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Evaluating Animal Welfare Awareness and Practices Among Halal Slaughterers and Slaughterhouse Personnel in Malang Raya, Indonesia

Herawati[1*], Ani Setianingrum[1]

[1] Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Brawijaya, Malang, Indonesia.

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Corresponding Author:
Herawati
herawati58@ub.ac.id

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Abstract: Implementing animal welfare principles is essential for minimizing animal suffering and improving meat quality. Verifying the appropriateness of the slaughtering process is the halal slaughterer's responsibility. This study assessed the knowledge, attitude, and practices (KAP) of slaughterhouse personnel and halal slaughterers (JULEHA) in Malang Raya, East Java, Indonesia. A cross-sectional study used thirty-six closed-ended structural questionnaires, comprising six demographic questions and 10 questions for each knowledge-attitude-practice variables, with 50 respondents. Demographic data was analyzed descriptively, the correlation among demographic variables was analyzed using Spearman's test, and the correlation between KAP was analyzed using Pearson's test and path analysis. Study results showed the overall scores were high, knowledge (4.56, out of 5), attitude (4.13, out of 5), and practice (4.43, out of 5). Significant relationship between Certification and Occupation (ρ=0.32, p=0.026), Training and Occupation (ρ=-0.40, p=0.004), Training and Certification (ρ=-0.72, p<0.001), Attitude and Age (ρ=-0.45, p=0.001), Knowledge and Age (ρ=-0.33, p=0.018). A positive direct association of knowledge toward practice (β=0.68, p<0.001), attitude toward practice (β=0.23, p<0.016), and between knowledge and attitude (β=0.50, p<0.001). Regular training and continuing education are important to ensure animal welfare and produce safe, healthy, intact, and halal meat.

Keywords: Animal welfare; Attitude; Knowledge; Halal slaughterer; Practice; Slaughterhouse personnel

Introduction

According to World Population Review 2025 (WPR, 2025), Indonesia has the world's largest Muslim population. Animal slaughter that adheres to halal principles is an important part of the food industry in Indonesia, and halal certification in animal slaughter is a crucial aspect to ensure the halal status of meat products consumed by the public (Masruroh, 2020). Regulations and standards for halal slaughter are continuously developed to ensure the quality and cleanliness of meat circulating in the market (Faridah, 2019). Pre-slaughter conditions and the slaughtering practice at the ruminant slaughterhouse are important aspects that influence meat quality (Njoga et al., 2023). Factors to consider in the animal slaughtering process following welfare standards encompass unloading the animals from the vehicle to the holding pen, herding them to the slaughtering area, positioning the animals, executing the slaughter, and ascertaining their death (Dirkesmavet, 2021).

Halal slaughter, characterized as the ceremonial way of ruminant slaughter, requires adherence to precise practices following Islamic law or Shari'ah.

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Slaughtering practice involves a specific technique for severing the jugular vein, carotid arteries, esophagus, and trachea while maintaining the animal's consciousness and tranquility during the slaughter process (El-Rahim et al., 2023). The slaughtering process must be conducted in a halal and thoyyib way, yielding safe, healthy, undamaged, and halal meat. The term "halal" signifies that the slaughtering adheres to Islamic law, whereas "thoyyib" indicates that the animal is treated humanely throughout the slaughtering process. In addition, the term thoyyib signifies that animals must be treated with compassion throughout the process, ensuring minimal suffering while upholding stringent standards for hygiene and safety (Maman et al., 2018).

The 'Five Freedoms' are the principles of animal welfare that were first officially declared in 1979 by the Farm Animal Welfare Council in the UK (FAWC, 2009). The World Organization for Animal Health (WOAH) also adopted this internationally recognized declaration on animal welfare, which is known as the five freedoms, consisting of: Freedom from hunger and thirst; Freedom from discomfort; Freedom from pain, injury, and disease; Freedom from fear and distress; and Freedom to express normal behavior (WOAH, 2017). Complying with animal welfare principles during the slaughter of animals is important as it prevents animal suffering and improves meat quality.

In Indonesia, the halal slaughter of animals is regulated by several regulations, including Law No. 33 of 2014 concerning Halal Product Assurance (UURI, 2014); Regulation of the Minister of Agriculture No. 13 of 2010 concerning Ruminant Slaughterhouses (Kepmentan, 2010). Indonesian National Standard (SNI) 99002:2016 on Halal Slaughtering of Ruminants (BSN, 2016), and regulation from Badan Penyelenggara Jaminan Produk Halal (Halal Product Guarantee Organizing Agency or BPJPH) regarding halal slaughtering (BPJPH, 2024). According to the regulations, each ruminant slaughterhouse must employ a halal slaughterer or JULEHA (Juru sembelih halal) with expertise in veterinary public health and animal welfare technicalities. Halal slaughterers (JULEHA) and slaughterhouse personnel must be trained in the mechanical aspects of slaughter and in understanding animal behavior and welfare (Herawati et al., 2025).

