient. The marrow is located deep inside the bone and most of the time regular spoon cannot fit in to reach it. There is a certain fun way that became a habit to enjoy the marrow served in Kaledo. First, pour some of the soup into the hole in the bone then use a straw to suck back the broth together with the marrow. Therefore, Kaledo usually served within spoon, fork, chopstick, and straw as the equipment to consume it.



Fig 5. How Local People Enjoy the Bone Marrow. (a) First pour some of the soup into the hole, (b) Use a straw to suck back the broth together with the marrow.

Therefore, there are still very few people who familiar and recognize marrow as proper food. Whereas, the marrow has an umami flavor and taste like butter and beef. Besides, consuming marrow will also give us health benefits because it contains so many good things, such as collagen, protein, and vitamin.

4.2.3 Nutritional Content of Bone Marrow

Table 2. Nutritional Content of Bone Marrow per 100 gram

Nutrient	unit	value	%Daily Value
Proximate			
Calories	gram	786	
Total Lipid (fat)	gram	84	129%
Total Carbohydrates	gram	0	0%
Protein	gram	7	14%
Water	gram	7.40	
Vitamins			4%
Thiamin	mg	0.04	
Niacin	mg	0.200	
Vitamin A	IU	240	
Minerals			
Iron	mg	4.50	25%
Phosphorus	mg	107	

Source: USDA, 2016

Based on the nutrition facts by the USDA (table 1), bone marrow is very rich in calories, fat, protein, and mineral. Highest nutrients in bone marrow happen to be calories and fat. In a serving of bone marrow, there are 6.79 grams of unsaturated fat and it contains zero grams of trans or saturated fats. Besides that, bone marrow consists high content of protein which provides 14% of protein daily value requirements by 100 grams consumption [20]. Bone marrow consists a little bit of iron as well. This iron content may be obtained because bone marrow is believed to be the site of the formation of red blood cells, so the bone marrow is suspected to contain iron component that is ready for use for the formation of red blood cells [21].

4.2.4 Benefits of Bone Marrow

Bone marrow contains 96% of fat, but also have many beneficial qualities, leading to potential health benefits [22]. The first benefit of bone marrow can freeze the blood and heal the wounds on the body. One of the ingredients of the bone marrow is the collagen that is included in the protein. Collagen has a usefulness as a protein that contains the human body and can heal the body from injury. Jade Institute claims that collagen plays a role in improving injuries, bruises, and bleeding gums. The second benefit is the bone marrow is a good source of essential fatty acids for the body. Bone marrow has a high fat content, but the amount of polyunsaturated fat is not much. The content of omega-3 fatty acids is very important because it helps the functioning of the brain. In addition to omega-3, glycine contained in bone marrow can be useful as a form and improve protein in the body [23]. Third, one of the Swedish oncologists, Dr. Astrid Brohult, conducted a study of bovine marrow to be given to children with leukemia. The purpose of this study was to increase the number of white blood cells that have been lost in patients with leukemia due to radiation therapy. The results of the study were several children showed good results, with the energy and normalization of their white blood cells increased. After investigation, the components that play a role in improving the normalization of white blood cells are alkylglycerols (AKGs) [22].

V. CONCLUSION

Kaledo is one of a typical food in Indonesia from Central Sulawesi. Kaledo is a type of clear broth soup which is very rich in flavor. It uses ox leg bone and meat as the main ingredients. Reputedly, Kaledo is usually served by the king in the valley of Palu for the guest of honor (nobility). Local resident used cook Kaledo with traditional method by using firewood. Using firewood would lead smoky flavor out to the food. In modern way, cooking Kaledo is done by using commonly used equipment such as a stove. Kaledo has many benefits are inseparable come from the main nutritious ingredients which are ox bone marrow. Bone marrow can prevent several diseases such as anemia, diabetes, increasing red blood cells, improving skin health and preventing heart attacks.

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