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PHYSICOCHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF BEEF MEATBALLS IN PALU CITY

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ABSTRACT

The aim of the study is to evaluate the physicochemical and microbiological characteristics of beef meatball produced and circulated in Palu City. The study used a completely randomized design with 8 micro, small and medium enterprises (MSMEs) where sampling was repeated three times to obtain 24 research samples. Parameters of analysis included water, ash, protein, fat, borax, formalin and total microbial content. The results show that beef meatball circulating in Palu City had water content (66.56 - 72.99%), ash content (1.28 - 1.99%), protein content (8.93– 10.76%).), fat content (1.16 - 5.84%) and total microbes (1.92–7.97 log cfu / g) and borax content and beef meatball formalin showed negative values.

Keywords: Beef, Meatball, Microbiological characteristics, Physicochemical.

INTRODUCTION

Meat is very susceptible to microbial contamination of meat either in the form of carcass or cut carcass, chopped meat or ground meat (Fakolade and Omojola, 2008), so that meat preservation methods are essential depending on the inhibition of microbial growth in order to create an unfavorable environment in meat (Lawrie, 2006). Microbial contamination in meat may occur continuously from cutting to consumption, so that to improve the quality of meat products, it is necessary to do processing and preservation which proposes to prevent or inhibit the occurrence of damage and extend the shelf life of these foods (Lawrie, 2006; Chukwu and Imodiboh, 2009). In storing and preserving meat, there are three things that need to be considered, namely temperature control, water control, and direct microbial control (Lawrie, 2006). While the preservation method is one alternative to develop the desired type of processed meat products (Gadekar et al., (2010). According to Abostate et al. (2006), temperature is one of the most important environmental factors that affect life and microbial growth.

The process that occurs during processing/cooking meat can possibly result in an increase in temperature which causes the myofibril protein and connective tissue to denaturate (Hui, 1992), inhibits microbial growth (Lawrie, 2006), where microbes have a certain temperature level desired for growth (Vulkov, 2006). Therefore meat and meat products can be preserved by including them in the refrigerator (refrigeration) or by heating (Lawrie, 2006). Processing meat by boiling, frying, roasting, skewing or processing it into other attractive products, the physical, chemical and microbiological qualities of the product are influenced by the temperature and length of the cooking process (Promeyrat et al., 2010). The principle of microbial control in meat is to prevent microbial growth, so that it can extend the maintenance time of product quality (Lawrie, 2006).

Society in consuming a food product keeps changing and tends to prefer food

with simple processing that is ready for food and guaranteed food safety. However, often quality and food security are not the focus of attention by producers and consumers. One type of processed livestock products that is well known and popular with the community is beef meatballs. Meatballs are processed beef foods made by means of ground beef, mixed with spices and additional ingredients tapioca flour to form a dough, shaped like small balls and boiled in boiling water until cooked with the characteristics of floating meatballs (Agustina et al., 2013).

Meatballs are one of the processed meat products that are very well known and favored by all levels of society both in Indonesia and in several other Asian countries (Widati et al., 2014). Meatballs are preferred because the price is relatively cheap, tasty and rich in nutritional value (Putri, 2009). Meat content in the manufacture of meatballs not less than 50% which is generally spherical and mixed with starch or cereal with or without the addition of other food ingredients and food additives is permitted (Hintono et al., 2012). Good quality meatballs can be made without the addition of any chemicals, but in fact many meatball makers add chemicals (Tarwiyal, 2001). It was also reported that some meatballs often use additional ingredients on their products, such as bleach, preservatives, borax, sodium tripolyphosphate and alum (Wibowo, 2006). Raw materials for making meatballs can come from various types of livestock meat, among others, cows, pigs, chickens, and fish (Purnomo, 1998). The raw material must be fresh without being stored first (Putri, 2009; Wiji, 2011).

Purnomo (2010) states that the problem in the food sanitation sector is the high level of food bacterial contamination presented by various food providers, including street vendors, restaurants, food services and the food industry. According to Pardede (2012), security guarantees in the food processing sector depend on the application of Good Manufacturing Practices (GMP) or guidelines for how to produce processed food that is good, which is part of the preconditions of Hazard Analysis and Critical Control Points (HACCP). In the city of Palu, Central Sulawesi, the business of meatballs was quite developed and the fondness for these meatballs caused the community to pay less attention to the quality of meatballs. Therefore, a study of the physicochemical and microbiological characteristics of meatballs in circulation in Palu City is needed. The research objectives were (1) evaluating the physicochemical properties and total microbial beef meatballs circulating in Palu City and (2) obtaining meatballs produced by micro, small and medium enterprises (MSMEs) that match the quality requirements according to SNI 01-3818-2014.

