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Sriyani, N. L. P., Sampurna, P., & Dewi, G. A. M. K. (2022). Bali beef organoleptic quality cut at Slaughterhouse with different management at Mambal Slaughterhouse, Pesanggaran Slaughterhouse and Darmasaba Slaughterhouse. *International Journal of Life Sciences & Earth Sciences*, 5(1), 10-14. <https://doi.org/10.21744/ijle.v5n1.1939>

Bali Beef Organoleptic Quality Cut at Slaughterhouse with Different Management at Mambal Slaughterhouse, Pesanggaran Slaughterhouse and Darmasaba Slaughterhouse

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Abstract---The purpose of the study was to determine the differences in management and organoleptic quality of male Bali beef from slaughterhouses in the Denpasar and Badung districts. The material used was male Bali beef in the Longissimus Dorsi (LD) muscle which was cut at different abattoirs. The abattoirs are Mambal Slaughterhouse, Pesanggaran Slaughterhouse, and Darmasaba Slaughterhouse. This study used a completely randomized design (CRD) with 3 treatments where three abattoirs were treated and 4 replications (4 times the frequency of collection) were assessed by 20 semi-trained panellists. The variables observed were the general description of abattoir management and organoleptic data of meat, namely color, aroma, texture, taste, tenderness, and overall acceptance. Data on management differences were analyzed descriptively and organoleptic data for meat were analyzed non-parametrically with Kruskal Wallis if there was a significant difference followed by the Man Witney test between the two treatments. The results of this study indicate that there is almost the same management in the government-run slaughterhouse, namely the Mambal Slaughterhouse, and the Pesanggaran Slaughterhouse. The management in these two RPHs has met the SNI (Indonesian National Standard) while the community-managed slaughterhouse, namely the Darmasaba slaughterhouse, the management is not following the SNI standard. Panellists' acceptance was lower on the organoleptic quality of Bali beef produced from Darmasaba Slaughterhouse, compared to Mambal and Pesanggaran Slaughterhouse. Panellists' acceptance of the organoleptic quality of Bali beef was not significantly different between Bali beef slaughtered at Mambal Slaughterhouse and Pesanggaran Slaughterhouse.
Keywords---abattoir management, Bali beef, organoleptic, slaughterhouse.

Introduction

The Bali Provincial Government has issued Bali Governor Regulation Number 99/2018 concerning the Marketing and Utilization of Agricultural Products, Fisheries, and Local Bali Industries. One of the regulations regulated in this governor regulation is supermarkets are required to buy and sell at least 60% of the total volume of products marketed for food crops, horticulture, and plantations as well as livestock. The governor's regulation also stipulates to use of livestock products at least 30% of the needs of hotels and restaurants and at least 10 percent of the needs of the meat processing industry. To implement the regulation, especially for meat products, it is necessary to know how the quality of the meat produced by Slaughterhouses which supply meat in the market, both modern and traditional markets, on the island of Bali in general and in the city of Denpasar in particular.

According to [Hidayat et al. \(2016\)](#), meat quality is strongly influenced by factors before slaughter including genetics, species, nation, type of livestock, sex, age, feed including additives (hormones, antibiotics, and minerals), and stress factors. The condition of livestock before slaughter greatly affects the quality of the meat produced. The abattoir management factor is one of the important factors in producing good quality meat. However, in several abattoirs in the city of Denpasar and in Badung regency in the province of Bali as the slaughterhouse that supplies the largest Bali beef on the island of Bali, the quality of the meat products produced is different ([Wijaya et al., 2018](#); [Verkaar et al., 2002](#)). Some of the operational slaughterhouses are managed by the government, some are managed by the community, which of course has different management. There are three locations of abattoirs as the largest meat suppliers to cities throughout Bali. The slaughterhouse is Pesanggaran slaughterhouse which is located in Denpasar city, Mambal Slaughterhouse and Darmasaba Slaughterhouse which is located in Badung Regency. Based on data from the Department of Agriculture and Food Security of the Province of Bali, the abattoirs, which are located in Denpasar City and Badung Regency, are the abattoirs with the largest number of cattle slaughtering among regencies in the province of Bali.

