BULETIN VETERINER UDAYANA

pISSN 2085-2495
eISSN 2477-2712

Received: 19 May 2026; Accepted: 10 June 2026; Published: 10 June 2026

THE WELFARE EVALUATION OF QURBAN CATTLE BASED ON MEAT QUALITY AT THREE SLAUGHTERHOUSES IN PALANGKA RAYA CITY

Evaluasi Kesejahteraan Sapi Kurban berdasarkan Kualitas Daging pada Tiga Tempat Penyembelihan di Kota Palangka Raya

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How to cite: Ma'rifah S, Aditya FR, Wibowo S, Sujoko H, Pudjirahaju A. 2026. The welfare evaluation of qurban cattle based on meat quality at three slaughterhouses in Palangka Raya city. *Bul. Vet. Udayana*. 18(3): 635-644. DOI: https://doi.org/10.24843/bulvet.2026.v18.i03.p15

Abstract

This study aimed to evaluate the welfare of sacrificial (qurban) cattle based on meat quality at three slaughter locations in Palangka Raya City. Observed parameters included meat color, texture, odor, pH, moisture content, shelf life, and cooking loss, along with animal welfare assessed through the Five Freedoms framework. The research employed direct observation and laboratory analysis of meat samples from each site. Results indicated that animal welfare was generally practiced to a fair degree; however, basic needs such as feeding and watering prior to slaughter were often neglected. The meat quality from two locations was found to be superior compared to another, as indicated by lower pH values and longer shelf life. Correlation analysis revealed a significant relationship between moisture content and weight loss ($r = 0.61$; $p < 0.05$). These findings highlight that proper implementation of animal welfare practices positively influences the quality of qurban beef. Therefore, improvements in pre- and post-slaughter management are necessary to ensure the future quality and safety of qurban meat products.

Keywords: animal welfare, qurban cattle, meat quality

Abstrak

Penelitian ini bertujuan untuk mengevaluasi kesejahteraan sapi kurban berdasarkan kualitas daging pada tiga lokasi penyembelihan di Kota Palangka Raya. Parameter yang diamati meliputi warna, tekstur, bau, pH, kadar air, daya simpan, dan daya susut daging, serta aspek kesejahteraan hewan berdasarkan prinsip *Five Freedoms*. Metode yang digunakan berupa observasi langsung dan analisis laboratorium terhadap sampel daging dari masing-masing lokasi. Hasil penelitian menunjukkan bahwa kesejahteraan hewan secara umum cukup diperhatikan, pemenuhan kebutuhan dasar seperti pakan dan air sebelum penyembelihan masih terbatas. Mutu daging sapi kurban dari dua lokasi menunjukkan hasil yang lebih baik

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https://doi.org/10.24843/bulvet.2026.v18.i03.p15

dibandingkan satu lokasi lainnya, yang tercermin dari tingkat pH yang lebih rendah serta daya simpan yang lebih lama. Hasil analisis korelasi mengindikasikan adanya hubungan yang signifikan antara kadar air dengan daya susut ($r = 0{,}61$; $p < 0{,}05$). Temuan ini menegaskan bahwa penerapan prinsip kesejahteraan hewan secara optimal berkontribusi positif terhadap kualitas daging. Oleh karena itu, diperlukan perbaikan dalam aspek manajemen sebelum dan sesudah penyembelihan guna menjamin mutu dan keamanan daging kurban ke depannya.

Kata kunci: kesejahteraan hewan, sapi kurban, kualitas daging

INTRODUCTION

The slaughtering of qurban animals constitutes a religious practice performed by Muslims on Eid al-Adha (the Festival of Sacrifice). This activity transcends mere ritual observance and is intrinsically linked to animal welfare and food safety. Animal welfare is a critical consideration at every stage of the process, from pre-slaughter handling and the method of slaughter to post-slaughter management. Inadequate animal welfare has direct implications for meat quality, affecting parameters such as color, pH, texture, and tenderness (Putra *et al.*, 2022).

Previous studies have demonstrated that stress experienced by animals prior to and during slaughter induces biochemical alterations in muscle tissue, which in turn influence meat quality (Fitrani *et al.*, 2021). Meat derived from stressed animals is prone to present DFD (dark, firm, and dry) or PSE (pale, soft, and exudative) characteristics, indicative of reduced quality and potential long-term health risks for consumers (Soeharsono *et al.*, 2020). Fresh meat has a natural bright red color, a distinctive aroma that is not pungent, a dense and chewy texture, and is not slimy.

