

Divergent Strategies for Halal Meat Production: A Comparison of Halal Slaughtering Practices in Muslim and Non-Muslim Countries

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ABSTRACT

The increasing global demand for halal meat, propelled by the expanding Muslim population and heightened consumer awareness, has transformed halal meat production into a profitable sector for both Muslim and non-Muslim countries. This increase has prompted questions regarding the integrity of halal slaughtering practices (HSPs), particularly in light of claims of fraud and inconsistencies. This study is an attempt to provide a comparative review of HSPs in Muslim countries (Brunei, Malaysia, Indonesia) and non-Muslim countries (Australia, United Kingdom), concentrating on pre-slaughter, slaughter, and post-slaughter procedures. The study used qualitative approaches, combining semi-structured interviews with stakeholders with document analysis of guidelines, certification and standards. The data were analysed thematically to uncover cross-country similarities and differences in HSPs. Principal issues encompass divergent interpretations of Islamic law, inconsistency in certification criteria, and disagreements on techniques such as stunning. The study emphasises the necessity of standardising halal regulations to fulfil religious requirements and enhance consumer confidence, providing suggestions for the advancement of global halal standards governance.

INTRODUCTION

The global halal meat market is seeing outstanding expansion, anticipated to increase from USD 266 billion in 2022 to USD 724 billion by 2032 (Jelan et al., 2024). This increase is propelled by the growing Muslim demographic, heightened consumer awareness, and escalating worldwide meat consumption. The transition from conventional slaughtering techniques to industrialised and mechanised processes, especially in non-Muslim countries, presents intricate issues with adherence to Islamic norms (Arshad et al., 2022; Nawawi & Peristiwio, 2022).

Moreover, halal slaughter must adhere to particular religious standards, but interpretations vary by region due to differing jurisprudential schools (*madhhabs*) and regulatory frameworks (Abdallah et al.,

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2021). Additionally, non-Muslim countries such as Australia and the United Kingdom (UK) have become significant exporters of halal products; yet, their policies have faced criticism for potential deviations from religious compliance, frequently emphasising efficiency and profit (Azam & Abdullah, 2021).

This study therefore examines the similarities and differences in HSPs among selected Muslim and non-Muslim countries, evaluating the integrity, safety, and religious adherence of halal meat production. The objective is to enhance policy, fortify regulatory structures, and promote standardisation initiatives to guarantee that halal meat production is both religiously compliant and ethically produced.

LITERATURE REVIEW

In the last fifty years, worldwide meat consumption has increased by more than 300%, primarily due to population expansion, urbanisation, and rising income levels. The halal meat market, a crucial segment of the halal industry, was valued at USD 266 billion in 2022 and is anticipated to attain USD 724 billion by 2032, indicating a compound annual growth rate (CAGR) of 9.7% (Jelan et al., 2024).

For Muslims, the consumption of halal meat is both a dietary preference and a religious obligation mandated by Islamic law. The principle of *halalan thayyiban*, signifying lawful and wholesome, underlies meat intake (Mohd Daud et al., 2023). This encompasses not just the slaughter process but also the animal's health, living environment, nutrition, handling, and general treatment. Thus, halal slaughter must be conducted by a competent Muslim, include the invocation of Allah's name, and avoid procedures that inflict unnecessary harm (Aghwan & Regenstein, 2019; Al-Teinaz, 2020). Consequently, halal meat certification must integrate ethical principles, spirituality, and food safety, guaranteeing that the meat is both religiously acceptable and hygienically secure.

Moreover, meat supplies vital nutrients such as proteins, amino acids (e.g., tryptophan, threonine, lysine), iron, zinc, and vitamins B12 and B6 (Awan & Sohaib, 2016). Nonetheless, it is vulnerable to contamination via microbiological, biochemical, and chemical pathways, potentially resulting in foodborne illnesses such as salmonellosis, avian influenza, and bovine spongiform encephalopathy (BSE) (Zulfakar et al., 2019). Ensuring the safety and integrity of halal meat therefore necessitates strict compliance with sanitary protocols and religious guidelines.

Animal Welfare in Halal Meat Production

The welfare of animals is fundamental to Islamic teachings and is becoming seen as a global issue associated with sustainability, ethics, and food quality (Aghwan, 2021; Hasnal & Aghwan, 2025). Substandard welfare conditions can elicit considerable physiological and biochemical stress reactions in animals, thereby impacting meat quality, public perception, and economic value (Azhar Alam et al., 2024). The World Organisation for Animal Health (WOAH) and Islamic jurisprudence both promote humane treatment across all phases of meat production. Islamic law acknowledges animal rights, encompassing their entitlement to proper nourishment, humane treatment, and protection from unnecessary pain (Sinclair et al., 2023).