Wibowo et al. (2022) assert that training for halal slaughterers can augment their understanding of animals' behavior and suitable killing methods, hence diminishing the likelihood of stress and agony in the animals. Continuing education and mentorship programs are needed to improve the knowledge and competencies of halal slaughterers in guaranteeing the integrity and quality of the products (Edris, 2024). The perspectives of slaughterhouse personnel and halal slaughterers significantly influence animal care procedures. Research indicates that proficient knowledge correlates positively with favorable attitudes in animal handling (Wibowo & Suhardi, 2022). This finding aligns with results indicating that enhanced education can alter the attitudes and behaviors of officers regarding animal care (Winarso et al., 2018). Consequently, ongoing training and instruction are necessary to guarantee that slaughterhouse personnel and halal slaughterers possess attitudes conducive to animal care standards. Investigating animal welfare throughout the slaughtering process and its connection to halal slaughter is crucial for maintaining the sustainability of slaughter practices based on animal welfare principles, ensuring the halal integrity and safety of the meat produced.

This study is novel as it comprehensively evaluates halal slaughterers' knowledge, attitudes, and practices (KAP) in Malang Raya, East Java, Indonesia, emphasizing animal welfare during halal slaughter. This study addresses an important gap by concentrating on the human element—the halal slaughterers (JULEHA), and highlighting how their knowledge and attitudes influence the implementation of animal welfare during the slaughtering process.

This research aims to provide data on slaughterhouse workers' and JULEHA's knowledge, attitudes, and practices (KAP) in Malang Raya, East Java, Indonesia. This study can provide initial information regarding the application of animal welfare principles. Improving knowledge and skills through training and mentoring programs can contribute to better and more humane slaughter practices, ultimately supporting animal welfare and meeting society's need for high-quality halal products.

Method

Study Area

The study was conducted in Malang Raya, East Java province, Indonesia. Malang raya comprises three main regencies: Malang City (located between 112.06° – 112.07° East Longitude and 7.06° – 8.02° South Latitude), Batu City (7°44'– 8°26' South Latitude and 122°17'– 122°57' East Longitude), and Malang Regency (112°17'10.90" to 112°57'00" East Longitude, 7°44'55.11" to 8°26'35.45" South Latitude). The Gadang slaughterhouse in Gadang, Sukun district, Malang City, is an important facility for providing meat in Malang City and the surrounding areas.

Study Design

A cross-sectional study was conducted from July to August 2025 to assess the knowledge, attitude, and practice of JULEHA (halal slaughterers) who serve as sacrificial animal slaughterers during the Eid al-Adha

religious event in Malang Raya. The slaughterhouse personnel were selected from the Gadang Slaughterhouse facility in Malang City, East Java, Indonesia. Purposive sampling was used to select study participants.

Study Population

The target population of the study consisted of halal slaughterers (JULEHA) in Malang Raya and slaughterhouse personnel of Gadang slaughterhouse, Malang City. A total of 50 respondents were included in this study. This sample size is considered acceptable for exploratory cross-sectional research where the aim is to provide an initial understanding of knowledge, attitudes, and practices (KAP) (Johanson & Brooks, 2010).

Data Collection Tools and Procedures

A structured questionnaire was utilized to collect comprehensive data across several key areas. Demographic information was gathered, including participants' age, gender, education level, occupation, JULEHA certification, and training. The questionnaire also assessed animal welfare knowledge by including questions about participants' understanding of the five freedoms principles, animal welfare regulation in Indonesia, animal welfare on the farm, and slaughtering practices. Furthermore, the study explores participants' attitudes towards animal welfare during slaughtering practices, evaluating their perspective on the importance of animal welfare principles and halal slaughtering. Lastly, the questions regarding animal welfare practices focus on animal handling during unloading, animal at lairage, and slaughtering.

The questionnaire consisted of 36 questions, organized into four categories: demographic (6 questions), knowledge (10 questions), attitude (10 questions), and practices (10 questions). Data collection was administered using an online questionnaire using Google Forms. Close-ended 5-point Likert scale questions were used in KAP categories: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree. The questions were in the Bahasa Indonesia language to enhance clarity for the respondents. The 5-point Likert scale enables participants to convey differing levels of agreement or comprehension, yielding more profound insights into the study (Malik et al., 2021).

