

Total plate count of beef meat at traditional markets in south of Surabaya, Indonesia

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ABSTRACT

This study is aimed to know the Total Plate Count of beef sold at traditional markets in south district Surabaya. The study was conducted from April until May 2019 at Laboratory of Veterinary Public Health Department, Faculty of Veterinary Medicine, Universitas Airlangga. Thirty samples of raw meat were bought from five traditional markets examined using Pour Plate Method of Total Plate Count. The result showed that 16 samples (53.3%) exceeding the limit of the level of TPC according to National Standard of Indonesia (SNI). The average Total Plate Count of raw meat sold at traditional markets was 1.4×10^6 CFU/g.

Key words : Beef, Traditional Markets, Total Plate Account

Introduction

One the basic of humans needs in order to carry out their daily activities is food. Availability of food with sufficient quantity and quality and safe for consumption is basic human need (Rachman and Ariani, 2012). Based on Law of Republic Indonesia No. 18 of 2012 about concerning food, food is anything that comes from biological sources of agricultural products, plantations, forestry, fisheries, livestock, and water, whether processed or not processed which are intended as food or drinks for human consumption, including supplementary materials food, food raw materials, and other materials used in the process of preparing, processing and making food or drinks.

Food with high nutritional value is important as an effort to improve public health. Meat as food from highly nutritious animal origin is easily damaged if handled improperly because meat is a good medium for the growth of microorganisms such as bacteria (Usmiati, 2010). This is because meat has nutritional content such as water, protein, fat, vita-

mins and minerals (Kuntoro *et al.*, 2013)

Meat is a food that tends to rot because it has a high nutritional content so that microbes can grow easily. There are several types of preservation so that meat has a long shelf life such as the use of chilling storage (1.4 - 2.2 °C), freezer, and the addition of ingredients such as salt and sugar (Harijani *et al.*, 2013). Besides meat can also be processed so that in addition to having a long shelf life also has more value such as the process of drying (jerky), fumigation (smoked meat), acidification, and heating (shredded) (Usmiati, 2010).

Traditional markets are place for selling daily necessities, one of which is beef. The sanitation conditions of traditional markets are generally not good, this can be seen from the environment that is dirty, muddy, smelly, uncomfortable, and less safe for buyers (Estoepangestie *et al.*, 2011). A place with poor sanitation can reduce the quality of meat. Meat quality can decrease due to bacterial activity in meat that can change color, taste, and aroma (Kuntoro *et al.*, 2013). The results of research conducted that beef samples from several traditional markets in the

south Surabaya region contained *Escherichia coli* contamination that exceeded the Indonesian National Standard (SNI) 7388-2009 with the lowest Most Probable Number (MPN) value of 253 MPN/g (Harijani *et al.*, 2013).

The quality of beef as food from animal that is consumed must be maintained so that consumers get beef that is safe, healthy, whole, and halal. Based on the Indonesian National Standard (SNI) 7388: 2009, the total bacterial colony in meat can be categorized as safe if it does not exceed 1×10^6 CFU/g.

Materials and Methods

The equipment used in this study consisted of plastic bags, cool boxes, gels, aluminum foil, petri dishes, pipettes, test tubes, test tube racks, scissors, tweezers, scales, bunsen, matchsticks, knives, paper, cotton rolls, autoclaves, erlenmeyer tubes, measuring cups, beaker glass, and incubators.

The sample used was 25 gram beef sample, aquadest, Nutrient Agar (NA) for general media for bacterial growth, Buffered Peptone Water (BPW) 1%, 70% alcohol and spiritus.

The market chosen for sample testing based on the Purposive Sampling method is market that has a building, crowded with visitors, and has a poor market cleanliness. Thirty beef meat samples were taken from the Keputran market, Jagir market, Pagesangan market, Siwalankerto market, and Wiyung market. The sample is put in plastic and then stored in a cool box that has been filled with cooling gel. Samples were taken to the Laboratory of the Department of Veterinary Public Health, Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya for further examination.

Media and solvents to be used were sterilized using an autoclave at 121°C for 15 minutes.

Each meat samples are first diluted with 1% Buffered Pepton Water (BPW) solution of: 10^{-3} , 10^{-4} , 10^{-5} which is used to make it easier to count bacterial colonies in a cup. Meat samples measured 25 g and cut into small pieces and then put into 1% 225 mL BPW diluent to dilute samples 10^{-1} . Dilution of sample 10^{-1} by pipeting 1 mL into BPW 1% 9 mL becomes dilution of sample 10^{-2} and so on until getting sample dilution of 10^{-3} , 10^{-4} , and 10^{-5} . Control using 1% BPW media, without dilution of meat samples. After diluting the culture of the sample on the Nutrient agar medium is carried out by the pour

method. Suspension from dilutions of 10^{-3} , 10^{-4} , 10^{-5} pipette as much as 1 mL and put into a sterile petri dish (duplo) using a sterile pipette. The cup containing the sample was added 15-20 ml of NA media which had been cooled to reach temperatures of 45 - 50°C . Move the petri dish rotating horizontal that it is evenly distributed. After the media has solidified, put it in the incubator upside down, incubating for 24 - 48 hours at 37°C . The observation was made by counting the number of bacterial colonies.