This study aims to find out differences in the management of abattoirs and meat quality, especially the organoleptic quality of Bali beef produced by the three abattoirs, namely Mambal Slaughterhouse in Badung Regency, Pesanggaran slaughterhouse in Denpasar Municipality and Darmasaba Slaughterhouse in Badung Regency. The above information is very important for meat consumers, especially for Horeka (Hotels, Restaurants, and Catering) to implement the Bali Governor Regulation No. 99/2018.

Research Methods

The research locations were three slaughterhouse locations, namely Mambal Slaughterhouse, Pesanggaran Slaughterhouse and Darmasaba Slaughterhouse. The organoleptic test was carried out at the Laboratory of Animal Products Technology and Microbiology, Faculty of Animal Husbandry, Udayana University. Data about the management profile of each abattoir was dug up by interview technique with a questionnaire instrument to the owners and managers. The interview was carried out to explore data on the origin of cattle, transportation techniques, management of slaughterhouse, management which includes resting livestock before slaughter, slaughtering techniques (there is stunning before slaughtering or none), the presence of Juleha (halal slaughter attendant), caressing techniques, and the implementation of commercial carcass cuts. Direct observations were also carried out at the abattoir location to see how the livestock slaughter management was carried out ([Kefalew & Lami, 2021](#); [Bourguet et al., 2011](#)).

The meat organoleptic testing method was carried out by taking samples of male Bali beef from the longissimus dorsi (LD) muscle taken at three different abattoir locations ([Nel et al., 2004](#)). Sampling was carried out every two weeks for three months. Samples were collected in the refrigerator in the freezer room until the end of the sampling schedule ended. Furthermore, the frozen meat samples were thawed and then organoleptic tests were carried out ([Hooda & Jood, 2005](#)). In this organoleptic test using the "Consumer Preference Test Method" which is a direct test method of the panellists' preference level in assessing a trait or quality of a food ingredient, the test is carried out by panellists concerning a meat organoleptic test questionnaire sheet ([Dhingra & Jood, 2002](#)). Panellists are asked to give product ratings based on sensory analysis and express their responses to the properties of the tested materials. Panellists fill in the form by marking (√) the appropriate answer according to the panellist. The hedonic quality test assessment format, namely color, aroma, taste, texture, and tenderness, while the hedonic test is overall acceptance. The technique used is a scoring technique, where the scores used in the hedonic test range from 1-5 where the scores are 1 (dislike very much), 2 (dislike), 3 (usual), 4 (like), and 5 (very like).

An overview of the management of Mambal slaughterhouse, Pesanggaran slaughterhouse and Darmasaba slaughterhouse. The organoleptic quality of the meat includes hedonic tests (level of preference) on color, aroma, taste, texture, tenderness, and overall acceptance of each abattoir using 20 semi-trained panellists. The analysis used in this study is a non-parametric test (Kruskal-Wallis), and if it shows a significant difference ($P < 0.05$) between treatments, it will be continued with the Mann-Whitney test ([Saleh, 1996](#)), with the help of the SPSS program.

Results and Discussion

Overview of the management of Mambal Slaughterhouse, Pesanggaran Slaughterhouse and Darmasaba Slaughterhouse

From the results of interviews and direct observations in the field, the following results were obtained: the management of Mambal Slaughterhouse and Pesanggaran Slaughterhouse is managed by the government while Darmasaba Slaughterhouse is managed by the community. This condition has an impact on the difference between antemortem and postmortem tests. At Mambal slaughterhouse and Pesanggaran antemortem and postmortem tests were carried out by temporary officers at Darmasaba slaughterhouse, there was no antemortem or postmortem test. The resting drum conditions at Mambal slaughterhouse and Pesanggaran slaughterhouse are in the form of permanent buildings, there is a supply of drinking water, faeces, and urine waste channels. The condition of the resting cage at the Darmasaba slaughterhouse building is not permanent, it is united with the slaughterhouse. The three slaughterhouses both apply livestock rest before slaughter for 8-12 hours.