Consequently, Council Directive 93/119/EC was enacted in the EU on 22 December 1993, addressing the protection of animals during slaughter, including their transport, housing, restraint, and stunning. This directive pertains to animals raised for meat, skin, fur, or other products, as well as to procedures utilised for the death of animals for disease management (Velarde et al., 2014). The emphasis on animal welfare applications pertains to the five freedoms in livestock management: freedom from hunger and thirst, freedom from discomfort, freedom from suffering, freedom from harm, and freedom from disease (Lestari et al., 2022).

Not only that, direct human interaction during carcass handling, meat deboning, and packaging heightens the probability of post-slaughter complications concerning product quality and cleanliness, in addition to animal welfare and cruelty issues that may arise during pre-slaughter handling. The storage,

distribution, transportation, and retail sale of meat products also represent further potential sources of contamination and degradation (Jelan et al., 2024).

i. Pre-Slaughter Handling

Stress during transportation and lairaging is a significant issue. Animals frequently endure extensive journeys without sufficient food or water, exposure to extreme temperatures, overcrowding, and rough handling (Fuseini et al., 2022). These variables diminish glycogen stores, resulting in Dark, Firm and Dry (DFD) or Pale, Soft and Exudative (PSE) meat, which is less appetising, has a reduced shelf life, and is more prone to microbial deterioration (Awan & Sohaib, 2016).

Although fasting diminishes the likelihood of gastrointestinal contamination, prolonged fasting may lead to weight loss and adversely impact meat flavour. Optimal fasting durations, typically ranging from 12 to 18 hours based on species, must be reconciled with animal welfare and product quality factors. Empirical studies indicate that excessive fasting diminishes carcass and liver weight, depletes muscle glycogen, and compromises meat flavour. One example demonstrated that elevated pH levels (6.4–6.8) result in DFD meat, whereas too quick lactic acid production leads to PSE meat characterised by low pH values (Abd El-Rahim, n.d.).

ii. During Slaughter Handling

Halal slaughter, as stipulated by the Codex Alimentarius and Islamic law, must be executed swiftly and accurately, utilising a sharp knife to sever the trachea, oesophagus, carotid arteries, and jugular veins while preserving the integrity of the spinal cord (Miskam et al., 2015). Meanwhile, some Islamic authorities approve stunning, providing it is non-lethal and reversible and reversible head-only electrical stunning is usually favoured in regions like Malaysia and UK. Additionally, Fuseini et al. (2022) indicates that effective stunning lowers cortisol levels and muscle activity during slaughter, consequently enhancing meat softness and colouration.

Nonetheless, divergent scholarly perspectives endure across locations, requiring customised policy adjustments. The orientation of the animal during slaughter, whether vertical or horizontal, influences blood drainage, a crucial element in preserving meat quality (Awan & Sohaib, 2016). For example, horizontal slaughter has been associated with increased blood drainage, but commercial facilities often employ vertical shackling. The disconnection of major vessels obstructs cerebral blood circulation, causing the animal to lose consciousness within seconds, thereby enabling painless exsanguination. Cutting procedures and knife length therefore must align with the animal's neck proportions to reduce pain and improve meat quality (Abd El-Rahim, n.d.).

iii. Post-Slaughter Activity

The post-slaughter processes include dehiding, evisceration, chilling, and distribution. All are essential for maintaining meat quality and achieving halal compliance (Buana Iskandar, 2023). Contamination may arise from inadequate sanitation, shared equipment, or human error; therefore, the implementation of distinct halal processing lines, traceability mechanisms, and trained workers is necessary.

Furthermore, studies indicate that efficient blood extraction, achieved by preserving spinal cord integrity, diminishes bacterial proliferation and improves meat colouration and longevity (Awan & Sohaib, 2016). Regulatory standards like ISO 22000 and HACCP must be incorporated into halal processing to guarantee compliance and safety. Storage and transportation facilities must adhere rigorously to halal standards to avoid cross-contamination (Buana Iskandar, 2023). Any interaction with non-halal products, like pork or inadequately butchered animals, renders the product non-halal.