As the capital of Central Kalimantan Province, Palangka Raya hosts a variety of qurban slaughtering sites during Eid al-Adha, encompassing traditional community-based locations and formal slaughterhouses (*Rumah Potong Hewan*/RPH). Nevertheless, the implementation of animal welfare principles is not uniformly optimal across these sites. Evaluating this condition is important, as it may serve as an indicator of compliance with halal, hygienic, and quality slaughtering standards.

This study aims to evaluate the welfare status of qurban cattle by employing meat quality parameters, namely color, texture, and pH across three distinct slaughtering sites in Palangka Raya. The findings are expected to elucidate the application of animal welfare practices during slaughter and their impact on meat product quality, and to inform policymakers and the general public in efforts to enhance the standards of qurban animal slaughtering.

RESEARCH METHOD

Ethical Permission and Research Object

This study does not require ethical approval because it does not involve the use of experimental animals or any direct treatment administered to animals. This research only observed and took samples of qurban meat to be tested in the laboratory. The object of this study was qurban beef obtained from 15 Bali cattle slaughtered at three different slaughter locations in Palangka Raya City. The slaughter location consists of three locations, namely location A, location B, and location C.

Research Design

This study was conducted through direct field observation by collecting qurban meat samples and performing both objective (measurable) and subjective (organoleptic/sensory) tests. Objective testing encompassed meat quality parameters, including pH value, moisture content,

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and cooking loss. Subjective testing involved the assessment of color, odor, and texture, which were observed directly by the researcher with careful and consistent evaluation.

Meat Color

Color was measured using the Hunter L*, a*, b* color scale. Meat color assessment was performed visually by the researcher. Meat samples were cut to approximately 25 g and allowed to rest at room temperature for 15–30 minutes to stabilize color. Assessment was conducted under natural lighting or standard white light using a simple visual scale from 1 to 5, where a score of 1 indicates dark or brownish color and a score of 5 indicates bright red color reflecting meat freshness. Scores were recorded directly by the researcher based on color correspondence with visual standards for fresh meat.

Meat Texture

Texture assessment was performed manually using a compression test by pressing the meat surface with the index finger. Meat samples were cut to approximately 25 g and left at room temperature for several minutes before testing. Texture was evaluated based on the degree of elasticity or tenderness upon pressing, and scores were assigned on a scale of 1 to 5. A score of 1 indicates very hard and tough texture, whereas a score of 5 indicates very tender texture that is easily compressed.

Meat Odor

Odor assessment was conducted organoleptically through the researcher's sense of smell. Meat samples were cut and allowed to rest at room temperature for several minutes to release their natural aroma. Testing was performed by directly smelling the meat aroma from close proximity without touching the nose to the sample surface. Assessment used a scale of 1 to 5, where a score of 5 indicates a fresh characteristic beef odor, and a score of 1 indicates a rotten or pungent odor indicating spoilage.

Moisture Content

High moisture content indicates significant moisture in the meat, which can affect shelf life and quality. Meat moisture content was determined using the oven drying method. Approximately 1 g of meat sample was weighed and placed in a porcelain dish with known initial weight. The dish containing the sample was dried in an oven at 105 °C for approximately 16 hours until constant weight was achieved. The dish was then removed, cooled in a desiccator for approximately 30 minutes, and reweighed.

Cooking Loss

Cooking loss assessment was performed by boiling samples in heat-resistant plastic to determine the weight difference before and after treatment. The meat sample was weighed first (initial weight), then placed in special high-temperature-resistant plastic. The plastic containing the meat was boiled in boiling water for approximately 30 minutes. After boiling, the sample was cooled to room temperature, removed from the plastic, and drained. The boiled meat was then weighed again (final weight). The higher the percentage of cooking loss, the more water and fat content lost during the heating process, which can affect meat quality and market value.