Ethical Consideration

Participants were given information about the study's purpose and procedures and asked to provide informed consent before participating. Respondent's data was kept confidential, ensuring personal information remained undisclosed in any reports or publications. The Ethical Research Committee of the Faculty of Veterinary Medicine, Universitas Brawijaya, document number 32-KEP-FKHUB-2025, approved the study.

Data Analysis

The study measured the participants' knowledge, attitude, and practice (KAP), and variables included demographic data such as age, gender, education level, occupation, JULEHA certification, and training. Frequency and percentages were used to describe demographic characteristics.

A scoring system was used, assigning 1 point for Strongly disagree, 2 points for disagree, 3 points for neutral, 4 points for agree, and 5 points for strongly agree. The data was cleaned in Microsoft Excel, and all statistical analysis was done in Jamovi (version 2.6), an open-source statistical software.

The precision levels of knowledge, attitudes, and practices were determined by computing the weighted averages and comparing the individual averages with the weighted average. (Keendjele et al., 2024). A non-parametric method, the Spearman correlation test, was used to determine the statistical significance between demographic and KAP variables. Pearson's test determined the correlation between knowledge, practice, and attitude level. The path diagram was constructed using linear regression to illustrate the theoretical relationship among knowledge, attitude, and practice determinants. The significance level for all statistical analyses was set at $P < 0.05$.

Result and Discussion

Questionnaire Reliability

The study evaluating the knowledge, attitudes, and practices (KAP) of slaughterhouse workers and halal slaughterers (JULEHA) regarding animal welfare during slaughtering highlights essential insights into their perceptions and understanding of animal welfare standards. The analysis included validating the questionnaire, ensuring its reliability and appropriateness for capturing the relevant data. The demographic data were excluded from the analysis, and only included knowledge, attitude, and practice questions.

Table 1. Reliability Analysis of the Questionnaire Items Regarding Knowledge, Attitude, and Practice

Variable	No. of items	Cronbach's α
Knowledge	10	0.88
Attitude	10	0.75
Practice	10	0.79

Table 1 shows the Cronbach's alpha value for knowledge, attitude, and practice, which range from

0.75 to 0.88, indicating high internal consistency for the questionnaire, suggesting that the items used to assess KAP toward animal welfare were reliable. Specifically, a Cronbach's alpha of 0.70 or higher is widely accepted as an indicator of satisfactory internal consistency (Kennedy, 2022). These results indicate that the questionnaire instrument in this study can be used for further research with a larger target of respondents.

Demographic Characteristics of the Participants

The demographic characteristics are presented in Table 2. The respondents indicate a significant gender disparity, with 98% being male and only 2% female, highlighting a predominantly male workforce among halal slaughterers and slaughterhouse personnel in Indonesia. The gender imbalances commonly observed in the meat handling sector are consistent with the study findings by Ahad et al. (2025).

Table 2. Demographic of the Respondents (n=50)

Variables	Frequency	Percentage
Gender		
Male	49	98%
Female	1	2%
Age		
18-25 years	5	10%
26-35 years	8	16%
36-45 years	12	24%
46-50 years	10	20%
>50 years	15	30%
Education		
Elementary school	1	2%
Junior high school	3	6%
Senior high school	24	48%
Bachelor's degree	22	44%
Occupation		
Employee	20	40%
Self-employed	30	60%
Juleha certification		
Certified	34	68%
Not certified	16	32%
Trainings		
Juleha training	38	76%
Slaughtering practice	12	24%

The age distribution of halal slaughterers is critical to understanding the workforce dynamics; the majority were older individuals, aged 36-45 years (24%), 46-50 years (20%), and over 50 years (30%). Older workers could possess more experience and traditional knowledge vital for ensuring halal standards and animal welfare (Jalil et al., 2018).

Regarding education level, most respondents were graduates from senior high school (48%) and have a bachelor's degree (30%), indicating a relatively educated workforce, which may positively influence their understanding and implementation of halal practices and animal welfare principles. Some respondents had completed elementary school (2%) and junior high school (6%), highlighting the need for continuous education and training to align traditional practices with contemporary standards. 40% of the respondents were employees, and 60% were self-employed, suggesting that JULEHA is a side profession. This trend reflects the increasing demand for halal products among Indonesian consumers, driven by religious beliefs and an emphasis on food safety and animal welfare.

Non-formal education is pivotal for the halal slaughtering profession. The high public demand for safe, healthy, intact, and halal animal-derived food products, especially meat, also requires professionals in animal slaughter and halal assurance to improve their competencies continuously. Among the respondents, 68% were certified as halal slaughterers (JULEHA), and 76% have experience participating in Juleha training. Previous research shows that JULEHA training effectively supports human resource development and strengthens the halal ecosystem (Herawati et al., 2025).