RESEARCH METHODS

This research was conducted in October - December 2017 in the City of Palu, Central Sulawesi and at the Central Laboratory of Biological Sciences Universitas Brawijaya, Malang, East Java. The main ingredients of the study were meatballs obtained from MSMEs as meatball business actors circulating in Palu city and supporting materials in the form of chemicals for the analysis of observed parameters. Research and analysis tools include sample boxes, blue ice, stereofoam, erlenmeyer, analytical scales, K-Jedhal flasks, measuring flasks, test tubes, stations, soxhlet distillation, glass cups, measuring cups, waterbaths, extraction flasks, desiccators, weigh bottles , micropipette, autoclave, furnace, oven, vortex, plastic, jump bottle and porcelain.

The implementation of preliminary research is a survey of meatball business in Palu City based on the method of Iqbal (2008), namely research conducted on a number of individuals / MSMEs units with the aim of obtaining facts from the symptoms that exist in fact in the field. The research sample was meatballs circulating in the area of Palu City. Determination of

the sample is done by Purposive random sampling (Nasir, 2005). Sampling was carried out on eight MSMEs actors scattered in Palu City and each MSMEs was taken three times as a replication with successive code samples for MSMEs 1, 2, 3, 4, 5, 6, 7 and 8. Beef meatballs are taken based on criteria such as (1) strategic location and easy reach by consumers, (2) location of selling meatballs at depots/ shop/shop and settling (not merchant carts/ street vendors), (3) cleanliness of depots/ shop/shop is maintained which includes floors, tables, tableware, and bowls and (4) the location of selling meatballs is already well known among the people of Palu City. Observation data uses a variety of analysis methods Complete Random Design (CRD). If the treatment gives effect, Duncan's Multiple Distance Test (Steel and Torrie, 1981) is carried out. Parameters observed were water content (AOAC, 2000), ash content (AOAC, 2000), protein content (AOAC, 2000), fat content (AOAC, 2000), formalin and borax levels (AOAC, 2000) and microbiological tests (Pettipher, 1999).

RESULTS AND DISCUSSION

Water content and beef meatball ash. Beef meatball water content is influenced by the production of MSMEs which are spread in Palu City. The average value of beef meatball water levels can be seen in Figure 1. Water content in 8 meatball samples from MSMEs showed significant differences ($p \leq 0.05$). The highest water content was obtained in MSME 2 of 72.99%, and the lowest was obtained in MSME 5 of 66.56%. Winarno (2002) states that the moisture content of meatballs is strongly influenced by chemical compounds, temperature, consistency, and the interaction of various food constituent components such as protein, fat, vitamins, free fatty acids, and other added components. The difference in meatball water content is thought to be due to differences in tapioca flour. Widhaswari et al. (2014) stated that in tapioca flour there is a polar group which is hydrophilic as a binder in making meatballs that can float in water. Usmiati and Priyanti, (2017) state that the higher tapioca flour is added in making meatballs, the lower the water content of the meatballs produced, and based on SNI 01-3818-2014, the water content of meatballs must be a maximum of 70% b / b. Based on the results of research on beef meatballs processed by MSMEs 1, 5, 6, 7 and 8 have met the quality requirements from the aspect of water content.