Acidity Degree

Meat pH was measured using a digital pH meter by inserting the sample into distilled water (aquadest). Approximately 1 g of fresh meat was placed in a graduated cylinder, and 10 ml of distilled water was added. The mixture was left for approximately 5 minutes at room temperature to achieve stable pH extraction. The pH meter electrode was then inserted into the

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solution, and pH was recorded. Measurements were performed twice: first, immediately after cutting (initial pH), and second, after 24 hours of storage with the same treatment. Changes in pH values can reflect physiological conditions and meat freshness. The normal initial pH for fresh meat ranges from 5.4 to 5.8, while higher pH values indicate easier spoilage or reduced meat quality.

Data Analysis

Data obtained from observations of qurban beef quality at each slaughter location were calculated for mean values, then presented in tables and diagrams for discussion. To determine the relationship between initial pH and shelf life, and between moisture content and both shelf life and cooking loss, simple linear regression analysis and Pearson correlation test were performed. The Pearson correlation test was used to measure the strength and direction of linear relationship between two numerical variables. The correlation coefficient (r) ranges from -1 to +1. Positive values indicate a direct relationship, while negative values indicate an inverse relationship. The closer the absolute value |r| is to 1, the stronger the relationship between variables. A significance value (p-value) < 0.05 indicates that the relationship between variables is statistically significant at the 95% confidence level.

RESULTS AND DISCUSSION

Table 1 shows that the mean values for texture, color, and initial odor of qurban beef differed across the three slaughter locations. Location A had mean texture, color, and odor scores of 3.60, 4.00, and 4.40, respectively, indicating that meat from this location exhibited moderately tender texture, relatively bright color, and comparatively fresh odor. In contrast, Location B had mean scores of 3.40 for texture, 3.20 for color, and 4.80 for odor, suggesting that although texture and color were relatively lower than other locations, the odor was very fresh, likely due to good slaughter and handling practices. Location C had mean scores of 3.80 for texture, 4.00 for color, and 3.80 for odor, indicating generally good meat quality, although the freshness of odor was slightly lower compared to the other two locations. This variation may be attributed to differences in factors such as slaughter time, animal condition prior to slaughter, and sanitation and hygiene at the slaughter locations.

Differences in texture, color, and initial odor scores may be caused by post-cutting handling factors, cleanliness, and environmental temperature at each location. Organoleptic parameters such as texture, color, and odor are primary indicators for assessing meat freshness and quality, as explained by Lawrie and Ledward (2006), who stated that organoleptic changes are early signs of meat quality degradation that can be influenced by environmental temperature, post-cutting handling speed, and equipment cleanliness. Meat quality grades are also differentiated by class. Class I requires bright red meat color with scores 1–5, whereas Class II and III have darker red color with scores 6–7 and dark red color with scores 8–9. Class I fat has white color with scores 1–3, whereas Class II and III have whitish-yellow color with scores 4–6 and yellow color with scores 7–9. For marbling, Class I has scores 9–12, whereas Class II and III have scores 5–8 and 1–4. Texture for Class I, II, and III is fine, medium, and coarse, respectively. Furthermore, SNI 3932:2008 states that fishy odor, pale color, and soft texture are early indicators of declining meat quality (National Standardization Agency, 2008).

Based on Table 2, the mean initial pH values (post-slaughter) of qurban beef from the three slaughter locations ranged from 6.85 to 7.22, whereas after 24 hours of storage at room temperature, pH values increased, ranging from 7.30 to 8.00. This pH increase is a normal phenomenon in the post-mortem process. After the animal is slaughtered, rigor mortis occurs, where muscle becomes stiff within 2–4 hours due to glycogen conversion to lactic acid, causing meat pH to decrease to the range of 5.4–5.7. In this data, pH did not decrease to acidic levels,

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possibly due to suboptimal post-slaughter treatment or high storage temperature, which accelerated microbial activity and slowed lactic acid formation. After the rigor mortis phase, pH begins to increase again with proteolytic enzyme activity and tissue decomposition by microorganisms, producing basic compounds such as ammonia, amines, and other volatile compounds. This pH increase accelerates the growth of spoilage microorganisms, thereby posing risks to shelf life and meat quality. Meat from Location C showed the lowest initial pH (6.85) and the lowest 24-hour pH compared to the other two locations, indicating that meat from this location should have better shelf life and lower microbial contamination.