The Standard Plate Count (SPC) method is colony counted in petri dishes containing 30 to 300 colonies, the colonies in petri dishes are multiplied by dilution. Data obtained from the results of counting the number of bacterial colonies by the TPC method are displayed in tables and numbers, then compared with SNI (Indonesian National Standard) 7388: 2009.

Results and Discussion

The following data are obtained from the results of testing the Total Plate Count (TPC) pouring method on beef meat in Keputran (K), Wiyung (W), Pagesangan (P), Jagir (J), and Siwalankerto (S) markets during the month April - May 2019.

The results obtained from TPC testing on beef meat in several traditional markets in the south Surabaya region have an average value of 1.4×10^6 CFU/g. This result is lower compared to research conducted the traditional market in Lamongan city which amounted to 3.2×10^6 CFU/g. Research conducted on several traditional markets in the city of Surabaya has a lower average TPC value of 5.6×10^5 CFU/g (Rachman and Ariani, 2012; Susanto and Wenny, 2013).

Sixteen samples from 30 samples or 53% of beef samples exceeded the contamination limit set by BSN (National Standardization Agency) in SNI 7388-2009 which is equal to 1×10^6 CFU / g. The average value of TPC in beef sold in the Pagesangan market is the highest at 2.7×10^6 CFU/g (Usmiati, 2010).

The variation in the total number of bacteria in each beef sample can be caused by differences in the transportation of meat to the market, the cleanliness of the seller, and the cleanliness of the equipment used by the seller in the market. The level of contamination comes from each source and depends on the sanitation methods used by individuals. Dirty seller's hands or not always washing hands and



Fig. 1. Bacteria colonies are round and white that grow on the media from samples P3

Table 1. TPC Value of the traditional market in the South Surabaya Region

No	Sample	Standard Plate Count (CFU/g)	Average (CFU/g)
1	K 1	1.3×10^6	1.3×10^6
	K 2	1.2×10^6	
	K 3	2.7×10^6	
	K 4	2.1×10^6	
	K 5	1.1×10^5	
	K 6	1.4×10^5	
2	W 1	3×10^5	1×10^6
	W 2	1.1×10^5	
	W 3	1.4×10^5	
	W 4	2.2×10^5	
	W 5	1×10^5	
	W 6	1.3×10^5	
3	P 1	2.7×10^6	2.7×10^6
	P 2	2.6×10^6	
	P 3	3.4×10^6	
	P 4	2.4×10^6	
	P 5	2.3×10^6	
	P 6	3×10^6	
4	J 1	2.9×10^6	2.4×10^6
	J 2	2×10^6	
	J 3	2.5×10^6	
	J 4	2.4×10^6	
	J 5	1.5×10^6	
	J 6	3×10^6	
5	S 1	2.6×10^5	2.3×10^5
	S 2	3.4×10^5	
	S 3	2.9×10^5	
	S 4	1×10^5	
	S 5	1.5×10^5	
	S 6	2.2×10^5	
	Average	1.4×10^6	

equipment such as knives or cutting boards that are not cleaned properly can contaminate meat (Upadhyaya *et al.*, 2012). Meat in traditional markets are sold by hanging or placed on a table. Buyers usually hold the meat before buying, which can also allow cross-contamination and increase the number of bacteria found on the surface of the meat. Dirty or contaminated hands can move pathogenic bacteria or viruses from the body, feces or other sources into food.

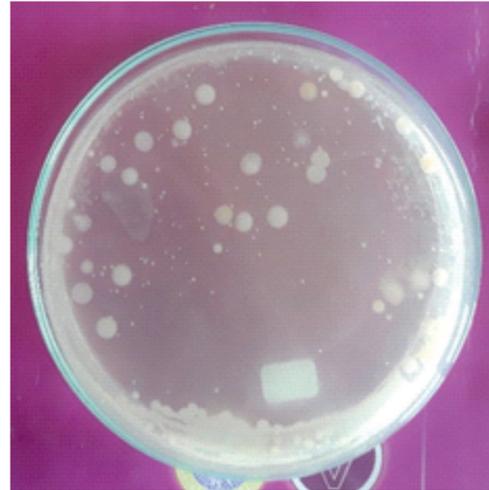


Fig. 2. Spherical and white bacterial colonies growing on agar media to form samples S 4 with a TPC value of 1×10^5 CFU/g

The Pageangan Market has a narrow and full market condition of buyers, then the air circulation is not good so it feels humid and hot when compared to other markets so that it allows for bacteria to grow and develop quickly. The lowest average TPC value is found in beef sold in the Siwalankerto market 2.3×10^5 CFU / g. Siwalankerto market has better air circulation conditions compared to other markets, so it does not feel crowded or humid even though the market is crowded.