Handling of Bali cattle before slaughter at Mambal slaughterhouse and Pesanggaran slaughterhouse uses a threshing machine to knock the cattle down, while at Darmasaba slaughterhouse the cattle are knocked down manually with ropes. The slaughter of livestock at Mambal slaughterhouse and Pesanggaran are carried out by Juleha (Halal Slaughterer) while at Darmasaba slaughterhouse it is carried out without using Juleha. The carcass process at Mambal slaughterhouse and Pesanggaran slaughterhouse is carried out by hanging on a temporary rail at Darmasaba slaughterhouse carried out on the floor. The complete data are presented in Table 1. From this data, it can be interpreted that the management of the government-run slaughterhouse, namely the Mambal slaughterhouse and Pesanggaran slaughterhouse, is following the slaughterhouse management standards to produce good quality meat. On the side of the Darmasaba slaughterhouse, the management is still below the standard (SNI 01-6159-1999) as seen from the absence of antemortem and post-mortem inspections, handling of livestock / crushing livestock using ropes which tend to hurt livestock and are prone to causing stress on livestock and grounding carried out on the floor not hanging, this condition causes a high risk of contamination with pathogenic bacteria from the gastrointestinal tract

Table 1
General Condition of Management of Mambal slaughterhouse, Pesanggaran slaughterhouse, and Darmasaba slaughterhouse

No	Indicator	Mambal slaughterhouse	Pesanggaran slaughterhouse	Darmasaba slaughterhouse
1	Management	Badung local government (government)	Denpasar Municipality (government)	Public
2	Resting cage	exists (permanent)	exists (permanent)	there is semi-permanent
3	Livestock rest before slaughter	(8-12 hours)	(8-12 hours)	(8-12 hours)
4	Antemortem inspection	Available	Available	Unavailable
5	Postmortem inspection	Available	Available	Unavailable
6	Cattle knocking method	Knocking Machine	Knocking Machine	Unavailable
7	Slaughter Method	Lay down with a stooping machine, then slaughtered in the vena jugularis, there is no stunning before slaughter.	Lay down with a stooping machine, then hanged and then slaughtered on the vena jugularis, there is no stunning before slaughter.	Manual with Strap
8	Executor of Slaughter	<i>Juleha*</i>	<i>Juleha</i>	Lay down with the help of a rope, then slaughtered in the vena jugularis, there is no stunning/stunning before slaughter.
9	carcass method	hanged	hanged	on the floor

Description: Juleha (halal butcher) official butcher from MUI/Majuelis Ulama Indonesia

The conditions and management differences of the three abattoirs most likely caused differences in the organoleptic quality of the meat products produced (Grigorakis et al., 2003). It can be seen in Table 2 that the panellist's acceptance of the color of meat produced at the Darmasaba slaughterhouse was statistically significantly lower than Mambal and Pesanggaran slaughterhouse ($P < 0.05$). This is because the availability of a threshing machine at Mambal and Pesanggaran slaughterhouses makes it easier for cattle to fall before slaughter than in Darmasaba slaughterhouse which uses manual techniques without a threshing machine (Mach et al., 2008; Al-Mutairi et al., 2004). This manual crushing of cattle causes the cattle to experience stress and this will have an impact on the decline in meat quality. It can be seen in the lower acceptance of meat color in meat produced at the Darmasaba slaughterhouse. Cattle when slaughtered under stress will produce a darker color of the meat. Mounier et al. (2006), stated that stress conditions can increase blood cortisol concentrations and are accompanied by glycogen depletion in muscles. This causes a decrease in postmortem lactic acid production and the pH of the meat remains high. A high pH value of meat will cause the meat to be dark in color. Sihombing et al (2020), also reported significant differences in the color of meat in Bali beef slaughtered at different abattoirs in several districts on the island of Bali.

