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FOOD SAFETY OF THE BALI BEEF CATTLE REARED ON WASTE DISPOSAL AREA

Tirta Ariana IN.*, AA. Oka, NLP. Stryani, Gd.Suarta, K. Budaarsa,
G.A.M. Kristina Dewi
Faculty of Animal Husbandry, Udayana University
Jl.PB.Sudirman Denpasar, Bali
E-mail: Ariana_gapar@yahoo.co.id*, Hp: 082236669945

Abstract

This study aim was to determine the food safety of the Bali beef cattle reared on waste disposal area. Research used a completely randomized design (CRD) with two treatments and 10 replications. The materials were beef from Bali cattle reared in waste disposal area (ST) and beef from Bali cattle with intensively reared (SO). The research variables including total microbial pathogens, the storability of the beef, and contamination of heavy metals (Pb, Cu, Cd) on the beef. The results showed a total microbial pathogens (total plate count) on the beef was similar to the beef SO (P< 0.05). Storability of the beef SO was 2 hours longer than the ST (P<0.05). Contamination of heavy metals (Pb, Cu, Cd) on the beef ST was higher than the SO (P<0.05) and still be safe to be consumed. The total microbial pathogens on ST were higher than the SO, and it has storability 2 hours shorter. Even though the heavy metals contamination of (Pb), cadmium (Cd) and copper (Cu) were still lower than the standard of the BPOM.

Keywords: Bali beef, food safety, and heavy metals

1. INTRODUCTION

Beef with good quality, healthy, and safe is a consumer demands that must be met by farmers as producers of meat. Beef with good quality is not only supported by the physicochemical qualities, but also by food safety from contamination of microbial pathogens and heavy metals (Lindawati, 1998; Soeparno, 2011). Cattle farm in Bali mostly been carrying out management of dairy farms properly, both from the aspect of reproduction, breeding and fattening (Anonymous, 2011). Bali cattle (Bos or Bibos sondaicus) is one of the original Indonesia’s germplasm which has many advantages, such as good adaptation to the environment and the level of carcass meat is high enough (meaty beef) (Hardjohubroto, 1994; Hedric, 1994; Oka, 2010).
Antagonism management of Bali cattle grazing on the location of landfills Denpasar, when compared to other Bali cattle farms in Bali or outside Bali. This means that cattle are not grounded, not washed, and got no green feed like ruminants. Only staple food of rubbish in the area. In appearance the cattle are healthy enough and not problematic. Total cattle in all ages (phase) in March 2015 are almost reached 1000 cattle in landfills with an area of ± 40 ha. The production reached 400 tons of garbage every day with a variety of constituent. Sriyani et al. (2014) said the composition of feed eaten by cattle Bali in area landfills consists of the residual group of vegetables, fruit, and the rest of the kitchen. The production goes to the cattle markets or to the butcher. Meat as a result of slaughter cattle has certainly sold to consumers in Bali and joins other beef. According to Kandeepan et al. (2009), the quality and food safety in the meat is influenced by the quality and quantity of feed.

The problem is the meat of the cow Bali that released in the Denpasar waste landfills area also sold to the general market. Is the waste feed impact on food safety of the meat? Seeing the facts found, it is necessary the study was conducted in order to know the influence of municipal solid waste is fed as Bali cattle to food security in the flesh.

2. MATERIAL AND METHOD

2.1. Material

Research material using sirloin of the Bali beef cattle released in waste disposal area in Denpasar and sirloin of the Bali cattle that were reared intensively (as a control). Bali cattle released in waste landfills in an area of nearly 40 hectares with production of 400 tons of garbage every day. Cows were not grounded, not washed, and the source of feed derived from waste (Ariana et al., 2016). This type of feed eaten by Bali cattle released in these areas is a waste from household waste, sewage hotel and others selection method. According to Sriyani et al. (2014), the type of waste that was eaten by Bali cows classified into vegetables, fruits and kitchen waste.

2.2. Method

This study used a Complete Random Design (CRD) with two treatments as follow: SO: Bali beef from Bali cattle reared intensively Bali (as a control).
ST: Bali beef from Bali cattle released in waste disposal area. Each treatment was repeated 10 times, thus this study using 20 pieces of samples.