pH increase in meat is caused by microbial activity that breaks down proteins into basic compounds such as amines and ammonia during decomposition. This phenomenon aligns with Arief *et al.* (2020), who stated that longer meat storage, especially at room temperature, leads to pH increase due to spoilage. Additionally, slaughter sanitation, post-cutting handling, and environmental temperature significantly influence the rate of pH increase. High initial pH also indicates possible pre-slaughter stress, which results in low muscle glycogen and reduced lactic acid production, preventing optimal pH decrease (Lawrie & Ledward, 2014). These results align with the principle that initial meat pH can influence pH dynamics during storage. Meat with high initial pH typically indicates stressed animal conditions prior to slaughter, resulting in limited glycogen reserves and minimal post-mortem lactic acid formation (Lawrie & Ledward, 2014). Consequently, protein degradation and microbial activity can occur more rapidly, accelerating pH increase during storage (Arief *et al.*, 2020).

Table 3 shows that moisture content measurements of qurban beef from the three slaughter locations exhibited different mean variations. Meat moisture content is influenced by various factors such as muscle type, physiological condition of the animal prior to slaughter, slaughter technique, environmental temperature, and storage method. Meat with high moisture content generally has shorter shelf life because high moisture supports the growth of spoilage microorganisms. Conversely, excessively low moisture content can cause meat to become dry and hard. According to the National Standardization Agency (2008), ideal moisture content for fresh beef ranges from 55–75%, depending on muscle type and post-cutting handling. This range indicates that fresh meat naturally has high water content, which plays an important role in determining freshness, texture, and shelf life. Nevertheless, excessively high moisture content can accelerate spoilage by facilitating microbial growth, whereas excessively low moisture content can affect meat tenderness and taste.

Based on Table 4, cooking loss values from the three slaughter locations showed variation in weight reduction after heating. The highest mean cooking loss was found at Location A (28.87%), possibly due to higher initial water and fat content, resulting in greater mass loss during heating. Conversely, the lowest mean cooking loss was found at Location C (24.64%), indicating better meat quality, such as denser muscle tissue structure or lower moisture content. This variation suggests that environmental factors, pre- and post-cutting handling, and initial meat condition can influence weight reduction levels. Putri *et al.* (2021) also stated that moisture content, muscle type, and heating treatment significantly affect meat cooking loss during processing. Therefore, slaughter location and meat condition are critical determinants of processing efficiency and final meat product quality.

Pearson correlation analysis results between moisture content and cooking loss of qurban beef yielded a correlation coefficient of $r = -0.617$ with significance $p = 0.014$ (Figure 1). This value indicates a significant negative relationship between moisture content and cooking loss at the 95% confidence level ($p < 0.05$). This means that higher moisture content in meat results in lower cooking loss during processing or storage. This correlation is classified as strong but in opposite directions, indicating that higher water content can inhibit weight reduction due to fluid loss. These results align with Cahyono and Fitriani (2019), who reported that high moisture content in animal muscle tissue can reduce weight loss during cooking because most water is tightly bound by protein structure. Nurfadilah *et al.* (2020) also stated that water in meat plays an important role as a heat protection medium, so meat with higher moisture content experiences lower cooking loss. Theoretically, this is supported by Warriss (2010), who stated that moisture content is inversely proportional to reduction level because water functions as a physical structure buffer during heat treatment or storage. Therefore, moisture content can serve as an important indicator for assessing physical quality and weight stability of qurban beef after slaughter.

Observation results in Table 5 show the shelf life of qurban beef at room temperature from the three slaughter locations in Palangka Raya City. Observations were conducted every 6 hours until meat showed early signs of spoilage or became unsuitable for consumption. Based on this data, average shelf life differed across the three locations. Location C had the highest mean shelf life of 18 hours, meaning all samples from this location remained suitable for consumption up to 18 hours after slaughter at room temperature. This indicates that post-harvest conditions such as place cleanliness, tool sanitation, distribution speed, and minimal contamination were likely better than the other two locations. Meanwhile, Location B had the lowest mean shelf life of 14.40 hours, indicating that most samples began showing spoilage signs before reaching 18 hours. This may indicate factors accelerating spoilage processes, such as poor sanitation, inadequate hygienic meat handling, or room temperature higher than normal standards. One primary indicator in post-slaughter meat quality assessment is odor, which undergoes significant changes within 12–24 hours at room temperature, marked by sour or rotten odors becoming detectable. Texture reduction also serves as an indicator of microbial spoilage (Rizka *et al.*, 2020).