Table 2
Organoleptic quality of male Bali beef at different abattoir locations

Variable	Mambal Slaughterhouse	Pesanggaran Slaughterhouse	Darmasaba Slaughterhouse
Color	4,13 ^{a 1)}	4,07 ^a	3,07 ^b
Aroma	4,46 ^a	4,40 ^a	2,73 ^b
Texture	3,27 ^a	3,20 ^a	3,60 ^a
Tenderness	3,47 ^a	3,53 ^a	3,06 ^a
Overall acceptance	4,26 ^a	4,20 ^a	3,27 ^b

Description: 1 = Values with different letters indicate significant or significant differences ($P < 0.05$). Hedonic scale: 1 (dislike very much), 2 (dislike), 3 (usual), 4 (like), and 5 (like very much).

In line with the meat aroma variable which received lower panellist acceptance of Balinese beef slaughtered at Darmasaba slaughterhouse ($p < 0.05$). Panellists accept the lower aroma value because the meat slaughtered at the Darmasaba slaughterhouse produces a fishier aroma than Bali beef slaughtered at Mambal and Pesanggaran slaughterhouses. The grounding system implemented on the floor is likely to cause high levels of contamination. The fishy smell is closely related to sanitation in the slaughterhouse. The fishy smell indicates that the meat has been contaminated with pathogenic bacteria. Sriyani et al. (2019), reported that Traditional slaughterhouses or slaughterhouses managed by the community had a higher content of pathogenic bacteria than Modern slaughterhouses managed by the government. According to Suardana & Swacita (2009), the taste of meat is strongly influenced by the smell or aroma of the meat.

The panellists' acceptance of the texture and tenderness of Balinese beef slaughtered at the three abattoirs was not significantly different ($P > 0.05$). Meat texture and tenderness are closely related to slaughter weight and the age of livestock. From the results of interviews with the managers of the three abattoirs, the average weight of the slaughtered Bali bulls is in the range of 250-300 kg. The three abattoirs have a cutting weight that is not much different. It is suspected that the texture and tenderness of the meat produced from the three abattoirs were not significantly different. The texture of the meat is influenced by the consistency of the meat. Meat whose consistency is chewy or tough because it contains a lot of connective tissue will have a coarse texture, on the other hand, if the consistency of the meat is soft, the texture will look smooth. Soeparno (2015), meat texture is probably the most important determinant of meat quality. Merthayasa et al. (2015), reported that the texture value of Bali beef was lower or coarser than wagyu beef.

Overall acceptance is the conclusion of the panellists to choose the selected product. The overall acceptance value between Bali beef slaughtered at Mambal and Pesanggaran slaughterhouses has a value that is not significantly different. This shows that the panellists both accept (like to very much like) Balinese beef slaughtered at the Mambal and Pesanggaran slaughterhouse. Meanwhile, the panellists' acceptance value of slaughtered Bali beef at the Darmasaba slaughterhouse was significantly lower than at Mambal and Pesanggaran slaughterhouses. The low value of color and aroma in the acceptance of meat from Darmasaba slaughterhouse is most likely the reason for the low overall acceptance value.

Conclusion

This research concludes that there is almost the same management in the government-run slaughterhouse, namely the Mambal and the Pesanggaran slaughterhouse. The management in these two slaughterhouses has met SNI (Indonesian National Standards) while the community-managed slaughterhouse, namely Darmasaba slaughterhouse, the management is not following SNI standards. Panellists' acceptance was lower of the organoleptic quality of Bali beef produced from Darmasaba slaughterhouse compared to Mambal and Pesanggaran slaughterhouse. Panellists' acceptance of the organoleptic quality of Bali beef was not significantly different between Bali beef slaughtered at Mambal and Pesanggaran slaughterhouses.

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