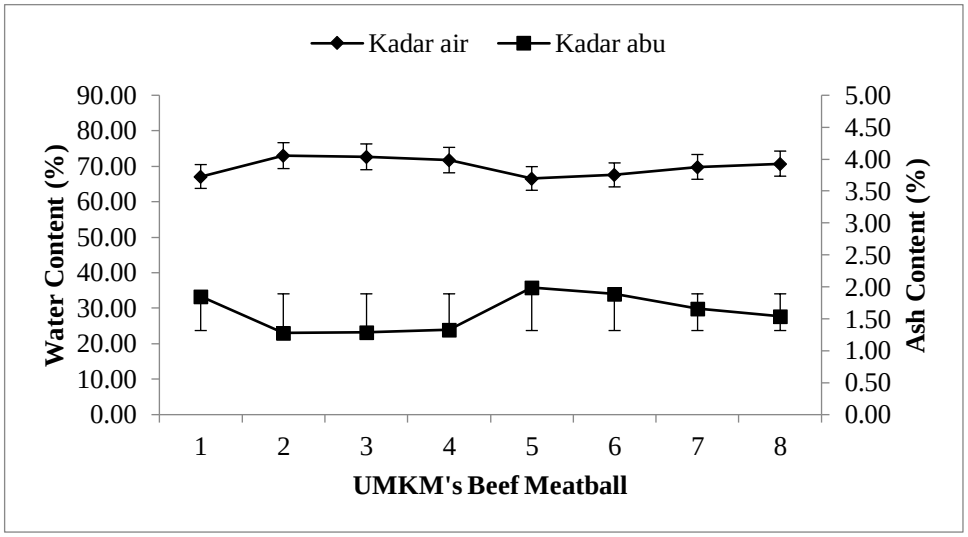

Figure 1. Water Content and Beef Meatball Ash From Various Types of MSMEs in Palu City

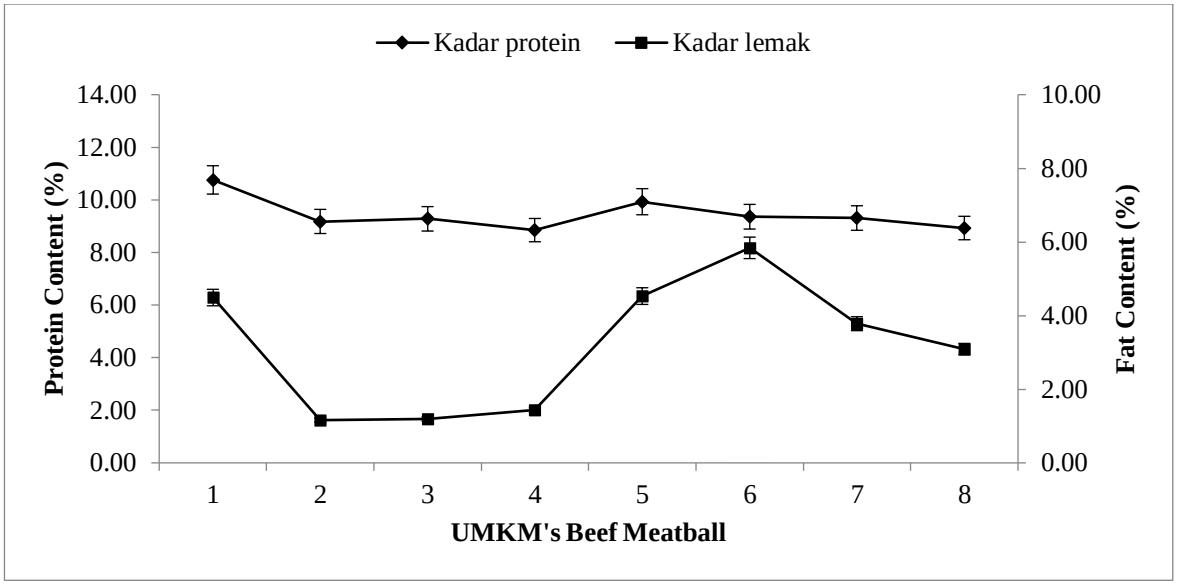

Figure 2. Protein Levels and Beef Meatball Fat From Various Types of MSMEs in Palu City.

Beef meatball ash content is influenced by the production of MSMEs that are spread in Palu City. The average value of beef meatball ash content can be seen in Figure 1. Beef meatball ash levels showed significant differences ($p \leq 0.05$) in 8 MSMEs of beef meatball samples circulating in Palu City. The highest average ash content was obtained in MSME 5, which was 1.99%, and the lowest was obtained in MSME 2, which was 1.28%. The results of the analysis of meatball ash content are below the SNI standard. Based on SNI 01-3818-2014 that meatball ash content is a maximum of 3% b / b. Fatriani (2003) reported that the addition of tapioca flour up to 50% did not affect the ash content of beef meatballs, this is because tapioca flour contains very low ash content. According to Usmiati and Priyanti (2017) that meatball ash levels with different levels of tapioca flour ranged from 3.72 to 4.26%. Based on SNI 01-3818-2014, it can be stated that beef meatballs produced by 8 MSMEs have met the quality requirements of the ash content aspect.