Observation results in Table 6 show that animal welfare evaluation of qurban animals at the three locations had not met the Five Freedoms principles. For the freedom from pain aspect, all locations still showed use of less-sharp cutting tools, rough handling, and slaughter processes that did not consider animal comfort. For freedom from hunger and thirst, animals were not given access to feed or water before slaughter, indicating insufficient attention to basic animal needs. Animals were also not free from fear and stress. This was evident from slaughter conditions where animals' eyes were not covered, allowing animals to witness other slaughter processes, thereby causing psychological pressure. Freedom from discomfort was inadequately met because animal holding areas were narrow, lacked proper bedding, and provided insufficient protection from heat or rain. Animals had no opportunity to express natural behaviors due to limited movement space (tied with ropes). These conditions indicate that qurban animal slaughter practices at the three locations had not considered good animal welfare standards. Improvements are needed in facilities, proper training, and awareness of the importance of ethical treatment toward animals so that qurban implementation is not only valid according to religious law but also meets ethical and humanitarian principles toward living creatures. This aligns with Yulianto and Handayani (2020), who stated that one often-neglected aspect of animal welfare is feed and water fulfillment, especially due to fasting practices before slaughter that do not meet standards. Additionally, Nugroho *et al.* (2021) confirmed that fasting exceeding 12 hours without water access can cause metabolic stress in qurban cattle. Meanwhile, Khairunnisa and Suwandi (2022) stated that low-stress handling and adequate cutting facilities can significantly improve welfare scores on fear and discomfort parameters. Although all three locations demonstrated commitment to implementing animal welfare principles, improvements are needed, particularly in feed and water management before slaughter, so that assessment scores on these aspects can reach ideal levels.

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CONCLUSION AND SUGGESTIONS

Conclusions

Based on the research results from three qurban cattle slaughter locations in Palangka Raya City, it can be concluded that the implementation of animal welfare principles is still not optimal, particularly regarding feed and water fulfillment, as well as animal comfort before slaughter. A significant correlation was found between moisture content and cooking loss (r = 0.61), indicating significant differences in meat quality that function as an objective indicator of qurban animal welfare levels at each slaughter location. The application of the Five Freedoms principles in the slaughter process ensures comprehensive quality and safety of qurban meat.

Suggestions

To improve qurban meat quality and the implementation of animal welfare, it is necessary to ensure basic animal needs such as feed and water before the slaughter process. Other aspects requiring improvement include sanitation, tool sharpness, animal handling, and meat distribution. Active participation from relevant institutions is crucial to ensure qurban implementation that is compliant with religious law, ethics, and produces safe meat.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the committee and mosque management in Palangka Raya City for their assistance and support throughout the research activity.

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Tables

Table 1. Initial Texture, Color, and Odor Scores of Qurban Beef at Three Slaughter Locations in Palangka Raya City

Replication	Location A			Location B			Location C		
	Texture	Color	Odor	Texture	Color	Odor	Texture	Color	Odor
1	4	4	4	4	4	4	4	4	4
2	3	4	4	3	3	5	4	4	3
3	3	4	5	3	3	5	3	4	4
4	4	4	5	3	3	5	4	4	4
5	4	4	4	4	3	5	4	4	4
Mean	3.60	4.00	4.40	3.40	3.20	4.80	3.80	4.00	3.80

Table 2. pH Values of Qurban Beef

Replication	Location A		Location B		Location C	
	Initial pH	24-Hour pH	Initial pH	24-Hour pH	Initial pH	24-Hour pH
1	7.60	7.90	7.63	8.21	6.26	6.68
2	7.80	8.20	7.68	8.03	7.11	7.90
3	6.90	7.77	7.71	7.99	7.43	7.59
4	7.00	7.90	6.03	7.86	6.59	7.22
5	6.80	8.10	6.99	7.30	6.88	7.09
Mean	7.22	8.00	7.21	7.88	6.85	7.30

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Table 3. Initial Moisture Content of Qurban Beef at Three Slaughter Locations in Palangka Raya City

Replication	Location A	Location B	Location C
	……%		
1	48.2	45.95	24.02
2	50.9	65.94	40.25
3	40.0	36.67	42.90
4	37.06	37.54	51.75
5	38.56	22.80	50.39
Mean	42.92	41.78	41.86