Knowledge of Respondents Towards Animal Welfare

The participants' knowledge is summarized in Table 3. Most participants in this study acknowledged the five freedom principles of animal welfare during the slaughtering process. 66% of the participants strongly agree, and 14% agree that livestock should be allowed to rest in lairage, given adequate water, and provided with food if it is held for more than 12 hours before slaughtering. A majority (78% strongly agree and 14% agree) indicated that respondents understand the freedom from animal discomfort at slaughtering by designing a lairage that ensures animals rest comfortably to recover from transport stress. A total of 86% of the respondents (76% strongly agree, 10% agree) know the importance of implementing proper handling and restraint of the animals before slaughter, the use of stunning devices, and sharp knives during slaughter. The participants (86%; 76% strongly agree; 14% agree) also understand the implementation of freedom from fear and distress principles during slaughtering by not mistreating animals from arrival until the slaughter process.

Regarding the freedom to express normal behavior, most respondents strongly agree (72%) and agree (22%) that holding pens should allow animals to move freely. Animals are grouped by species, and aggressive animals should be separated. Most respondents know that in Indonesia, animal welfare is regulated by law (68% strongly agree, 26% agree), and animals are sentient (74% strongly agree, 20% agree). Most respondents were aware that animals with a good body condition score (BCS) indicate good welfare at the farm (70% strongly agree, 22% agree). The highest score shows the

respondents understand the importance of complete bleeding to meat quality (88% strongly agree, 6% agree). While 88% (70% strongly agree, 18% agree) were aware that animal pre-slaughter stress and fatigue can adversely impact meat quality and increase the risk of contamination.

The study reported that high and low perceptions toward animal welfare during slaughter were equal. In this study, the low perception includes freedom from hunger and thirst; freedom from pain, injury, and diseases; freedom from fear and distress; knowledge about welfare on the farm; and pre-slaughter stress on meat quality. Research by Fuseini et al. (2022) also shows a noticeable gap in understanding the specific requirements of halal slaughter practices, particularly concerning stunning and handling procedures.

Table 3. Knowledge of the Respondents Toward Animal Welfare

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD	Perception level
Freedom from hunger and thirst. Livestock in lairage were provided adequate water; if held more than 12 hours before slaughter, they should be given food	3 (6%)	2 (4%)	5 (10%)	7 (14%)	33 (66%)	4.30	1.18	low
Freedom from discomfort. Livestock lairage pens are built to ensure the animals' comfort and prevent injury.	3 (6%)	0 (0%)	1 (2%)	7 (14%)	39 (78%)	4.64	0.08	high
Freedom from pain, injury, and disease. It is important to carry out proper handling and restraint before slaughter; the use of stunning devices, and the use of sharp knives during slaughter	3 (6%)	2 (4%)	2 (4%)	5 (10%)	38 (76%)	4.46	1.15	low
Freedom from fear and distress. Animals are not treated harshly; sick animals are placed in an isolation pen, animals are not slammed, stepped on, or have their tails pulled before slaughter, and restraint boxes are used during the slaughtering process.	2 (4%)	3 (6%)	0 (0%)	7 (14%)	38 (76%)	4.52	1.05	low
Freedom to express normal behavior. Pens are designed to allow animals to turn around and lie down, and animals are grouped according to species. Horned and aggressive animals are separated.	1 (2%)	0 (0%)	2 (4%)	11 (22%)	36 (72%)	4.62	0.75	high
In Indonesia, animal welfare is regulated by law and government regulations.	1 (2%)	0 (0%)	2 (4%)	13 (26%)	34 (68%)	4.58	0.76	high
Animals are sentient.	0 (0%)	1 (2%)	2 (4%)	10 (20%)	37 (74%)	4.66	0.66	high
Livestock with a good body condition score indicates a good level of welfare on the farm.	1 (2%)	1 (2%)	2 (4%)	11 (22%)	35 (70%)	4.56	0.84	low
Proper slaughter with complete bleeding affects meat quality.	1 (2%)	1 (2%)	1 (2%)	3 (6%)	44 (88%)	4.76	0.77	high
Stress and fatigue in animals before slaughter can affect meat quality and cause meat to spoil easily.	1 (2%)	0 (0%)	5 (10%)	9 (18%)	35 (70%)	4.54	0.84	low
Weighted mean						4.56		

SD: standard deviation.
Perception: comparison of the mean and weighted mean, where the weighted mean = sum of the means/10 statements.