Protein levels and beef fat meatballs. The level of beef meatball protein was significantly influenced by the production of MSMEs which were spread in Palu City. The average value of beef meatball protein levels is shown in Figure 2. Protein levels showed significant differences ($p \leq 0.05$) in 8 beef meatball MSMEs. The highest protein content was obtained in meatballs originating from MSME 1 which was 10.76% and the lowest was obtained in 8 MSMEs of 8.93%. Increased and decreased levels of meatball protein allegedly due to excessive use of tapioca flour. Hasnudi (2005) reported that the levels of meatball protein decreased with the addition of tapioca flour. Fatriani (2003) states that the higher the amount of tapioca flour addition results in lower levels of meatball protein or lower proportion of meat. Based on SNI 01-3818-2014 beef meatball protein levels are at least 11% (b/ b), therefore beef meatballs produced by MSME 1 meet protein content quality requirements.

The fat content of beef meatballs is significantly affected by the production of MSMEs that are spread in Palu City. The average value of beef meatball fat levels as shown in Figure 2. Fat content showed a significant difference ($p \leq 0.05$) in 8 beef meatball MSMEs. The highest fat content was obtained in MSME 6 of 5.84%, and the lowest was obtained in MSME 2 of 1.16%. Usmiati and Priyanti (2017) state that the fat content of meatballs is always related to

water content. If high water content will be followed by low fat content. Untoro et al. (2012) state that the addition of tapioca flour 30% to 50% does not affect the fat content of meatballs, this is probably because the fat content of tapioca flour is very low so it does not affect the level of meatball fat produced. Based on SNI 01-3818-2014 beef meatball fat content is a maximum of 10% (b / b), therefore beef meatballs produced by 8 MSMEs meet the fat content quality requirements.

Borax levels and beef meatball formalin. Borax and formalin levels in 8 MSMEs beef meatball samples circulating in Palu City as presented in Table 1. The results showed that the content of borax and formalin in 8 MSMEs beef meatball samples circulating in meatball depots in Palu City area was negative results which means that the meatballs are free from borax and formalin. Nevertheless efforts to guide and escort towards a business that is safe, healthy, intact, and halal remains a priority of the technical advisory agency for business actors at the field level.

Borax in the human body with high borax levels can cause dizziness, vomiting, and diarrhea (Cahyadi, 2006). According to International Standards that borax doses that have fatal effects on health are in the range of 3-6 g / day for infants and young children and for adults with fatal effects of 15-20 g/day. Based on the quality requirements of meatballs according to SNI 0I-3818-2014, the borax content in outstanding meatball products is not allowed. Angga (2007) reports that meatballs are processed meat products that are popular with people who have high nutrition, pH 6.0-6.5 and high water (aw) activity (> 0.9) so that the maximum shelf life is only 1 day (12-24 hours) and to make a longer shelf life of meatballs dangerous ingredients such as formalin are often added. It was reported that formalin buried above the threshold could impair health. A safe threshold is 1 millimeter per liter. Formalin when swallowed, the mouth, throat and stomach are burning, pain when swallowing, nausea, vomiting and diarrhea, bleeding, severe abdominal pain, headache, hypotension, convulsions, unconsciousness until coma.

Formalin consumption at very high doses can result in convulsions (seizures), haematuri (blood urine) and hematoma (vomiting of blood) that end in death (Cahanar and Suhanda, 2006). The use of formalin for food is prohibited because it is not in accordance with Food Law Number 7 of 1996 and Government Regulation Number 28 of 2004 concerning food safety, quality and nutrition. While the commercial procedures are regulated by the decision of the Minister of Industry and Trade No. 254/MMP/Kep/7/2000. Referring to the description, it can be stated that the 8 beef meatball MSMEs in Palu City have known the dangers of using borax and formalin in food products.