Note: Measured 4 hours post-slaughter

Table 4. Cooking Loss of Qurban Beef at Three Slaughter Locations in Palangka Raya City

Replication	Location A	Location B	Location C
	……%		
1	25.21	29.34	34.57
2	29.33	24.74	24.85
3	27.87	26.88	23.49
4	27.11	25.43	20.29
5	32.82	31.22	20.00
Mean	28.87	27.52	24.64

Table 5. Shelf Life of Qurban Beef at Room Temperature from Three Slaughter Locations in Palangka Raya City

Replication	Location A	Location B	Location C
	……Time……		
1	18	18	18
2	12	12	18
3	12	12	18
4	18	12	18
5	18	18	18
Mean	15.60	14.40	18.00

Note: Observations conducted every 6 hours

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Table 6. Evaluation of Qurban Animal Welfare at Three Slaughter Locations in Palangka Raya City

Five Freedom	Location A	Location B	Location C
Freedom from pain, injury, and disease	The cutting tools were not sharp enough; animals appeared to be in pain.	Animals appeared to be in pain during slaughtering.	Animals were cast down roughly.
Freedom from hunger and thirst	Not provided with food or water prior to slaughtering.	Not provided with food or water prior to slaughtering.	Water and feed were highly limited prior to slaughtering.
Freedom from fear and distress	Animals were visible to the general public, causing them to become agitated.	The environment was noisy and open, causing the animals to become frightened.	Animals appeared agitated because their eyes were not covered during slaughtering.
Freedom from discomfort	The area was cramped and lacked bedding/flooring mats.	The floor was hot and hard, causing discomfort.	There was no shelter provided for the animals.
Freedom to express normal behavior	Unable to express normal behavior.	Unable to express normal behavior.	Unable to express normal behavior.

Figure

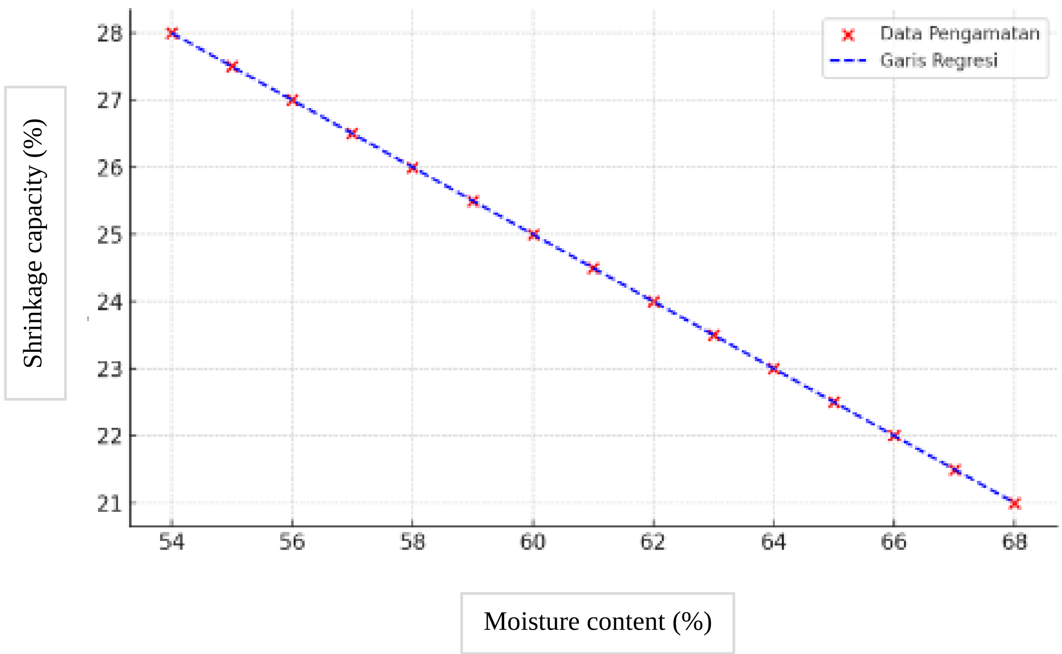

Figure 1. Graph of the Relationship between Initial Moisture Content and Qurban Beef Shrinkage Capacity

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