The variables were observed in this study were as follow: (1) Profile of microbial meat, which includes total plate count (TPC) and the storability of beef; (2) Contamination of heavy metals (Pb, Cu, and Cd). Bali cattle released in waste disposal area determined by purposive random sampling with the aim to represent the group. After the slaughtering process, followed by a sampling of the sirloin (back). Samples were wrapped in plastic and then characterized using markers to proceed with the microbiological test in Livestock Product Technology Laboratory and Microbiology, Faculty of Animal Husbandry and Analytical Laboratory of the University of Udayana. For heavy metal contamination test.

Total plate count (TPC) is a technique to calculate the total number of microbial which found in meat by using PCA (Plate Count Agar) media for the analysis of total plate count of Bali beef (Fardiaz, 1992). Storability testing using a sample of 1 kg of Bali beef for each treatment. Samples were observed until the flesh decay, with an interval of observation time was 2 hours (Lindawati, 1998). The meat was stored in an open space with room temperature (25 ± 10°C). The calculation of total plate count (TPC) as an indicator of the storability of meat because of the number of microbes/TPC on beef is closely connected with the damage to the flesh, the number of microbes that reach 10^9 cfu/g or more indicates the beef has begun to decay in accordance with the opinion of Adams and Moss (2008) which stated that the initial decay in fresh meat is a stench arising from the growth of microbes reaching the number of 10^7 cfu/g or more.

2.3. Data analysis

The data obtained were analyzed using analysis of variance / ANOVA. If F count is greater than the F table shows the results significantly different (P < 0.05) (Sastrokupadi, 2000), then a further test of the LSD (least significant differences). Data acquired before the microbial transformation analyzed beforehand in the form of log x. (Steel and Torie, 1989).
3. RESULTS

3.1. TPC and storability of beef

Total Plate Count (TPC) of the Bali Beef that released in waste disposal area amount to $7.6 \times 10^4$ and the TPC in SO Bali beef amount to $5.7 \times 10^4$ (P<0.05) (Table 1).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage Time (Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>SO</td>
<td>$5.7 \times 10^4$</td>
</tr>
<tr>
<td>ST</td>
<td>$7.6 \times 10^4$</td>
</tr>
<tr>
<td>SEM</td>
<td>0.357</td>
</tr>
</tbody>
</table>

Note: SO: Beef from Bali cattle reared intensively (as a control). ST: Beef from Bali cattle released in waste disposal area. SEM: "Standard Error Of The Treatment Means".

The profile of microbes in the beginning of observation was no different between two samples (P<0.05), but in the next two hour of observation there has been an increase of pathogen microbe and the different becoming apparent between different treatment of samples (p<0.05) (Table 1). The growing rate of microbe while kept in room temperature storage as seen in Fig. 1.

![Figure 1. The growing rate of microbe (TPC) in storage](image)

3.2. Contaminations of heavy metals

The contaminations of ST Bali Beef such as Pb 42% was higher than SO metals like Cd and Cu which was 22% and 33%, respectively due to heavy metals were higher on SO Bali Beef compared to ST (P<0.05). The value of contaminations was still lower than the standard of BPOM (Table 2).
Table 2. The amount of heavy metals in Bali beef that released in waste are landfills

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Variables</th>
<th>Pb (mg/kg)</th>
<th>Cd (mg/kg)</th>
<th>Cu (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST</td>
<td></td>
<td>1.359</td>
<td>1.363</td>
<td>1.515</td>
</tr>
<tr>
<td>SO</td>
<td></td>
<td>0.908</td>
<td>1.038</td>
<td>1.008</td>
</tr>
<tr>
<td>SEM</td>
<td></td>
<td>0.0225</td>
<td>0.0490</td>
<td>0.0430</td>
</tr>
<tr>
<td>BPOM</td>
<td></td>
<td>0.1 - 10</td>
<td>1.0 - 15</td>
<td>0.1 - 150</td>
</tr>
</tbody>
</table>