Total beef meatball microbial. The total beef meatball microbial was significantly affected by the production of MSMEs that were spread in Palu City. The average total value of beef meatball microbes as shown in Figure 3. Total microbes showed no significant difference ($p>0.05$) in 8 MSMEs samples of beef meatballs circulating in Palu City. The highest average number of microbes was obtained in MSME 4, which was 7.97 log cfu/g, and the lowest was obtained in 8 MSMEs of 1.92 log cfu/g. Fauziah (2017) reports that all food products have a maximum limit of Total Plate Count (TPC) regulation according to SNI.

Table 1. Borax Levels and Beef Meatball Formalin.

Sample Code	Content (%)	
	Borax	Formalin
MSME 1	-	-
MSME 2	-	-
MSME 3	-	-
MSME 4	-	-
MSME 5	-	-
MSME 6	-	-
MSME 7	-	-
MSME 8	-	-

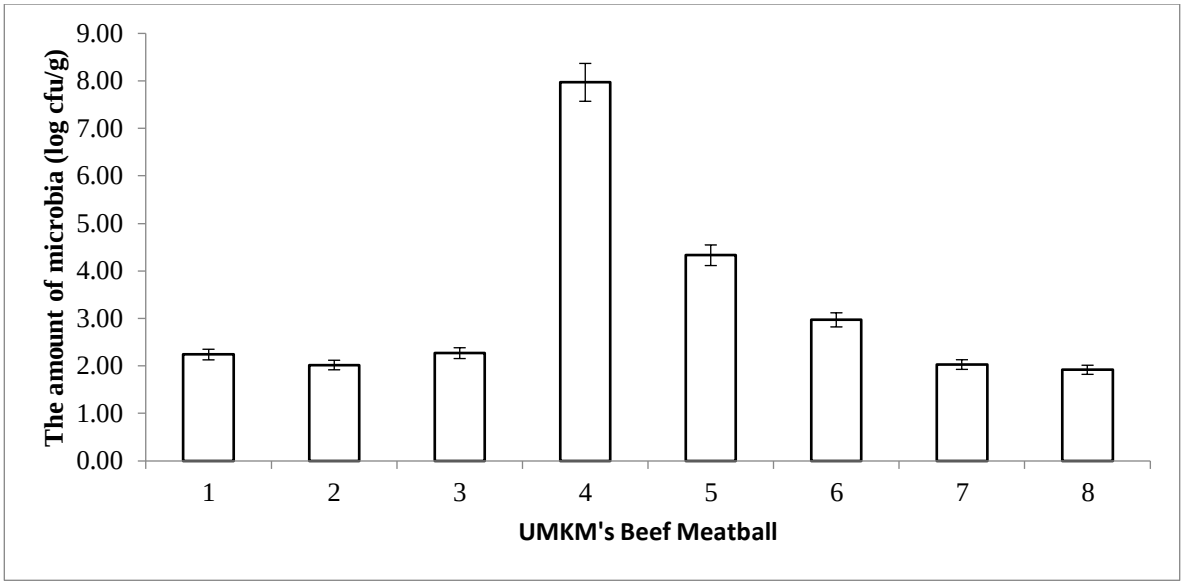

Figure 3. Total Beef Meatball Microbes From Various Types of MSMEs in Palu City

According to Frazier and Westhoff (1988), the number of microbial populations at the time of mucus formation is 3.0 x 106 to 3.0 x 108 colonies/gram samples and the number of microbial populations when detected unpleasant odor is 1.2 x 106 to 108 colonies/gram. High TPC content is thought to be the length of the meatball distribution chain before being sold. Besides that, it is also suspected that the implementation of the sanitation program applied by traders of meatballs is still low, starting from handling raw materials to the production process which requires handling by applying basic hygiene principles based on critical hazards analysis system (Pardede, 2012). Based on SNI 01-3818-2014 the total beef microbial maximum is 1 x 105 log cfu / g (5.0 log cfu /g), therefore beef meatballs are produced by MSMEs 1, 2, 3, 5, 6, 7 and 8 have met the quality requirements from aspects of the total microbial content.

CONCLUSION

Water content, ash content, protein content, fat content and total amount of beef meatball microbial originating from 8 MSMEs in Palu City showed a variety of quality variations. The content of borax and beef meatball formalin gives negative results. Beef meatballs produced by MSME 1 have met the quality requirements of SNI 01-3818-2014, while the production of beef meatballs by other MSMEs still needs supervision and guidance in the production of meatballs.

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