Overview of Halal Meat Productions in Muslim Countries

Brunei

Brunei's halal governance structure is one of the most centralised and rigorous globally. According to the Halal Meat Act (CAP 183) and the Halal Certificate and Halal Label Order (2005), only meat that is certified and supervised by the Brunei Islamic Religious Council (MUIB) and other governmental entities is permitted for importation or sale. Every consignment of imported meat necessitates on-site verification by MUIB personnel, who are required to observe the slaughter process in the exporting countries. The Inspection Committee, comprising officials from MUIB, the State Mufti Department, and the Department of Agriculture and Agrifood (DoAA), guarantees rigorous adherence to Islamic law and safety regulations. Overseas facilities must undergo comprehensive inspections prior to receiving approval for export to Brunei. Importers are required to be Muslim and adhere to labelling regulations by prominently displaying the MUIB's approved halal logo. To maintain food integrity, carcasses that do not pass inspection are either discarded or allocated for animal feed (Haji Ibrahim, 2022; Mohd Raffi, 2020).

Malaysia

Malaysia's Department of Islamic Development (JAKIM) is the exclusive authority for halal certification in Malaysia (Abdul Jalil et al., 2018). The country enforces the Malaysian Standard MS1500:2019, which delineates the comprehensive standards for the production, preparation, handling, and storage of halal food (Ruzulan et al., 2021). In Malaysia, slaughterers are required to be practicing Muslims, and stunning is allowed provided it is pneumatic, non-penetrative, reversible, and conducted under supervision. JAKIM partners with the Department of Veterinary Services (DVS) and the Ministry of Health to do joint inspections, while the Food Safety Information System of Malaysia (FoSIM) will authenticate imported halal products (Mohd Riza et al., 2022; Sahari et al., 2024). Nonetheless, recent halal scandals with mislabelled meat have intensified public awareness and prompted regulatory reforms and more stringent enforcement. In 2017, Malaysian Quarantine and Inspection Services (MAQIS) confiscated four containers containing a dubious combination of pig and mutton (Ruzulan et al., 2021). Additionally, the 2020 "halal meat cartel" controversy revealed illicit importation of non-halal meat, significantly diminishing public trust (Bernama, 2021).

Indonesia

Indonesia mandates halal certification by Law No. 33/2014, executed by the Halal Product Assurance Agency (BPJPH) (Buana Iskandar, 2023). Certification encompasses pre-market audits, laboratory testing conducted by the Assessment Institute for Foods, Drugs, and Cosmetics – Indonesian Ulema Council (LPPOM-MUI), and routine factory inspections. Mechanical slaughter is permissible provided it adheres to Islamic principles and incorporates the reciting of prayers. A halal supervisor is required to monitor the process, and enterprises must regularly renew their certification. The certification process in Indonesia is distinguished by its multi-stakeholder approach and robust legislative framework (Lestari et al., 2022). Both foreign and domestic producers must adhere to these criteria, which further establishing Indonesia as a paradigm for extensive halal control.

Overview of Halal Meat Productions in Non-Muslim Countries

Australia

Australia ranks among the major exporters of halal meat globally, especially to Southeast Asian and Middle Eastern markets. The Australian government acknowledges more than 20 Approved Islamic Organisations (AIOs) authorised to perform halal certification in accordance with the Export Control Act 2020 (Naznii, 2023). These AIOs collaborate with the Department of Agriculture, Fisheries and Forestry (DAFF) to oversee halal slaughter, educate personnel, and guarantee product segregation. Halal certifiers are required to do periodical assessments and authorise halal programs executed by meat processors. An Approved Arrangement (AA) guarantees the segregation of halal and non-halal meat during production,

storage, and distribution (Sahari et al., 2022). Domestic halal production is not subject to the same regulations; yet, the majority of businesses still favour certification for market growth. AIOs also provide instruction for halal slaughtermen and assess their religious competence to maintain standards.

United Kingdom

UK possesses a fragmented but dynamic halal certification ecosystem, featuring organisations such as the Halal Monitoring Committee (HMC) and the Halal Food Authority (HFA) (Yakar, 2021). All slaughter must take place at approved establishments under the supervision of the Food Standards Agency (FSA). In UK, regulatory focus is directed towards animal welfare, religious liberty, and food safety. HFA permits stunning for poultry and small ruminants, but not for large animals (Fuseini et al., 2022). The proportion of small ruminants rendered insensible before halal slaughter decreased from 90% in 2011 to 75% in 2015, reflecting changes in industrial practices and research debates (Fuseini et al., 2022).

Challenges of Current HSPs for Halal Meat Production

Notwithstanding progress, halal meat production has persistent obstacles. Scandals like the 2020 Malaysian meat cartel, in which non-halal meat was misrepresented and marketed as halal, underscore systemic weaknesses (Bernama, 2021). In 2017, four containers believed to contain pork-mutton mixes were seized, prompting significant concerns (Ruzulan et al., 2021). In Thailand, pork meat smeared in ox blood was discovered being marketed as halal (Dashti et al., 2024). These shortcomings indicate insufficient enforcement and oversight at pivotal junctures in the supply chain.