Note: SO: Beef from Bali cattle reared intensively (as a control) ST: Beef from Bali cattle released in waste disposal area SEM: "Standard Error Of The Treatment Means"

3.3. Discussion

The TPC was significantly different (P<0.05) between the ST and SO beef caused by the slaughter processing was done in the same slaughterhouse and the lack of sanitation during the cutting process due to contaminated by microbes. Mukarinti et al. (1995) stated that the microbial contamination of beef can come from a slaughterhouse that is not hygienic. This was supported by Fathurahman (2008), who stated that initial contamination of beef starts from slaughterhouses that is off the floor, a knife, skin, digestive tract contents, water and equipment used for the preparation of carcasses, as well as the separation of meat from its own workers.

According to Lawrie (2003), the source of contamination of meat typically starts from the time of slaughter until consumed. Further explained that the meat quality influenced by several factors, both at the time the animals alive or after being butch. At the time of live animals, meat quality deciding factor was the way of maintenance, including feed, management of maintenance, and health care. The quality of the meat after slaughter affected by bleeding at the time of slaughter and the contamination after cutting. Slaughterhouses allegedly made great contribution especially bacterial contaminations that affect the quality of the beef. TPC beef from Bali cattle that were used as controls (SO) or (ST) was still below the threshold of food security. Threshold limit security for the amount of microbial TPC is equal to 1 x 10⁶ cfu/g (SNI 7388, 2009).

Based on TPC, the maximum storage time of Bali beef (SO) was 12 hours while on beef ST optimum storage time was 10 hours (based on a reduction in microbial populations and discharge marks of physical decaying
process of Bali beef). Stench (off-odor) beef from Bali cattle ST occurred in the storage time 6 hours, where the number of microbes has reached $2.1 \times 10^6 \text{ cfu/g}$, whereas in beef from Bali cattle used as control (SO) occur in old storage 8 hour with microbial count of $1.2 \times 10^7 \text{ cfu/g}$ (Table 1). Adams and Moss (2008); Suwansonthichai S, and S Rengpipat (2003) stated that the initial decay in fresh meat is a stench arising from the growth of microbes reaching the number of $10^6 \text{ cfu/g}$ or more.

Other damage on beef in general characterized by mucus as an indication that the beef already decomposed. This occurs during 8 hours storage on beef from Bali cattle ST with total microbial reached $2.2 \times 10^6 \text{ cfu/g}$ and in beef from Bali cattle used as control (SO) occurs in the storage time for 10 hours with a total microbial reached $2.2 \times 10^7$ (Table 1). Jay (1986); According to Gorris (2005) that the mucus in the flesh began to appear if it is found the number of microbes reach $10^6$ to $10^8 \text{ cfu/g}$ or more. The rotteness of the beef is marked with a foul odor, slime formation, changes in texture, formation of pigment (color change), and changes in taste (Adams & Moss, 2008).

The decline in the population of microbes on beef of the Bali cattle used as control (SO) occur in the storage time for 12 hours with a total of microbes at $1.4 \times 10^7 \text{ cfu/g}$ and the Bali beef ST occurred in the storage time for 10 hours with a total of microbes by $1.2 \times 10^6 \text{ cfu/g}$ (Table 1). Beef microbial population declining is the optimum point of spoilage in beef. This is because the amount of nutrients in the meat begins to decline and the microbe enters the death phase. This followed in accordance with the opinion of Soeparno (2009) that decline phase or microbial death phase was influenced by several conditions such as being endless supply of nutrients in the medium.

Microbial growth in beef from Bali cattle ST was faster than the beef from bali cattle SO, allegedly due to the influence of high cooking loss. This was in accordance with the opinion of Ariana (2015), which stated that the Bali beef cattle grazing in landfills area have high value cooking (39%) compared with controls (37.6%). (Soeparno, 2009) claimed that the high value of cooking loss is an indicator of a weakening of the bonds of the protein, so the ability to bind fluid weakened meat and plenty of fluids flesh that out because it decreases water-holding capacity. Further explanation stated that the water holding capacity decreases the amount of fluid as well.
as resulting in drip. Fluid that comes out on the surface of the meat is a good medium for the growth of microorganisms. This is why the microbes in meat from Bali cattle ST has a faster growth, so as to have a shorter storage.