High levels of microorganism contamination at the TPC examination indicate that beef meat samples have been contaminated by many microorganisms at the sales level. The condition of the traditional market as a place to sell beef has a temperature above room temperature, crowded, and clean water facilities to wash equipment or lack of hands, can have an impact on the number of beef microorganisms. The longer the storage at high temperatures will further increase the activity of microorganisms that ultimately lead to spoilage. The num-

ber of microorganisms that exceed the threshold in beef indicates that the meat can experience a decrease in storability and can cause health problems if consumed without proper processing (Gustiani., 2009).

Research conducted the traditional markets in the southern Surabaya region found *Escherichia coli* bacterial contamination that exceeds SNI limits in all samples (Harijani *et al.*, 2013). Contamination from *Escherichia coli* bacteria shows that traditional markets in southern Surabaya have not implemented good hygiene and sanitation, because *Escherichia coli* bacteria are bacteria that originate from the intestinal tract of warm-blooded living things (Sutiknowati, 2016). A high TPC value also indicates that the sanitation factor at the point of sale has not been implemented properly.

Conclusion

Based on the results of research conducted it can be concluded that the average value of TPC in beef meat in traditional markets in the south Surabaya region has an average of 1.4×10^6 CFU/g. Beef samples from the traditional markets in the south Surabaya region were 16 samples or 53.3% did not meet the Indonesian National Standard (SNI) 7388-2009.

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The existence of this research can be beneficial for maintaining good quality beef consumed by the community, and it is hoped that there will be better follow-up. I am grateful to be given the opportunity and support for research with the expected results so that there is ongoing research to develop this research.

References

Estoepangestie, S., Dimas Hariyono, and Setya Budhy. 2011. The Effect of Storage Temperature on the Early Occurrence of Meat Spoilage for Sale in One of

Surabaya's Traditional Markets. *Veterineria Medika*. 4 (2): 125 - 128. [Text in Indonesia].

Frazier, W. C. and Westhoff, D. C. 1988. Food Microbiology 4th edition. Mc Graw Hill Book Company, New York.

Gustiani, E. 2009. Control of Microbial Contamination in Food From Animal Origin (Meat and Milk) From Animal Husbandry to Serving. *Jurn. Agricultural Research and Development*. 28 (3) : 96 - 100. [Text in Indonesia].

Harijani, N., Rahadi, U. S. E. and Nazar, D. S. 2013. Isolation of *Escherichia coli* in Meat Obtained from Several Traditional Markets in South Surabaya. *Journal of Veterinarians Medika*. 6 (1) : 39-44. [Text in Indonesia].

Kuntoro, B., Maheswari, R. R. A. and Nuraini, H. 2013. Physical Quality and Microbiology of Beef from Slaughterhouses (RPH) Pekanbaru City. *Animal Husbandry Journal*. 10 (1) : 1 - 8. [Text in Indonesia].

Kuntoro, B., Maheswari, R. R. A. and Nuraini, H. 2012. The Relationship of Application of Standard Sanitation Operational Procedure (SSOP) to Meat Quality in terms of Microbial Contamination Level. *Animal Husbandry Journal*. 15 (2) : 70 - 80. [Text in Indonesia].

National Standardization Agency, 2009. Indonesian National Standard (SNI). SNI 7388-2009. Maximum Limits of Microbial Contamination in Food. Indonesian Standardization Board. *Jakarta*. [Text in Indonesia].

Rachman, H. P. S. and Ariani, M. 2012. Food Security: Concepts, Measurements, and Strategies. *FAE*. 20 (1): 12-24. [Text in Indonesia].

Susanto, E. and Wenny, L. N. A. 2013. Analysis of Beef Microbiological Quality in Traditional Market in Lamongan City. *Animal Journal*. 4 (1): 3-8. [Text in Indonesia].

Sutiknowati, L. I. 2016. Bioindicator of *Escherichia coli*. *Oseana*. 60 (1): 63 - 71. [Text in Indonesia].

Usmiati, S. 2010. Preservation of Fresh and Processed Meat. Center for Postharvest Agriculture Research and Development. Bogor. [Text in Indonesia].

Upadhyaya, M., Poosaran, N. and Fries, R. 2012. *Prevalence and Predictors of Salmonella spp. in Retail Meat Shops in Kathmandu*. *J. Agri. Science and Tech*. 2 : 1094-1106.

Widhowati, D. 2012. Number of Bacterial Contamination in Beef for Sale in Several Traditional Markets and Supermarkets in Surabaya [Thesis]. Faculty of Veterinary Medicine. Airlangga University. Page 20. [Text in Indonesia].