The absence of worldwide harmonisation in halal standards exacerbates the challenge for exporters to satisfy the varied criteria of each importing nation (Sahari et al., 2022). Multi-agency governance frameworks frequently lead to confusion, delays, and inefficiencies (Mohd Riza et al., 2022). The ambiguous distinction between federal and state authority regarding halal legislation in Malaysia has resulted in both overlaps and deficiencies in enforcement. The lack of a centralised halal authority adds to challenges in preserving integrity across the production chain. Regulatory and legal inconsistencies further undermine food security, hinder processing efficiency, and erode customer trust.

METHODOLOGY

This study utilised a qualitative research design to investigate and contrast Halal Slaughtering Practices (HSPs) in chosen Muslim countries (Brunei, Malaysia, Indonesia) and non-Muslim countries (Australia, UK). A purposive sample technique was employed to select stakeholders from halal-certified slaughterhouses, managers, executives, slaughtermen, and halal consultants. The selected participants were identified for their engagement with HSPs and their ability to offer expert perspectives on local practices, compliance, and regulatory obstacles.

Data collection was performed using semi-structured interviews, enabling participants to discuss particular aspects of halal slaughter openly. This methodology facilitated a comprehensive comprehension of each countries' execution and interpretation of halal standards. Furthermore, an examination of national halal guidelines, certification rules, and international standards (e.g., from JAKIM, MUI, SMIIC, OIC) was performed to enhance and corroborate the findings from the interviews.

The data were examined thematically to uncover trends, contrasts, and common themes across countries. Thematic analysis enabled the categorisation of key variables affecting HSPs, such as animal welfare, regulatory enforcement, and stunning methods. A comparative framework was subsequently employed to elucidate significant differences and similarities between the chosen Muslim and non-Muslim countries.

RESULTS AND DISCUSSION

Eight representatives were picked from five different countries (Brunei, Malaysia, Indonesia, Australia, and UK) using purposive sampling. The representatives were engaged in halal slaughtering activities, whether in management, compliance auditing, slaughtering, or advising capacities. Their professional jobs and backgrounds offered varied and contextually relevant views into HSPs within distinct regulatory, religious, and socio-cultural contexts. Table 1 further illustrates the countries of origin of the respondents and their corresponding professions.

Table 1. Representative from Muslim and non-Muslim Countries

Representative	Country	Role
A	Brunei	Slaughterhouse Manager
B	Brunei	Administrative Officer
C	Malaysia	Company Director
D	Indonesia	Halal Executive
E	Australia	Slaughterhouse Director
F	Australia	Slaughterman
G	United Kingdom	Animal Welfare Advocate
H	United Kingdom	Halal Consultant and Managing Director

Source: Analysis by the authors.

1 Differences of HSPs between Muslim and non-Muslim Countries

1.1 Regulatory Frameworks

In Muslim countries, HSPs are typically implemented through rigorous legal systems based on Islamic law. These activities are overseen by national Islamic councils or religious bodies, such as the MUIB, JAKIM, and MUI. These organisations guarantee that halal activities conform to Islamic principles, specifically the jurisprudential stances of the four *madhhabs*: Shafie, Hanafi, Maliki, and Hanbali. Nonetheless, discrepancies arise from divergent interpretations among *madhhabs*, resulting in disparities in the implementation of halal slaughtering standards throughout the Muslim world.

In non-Muslim countries, halal standards are primarily voluntary and largely influenced by market demand rather than religious requirements. Certification is generally performed by independent private or third-party organisations with limited governmental supervision. While several countries have implemented halal frameworks to accommodate their increasing Muslim populations or export opportunities, the lack of a cohesive religious authority often leads to disparate interpretations of halal criteria. Non-Muslim countries frequently consult internationally recognised organisations such as JAKIM or MUI for guidance; nonetheless, the absence of a centralised legal or theological authority results in a lack of consistency. This decentralisation generates uncertainties for consumers concerning the religious authenticity of halal-certified meat products.

1.2 Certification Processes

In Muslim countries, halal certification is embedded into governmental frameworks. Certifications are issued by national Islamic organisations governed by Islamic law and supported by legal regulations. These authorities are typically composed of experts proficient in Islamic jurisprudence, guaranteeing that certification methods are stringent and reliable. Failure to adhere to halal standards, including slaughtering practices, sanitation, or documentation, may lead to the revocation of certification and disciplinary actions. The reliable oversight procedures foster public confidence and enable the export of halal products to nations with stringent import regulations.