3.4. Heavy metals

The average metal content of Pb, Cadmium and Copper was shown in loin veal SO because the feed was consumed in the form of restaurants waste, hotels, households and markets that have been contaminated with wastes originating from the garage, industries, shops and households containing Pb, Cadmium and Copper sourced from paint cans, food cans, batteries, plastics, oil, battery, metal and frames). Cd and Cu metal contamination on beef ST was not significant compared to the SO, due to the characteristics of garbage in the area, mostly from household waste, and the hotel market. Loin is the final portion of the meat exposed to heavy metals such as Pb, cadmium (Cd) and copper (Cu) after organ digestive tract, internal, and fat tissue (Ariana, 2015; Soeparno, 2009). Cows grazing extensively in waste disposal area have been contaminated by heavy metals Pb, cadmium (Cd) and copper (Cu) but remained below the standardization of the BPOM.

4. CONCLUSION

The results of this study concluded that:

1. TPC Bali beef ST higher (7.6 x 10⁴ cfu/g) compared to SO (5.7 x 10⁴ cfu/g) and has 2 hours shorter storage at room temperature (25 ± 10°C)
2. Bali beef ST have been contaminated by metals such as Pb, Cd and Cu higher than the SO but still lower than the threshold recommended by BPOM.
3. Bali beef (sirloin) of the Bali cattle were reared in waste disposal area declared safe and still can be consumed.

ACKNOWLEDGMENT

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the farmer in the waste area waste disposal of Pesanggaran – Denpasar who permitted the research.

REFERENCES


PROCEEDING

1st INTERNATIONAL CONFERENCE ON BIODIVERSITY, FOOD SECURITY AND HEALTH

This Proceeding contains papers and abstracts of papers that have been presented in the 1st International Conference on Biodiversity, Food Security and Health 22-23 November 2016 held by the Center for Food and Nutrition Studies (CFNS) in collaboration with Faculty of Agricultural Technology Universitas Gadjah Mada, Yogyakarta, Indonesia.

There are 35 research papers related with food, agricultural, and health aspects that can be linked to biodiversity issues. The papers are divided into four sections, i.e., Agrobiodiversity and Agroforestry (AA), Food Security and Safety (FS), Food Technology (FT), and Human Nutrition and Health (HN). In this Proceeding, the readers can find interesting articles such as Conflicting or Combinative – Human and Natural Values at Kathotiya, Central India; Biodiversity Assessment of Mangrove in Pasuruan District, East Java; Traditional Red Rice Grain Characteristics Still Cultivated in Regencies of South Sulawesi, and so on (Section 1). In Section 2, we can find articles such as Chemical, Biological Activity and Heavy Metal Content of Sea Cucumbers from Karimunjawa and Lampung’s Marine, Indonesia; Pathogenic Bacteria Contamination of Loin Bali Cattle That Slaughter at Modern and Traditional System; Promoting Sustainable Agriculture in Pekalongan, Indonesia: Coastal Farmers Choices; and so forth. Section 3 contains articles such as Exterior and Interior Egg Quality of Muscovy Duck (Cairina moschata) Reared Traditionally in Yogyakarta; Copigmentation of Anthocyanin Extract of Java Prune (Kopsia priniformis) Fruit with Quercetin to Increase the Colour Stability; and, Effect of Autoclaving-cooling Cycle on Resistant Starch Content and Functional Properties of Gayam (Inocarpus fagifer Forst.) Flour. Papers in the Section 4 including Protective Effect of Tropical Fruit Juice on Histopathological Image of Rats Lung Exposed to Cigarette Smoke; Antioxidant Activity of the Ethanolic Extracts of Peel and Flesh of Coleus tuberosus; and The Effectiveness of Various Salacca Vinegar as Therapeutic Agent for Management of Hyperglycemia and Dyslipidemia on Diabetic Rats.

This Proceeding is relevant for those who concern with food security, food safety, nutrition and health, agrobiodiversity, agroforestry and biodiversity in general.