Attitude of Respondents Towards Animal Welfare

Most of the individual items of attitude level of respondents compared with the weighted mean were high (Table 4). However, the second item of the attitude question was inversely scored, due to a higher response (strongly agree), indicating a less desirable attitude, and was assigned a lower score. The low perception was regarding the respondents' belief that beating animals was more efficient than being ordered. According to Wibowo et al. (2021), aggressive methods lead to heightened animal stress levels, which can harm their health. Long-term stress before slaughter leads to muscle glycogen consumption, resulting in less lactic acid production post mortem. The lack of lactic acid results in dark, firm, and dry (DFD) meat, which is less desirable (FAO, 1991). Additionally, stress can impair the welfare of animals, raising ethical concerns about humane slaughter practices (Rahman, 2017).

The attitude question item concerning stunning animals before slaughtering as a better practice for minimizing pain was given a low perception level. The respondents' answers were strongly disagree (24%), disagree (22%), and neutral (26%). These findings were aligned with Riaz et al. (2021), stating that some traditional halal practices oppose pre-slaughter stunning, asserting that it contradicts religious

requirements. Nevertheless, studies have shown that effective stunning ensures a rapid loss of consciousness, which minimizes the animal's welfare concerns (Cenci-Goga et al., 2010). Also, effective stunning contributes to better meat quality by reducing animal stress-induced conditions (Grandin, 2013).

Table 4. Attitude of the Respondents Towards Animal Welfare

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD	Perception level
Ability to herd livestock from one place to another.	1 (2%)	1 (2%)	12 (24%)	12 (24%)	24 (48%)	4.14	0.99	high
Animals are more obedient when beaten than when ordered.*	16 (32%)	10 (20%)	18 (36%)	3 (6%)	3 (6%)	3.66	1.17	low
It is important to keep animals healthy before slaughter.	0 (0%)	0 (0%)	1 (2%)	5 (10%)	44 (88%)	4.86	0.41	high
Animal welfare training is essential for JULEHA and slaughterhouse staff.	0 (0%)	0 (0%)	2 (4%)	4 (8%)	44 (88%)	4.84	0.47	high
The government needs to provide financial support to improve animal welfare at slaughterhouses.	2 (4%)	0 (0%)	2 (4%)	9 (18%)	37 (74%)	4.58	0.91	high
Slaughtering animals according to Islamic law (halal) does not cause pain and suffering to animals.	1 (2%)	0 (0%)	0 (0%)	6 (12%)	43 (86%)	4.82	0.52	high
Stunning before slaughter is better than not stunning them.	12 (24%)	11 (22%)	13 (26%)	4 (8%)	10 (20%)	2.78	1.43	low
Ability to quickly identify the condition of sick animals before slaughter.	0 (0%)	2 (4%)	10 (20%)	13 (26.0%)	25 (50%)	4.22	0.91	high
Slaughtering at a slaughterhouse is better than slaughtering outside the slaughterhouse (on the farm, etc.).	3 (6%)	1 (2%)	3 (6%)	17 (34%)	26 (52%)	4.24	1.08	high
Practical rules (SOP) or guidelines for emergency slaughter at the slaughterhouse must exist.	2 (4%)	0 (0%)	3 (6%)	10 (20%)	35 (70%)	4.52	0.93	high
Weighted mean						4.13		

*Inverse scored, SD: standard deviation
Perception: comparison of the mean and weighted mean, where the weighted mean = sum of the means/10 statements

Practice of Respondents Towards Animal Welfare

In this study, the attitude level of the respondents was mainly high (Table 5). Three question items give low perceptions of practices. These include the practice of herding the animals during the slaughter process and the skill to restrain and perform the animal lying down technique. According to Badu et al. (2021), skilled operators familiar with animal behavior can significantly reduce stress during handling and restraint processes. In slaughterhouse operations, it is essential to employ restraint techniques that guarantee worker safety and animal welfare (Abdullah et al., 2019). An important prerequisite for competent animal handling is the education and training of slaughterhouse personnel and halal slaughterers, ensuring familiarity with appropriate techniques (Setiawan et al., 2023).

Another low perception was regarding the effect of the pre-medication of animals before slaughter on meat quality. Interestingly, more than half of the respondents (32.0% strongly agree, 24.0% agree, 14.0% neutral) believe, or have a neutral opinion, that medication or vaccine given to animals pre-slaughter does not affect meat quality. The administration of medications or vaccination in livestock before slaughter presents considerable issues related to meat quality, safety, and adherence to food regulations, particularly concerning the requirement for withdrawal periods. Withdrawal time denotes the duration necessary before the slaughter of an animal post-medication, ensuring that drug residues are eliminated from the meat to levels that are not harmful to consumers (Lin et al., 2016).

Table 5. Practice of the Respondents Toward Animal Welfare

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD	Perception level
A health check is performed upon the animal's arrival before slaughter to ensure its welfare.	1 (2.0%)	0 (0.0%)	4 (8.0%)	7 (14.0%)	38 (76.0%)	4.62	0.81	high
Animals are carefully unloaded from the vehicle to ensure the safety of both the animal and the staff.	1 (2.0%)	0 (0.0%)	2 (4.0%)	4 (8.0%)	43 (86.0%)	4.76	0.72	high
Animals experiencing lameness or broken legs during unloading from the vehicle cause stress.	0 (0.0%)	3 (6.0%)	1 (2.0%)	13 (26.0%)	33 (66.0%)	4.52	0.81	high
Effective animal herding involves no hitting, whipping, or pulling.	3 (6.0%)	1 (2.0%)	3 (6.0%)	7 (14.0%)	36 (72.0%)	4.44	1.11	low
Animals should be kept at a lairage before slaughter.	0 (0.0%)	2 (4.0%)	2 (4.0%)	5 (10.0%)	41 (82.0%)	4.7	0.74	high
A veterinarian or veterinary paramedic performs an antemortem examination before slaughter.	1 (2.0%)	3 (6.0%)	2 (4.0%)	6 (12.0%)	38 (76.0%)	4.54	0.97	high
I know and can perform the correct animal lying down technique.	1 (2.0%)	1 (2.0%)	5 (10.0%)	10 (20.0%)	33 (66.0%)	4.46	0.91	low
I know and can perform the halal slaughter process according to Islamic law.	0 (0.0%)	1 (2.0%)	0 (0.0%)	6 (12.0%)	43 (86.0%)	4.82	0.52	high
I can ensure the animal dies completely after slaughter.	1 (2.0%)	0 (0.0%)	1 (2.0%)	5 (10.0%)	43 (86.0%)	4.8	0.57	high
Medication and vaccination before slaughter do not affect the quality and safety of the meat produced.*	10 (20.0%)	5 (10.0%)	7 (14.0%)	12 (24.0%)	16 (32.0%)	2.62	1.52	low
Veighted mean						4.43		

*Inverse scored, SD: standard deviation
Perception: comparison of the mean and weighted mean, where the weighted mean = sum of the means/10 statements

Association between Demographic Factors and Knowledge, Attitudes, and Practices in Animal Welfare

The association between demographic factors and KAP scores was analyzed using Spearman's correlation test. The analysis showed five significant relationships ($p<0.05$) illustrated in Figure 1.

The negative correlation between attitude and age ($\rho=-0.45$, $p=0.001$) suggests that older respondents tend to have a lower attitude toward animal welfare. Moreover, knowledge and age also negatively correlated ($\rho=-0.45$, $p=0.001$). A consistent finding across various studies is the negative correlation between age and knowledge about animal welfare, indicating that younger respondents typically demonstrate broader awareness and more favorable attitudes towards humane practices in animal handling and slaughter (Carnovale et al., 2022; Li et al., 2018).

Demographic factor of training negatively correlates to occupation $\rho=-0.40$, $p=0.004$), and certification ($\rho=-0.72$, $p<0.001$). This result indicates that employed respondents had less training than the self-employed. This study's respondents were primarily self-employed workers who served as halal slaughterers (Table 1). Training is a fundamental component in the development and implementation of halal slaughterers. Sari and Dini (2023) recommend that slaughterers be provided with training highlighting the importance of adhering to halal practices and minimizing contamination risks. Negative correlation between training and certification implies that not all respondents who undergo JULEHA or slaughtering practice training were certified as halal slaughterers (JULEHA). Hardi et al. (2024) recommend that to meet halal slaughterers' competency, a mentoring and assistance program should be implemented to obtain certification according to national standards.

One positive correlation between certification factor and occupation ($\rho=0.32$, $p=0.026$) suggests that certified JULEHA tend to gain more jobs. Zainalabidin et al. (2019) highlighted that organizations involved in halal meat production require certified personnel to ensure compliance with halal standards throughout their supply chain, from farm practices to the final processing stage. This necessity creates increased job opportunities for certified slaughterers, indicating a direct correlation between certification and employment prospects in the halal meat industry.

A Pearson correlation analysis was conducted to assess the relationship between the total score of the KAP scales (Table 6). There was a significant positive association between respondents' knowledge and attitude toward animal welfare ($r=0.50$, $p<0.01$), suggesting that high awareness of animal welfare influences the appropriate attitude. Similarly, there was a strong positive association between respondents' knowledge and practice ($r=0.79$, $p<0.01$), suggesting that

good knowledge influences slaughtering practices. Good practices also had a strong and positive correlation with desirable attitudes (r = 0.57, p < 0.01).

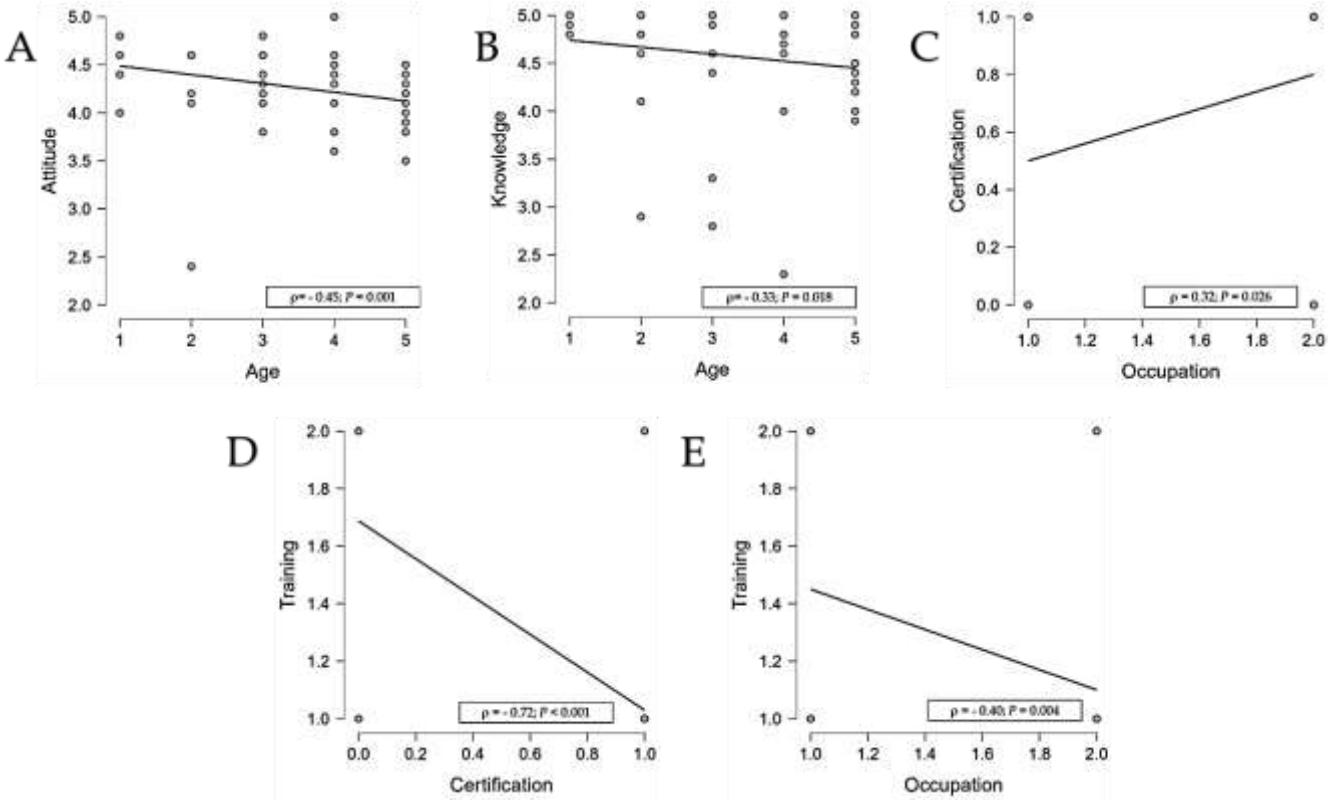

Figure 1. Scatter plot graphs illustrate Spearman's significant correlation between demographic and KAP variables. A (attitude-Age), B (knowledge-age), C (certification-occupation), D (training-certification), E (training-occupation) Correlation analysis between knowledge, attitude, and practice

Table 6. Correlation between Knowledge, Attitude, and Practice of the Respondents

		Knowledge	Attitude	Practice
Knowledge	Pearson's *r*	—		
	p-value	—		
Attitude	Pearson's *r*	0.50***	—	
	p-value	< .001	—	
Practice	Pearson's *r*	0.79***	0.57***	—
	p-value	< .001	< .001	—

* p < .05, ** p < .01, *** p < .001

This study result corresponds with Hötzel et al. (2018), stating that increased education on animal behavior and welfare issues can positively influence the implementation of humane slaughter practices. According to Lipovšek et al. (2024), individuals committed to improving animal welfare reflect a positive attitude and motivate them to adopt better practices in their daily operations.

Path Relationship between Knowledge, Attitude, and Practice

The path analysis in this study examined the causal relationship among the KAP variables of respondents toward animal welfare during slaughter. Table 7 presents the regression estimates for path analysis. Fig. 1 illustrates the direct relationship between the variable of KAP. The number on the arrow represents standardized β coefficients, indicating the relative strength of the relationship. In this study, knowledge demonstrates the most substantial positive influence on practice (β=0.68, p<0.001). The proposed path model demonstrated a good fit to the data, RMSEA= 0.0; CFI= 1.00; TLI= 1.00. These results suggest that the hypothesized relationship between knowledge, attitude, and practice adequately represents the observed data structure.

Table 7. Regression Parameter Estimates between Knowledge, Attitude, and Practice

Path relationship	Coefficient β	p-value
Knowledge - Practice	0.68	<0.001
Attitude – Practice	0.23	0.016
Knowledge - Attitude	0.50	<0.001

Path analysis also highlighted the significant direct effects of knowledge on attitudes and the positive effects

of both knowledge and attitudes on practices. These results suggest that slaughterhouse workers and JULEHA with greater knowledge of animal welfare exhibit more positive attitudes and are more likely to engage in practices that help them implement humane treatment practices, ultimately leading to better animal welfare and meat quality standards.

The results indicate that knowledge and attitude positively influence practice, with standardized path coefficients of 0.68 and 0.23, respectively. The findings suggest that slaughterers with a comprehensive understanding of animal welfare principles are more inclined to exhibit appropriate practices during slaughtering. A favorable attitude toward animal welfare also reinforces humane handling and slaughtering behaviors.

The significant relationship from knowledge to practice (β=0.68) indicates that cognitive understanding is a key factor influencing the practical behavior of slaughterers. Knowledgeable slaughterers, who understand how to minimize animal pain, implement proper restraint, and maintain knife sharpness, are more effective in applying these principles during the halal slaughter process. The finding is consistent with prior studies indicating that training and education markedly enhance compliance with animal welfare standards in slaughterhouses (Descovich et al., 2019; Hötzel et al., 2018).

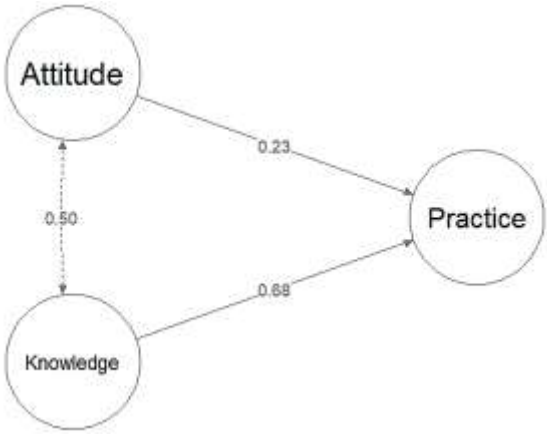

Figure 2. Pathway model illustrating the relationship between Knowledge, Attitude, and Practice (KAP)—path coefficient (β) shown by the number in the arrow

The influence of Attitude on Practice (β = 0.23) suggests that while positive perceptions and empathy toward animals enhance welfare-oriented practices, these attitudes alone may be inadequate without sufficient technical knowledge. The study result suggests that animal welfare behavior changes necessitate ethical understanding and practical skills. The moderate positive correlation between knowledge and attitude (r = 0.50) indicates that more knowledgeable slaughterers are likely to have more favorable attitudes toward animal welfare (Erian et al., 2019).

Cultural and personal factors significantly shape perceptions of animal welfare. A study indicated that slaughterhouse officers' perceptions of stunning and humane handling were influenced by their prior experiences and positions within the food production system (Fuseini et al., 2019). As advocated in various studies, enhanced training that includes welfare discussions and guidelines could strengthen workers' understanding and application of humane practices (Aghwan et al., 2016), highlighting the necessity of ongoing dialogue between Islamic scholars, animal welfare researchers, and halal practitioners to reconcile differing views and create a more integrated welfare approach (Fuseini et al., 2022).

Conclusion

The level of knowledge, attitude, and practice of JULEHA and slaughterhouse personnel in this study was sufficient, with a strong correlation between KAP variables and a positive direct association of knowledge and attitude toward practice, as well as between knowledge and attitude. Regular training and continuous education programs for JULEHA and slaughterhouse personnel are important to implement animal welfare principles and maintain the quality of meat produced from halal slaughtering.

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Author Contributions
Conceptualization, H and A.S.; methodology, H and A.S.; formal analysis, A.S.; investigation, H.; resources, H.; data curation, A.S.; writing—original draft preparation, A.S.; writing—review and editing, H and A.S.; funding acquisition, H. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest. The funders had no role in the study's design; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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