Conversely, non-Muslim countries lack a centralised religious framework for standardising certification. A multitude of halal certifying organisations exists, each with differing levels of recognition, procedural rigour, and academic involvement. The proliferation of these entities, even within a singular jurisdiction, results in discrepancies in certification outcomes. Some of these organisations interact with scholars or international certifiers, while others may lack theological rigour, leading to halal certificates that are scrutinised by both domestic and foreign Muslim consumers. The absence of standardisation in these certification methods diminishes the credibility of halal assurances in non-Muslim countries.

1.3 The Use of Stunning

The matter of stunning continues to be one of the most disputed elements of halal slaughter (Aghwan, 2022). In numerous Muslim countries, the procedure of stunning is clearly opposed due to apprehensions that it may result in the animal's death before the halal slaughter, thus deeming the meat non-halal. For example, Representative A presented a case in which cattle subjected to stunning displayed fractured skulls, prompting the relevant authority to prohibit the practice entirely:

"...we did try 10 cattle for the stunning and we found that the skull is fractured due to the use of stunning, so it does not considered halal in our country, so now stunning is not allowed and we have to bury the animals."

However, in other Muslim countries, conditional acceptance of stunning is allowed, as long as it does not result in the animal's death and the animal is alive at the time of slaughter. The acceptability is contingent upon the methodology, its reversibility, and its compliance with designated halal criteria.

"If the stunning operation performed by skilled operator and at the exact point of stunning, it should work out well. And bleeding/killing must be done before the animal regain its consciousness." – Representative C

In contrast, in non-Muslim countries, the practice of stunning is prevalent and frequently required by animal welfare regulations. Slaughterhouses have implemented stringent monitoring systems, incorporating trained personnel and calibrated technology, to assure adherence to animal welfare and halal standards.

"Electric stunning for sheep and captive bolt for cattle is calibrated daily to ensure effectiveness and trained staff check for signs of unconsciousness..." – Representative E

Although these methods may meet local welfare standards, they are nonetheless scrutinised by orthodox Muslim consumers who are apprehensive about the possibility of pre-slaughter death and non-adherence to religious requirements.

1.4 Slaughtering Techniques

Conventional halal slaughter in Muslim countries persists in prioritising manual methods performed by a certified Muslim slaughterer. The technique entails a rapid incision that cuts through the jugular veins, carotid arteries, and trachea, facilitating optimal blood drainage and reducing discomfort. This practice emphasises the religious and ethical obligations of compassion, purpose (*niyyah*), and personal accountability in the act of slaughter.

In non-Muslim countries, technological efficiency frequently influences slaughtering practices. High-capacity slaughterhouses depend on mechanised or semi-automated technologies to handle the volume necessary for domestic consumption and export requirements. These devices are frequently integrated with sophisticated monitoring technology, including CCTV and EEG (electroencephalography), to assess the efficacy of stunning and observe the animal's condition before to slaughter.

"Modern slaughterhouses use monitoring equipment such as CCTV cameras and EEG sensors to monitor the brain activity of animals during and after stunning." – Representative G

Notwithstanding the practicality of these technologies, the theological validity of mechanised slaughtering is still disputed. Representative B emphasised a sentiment prevalent among numerous halal certifiers in Muslim nations:

“...If we aim to update everything with the latest technology, does this implementation not conflict with halal principles? If it is okay then we will implement it...”

This quotation illustrates a cautious yet receptive stance towards modernisation, dependent on religious acceptance.

1.5 Monitoring and Enforcement Bodies

In Muslim countries, the function of monitoring and enforcement is generally established within government-mandated religious institutions. Internal halal compliance personnel execute daily inspections, while external audits, often unannounced, are conducted by national halal bodies. These mechanisms promote accountability and traceability, assuring Muslim buyers of the product's religious authenticity.

“Internal audit is done by halal executive of the company... the external audit from halal authorities will be divided into two surveillance audit will come unnoticed once a year and application audit will come once a year.” – Representative D

Conversely, non-Muslim countries frequently depend on a fragmented array of private auditors, retailers, or certifying agencies for oversight. These entities may prioritise quality control and ethical sourcing over religious compliance, resulting in deficiencies in enforcement and trust.

“The audit is conducted by retailers, supermarkets, or independent auditors to ensure that the meat meets specific quality and ethical sourcing standards...” – Representative H

The lack of Islamic authorities in these processes may undermine the theological legitimacy of halal certificates among Muslim customers, especially for exports to Muslim countries.

2. Similarities of HSPs between Muslim and non-Muslim Countries

2.1 Adherence to Islamic Principles

Regardless of geographical, political, and theological differences, both Muslim and non-Muslim countries involved in halal meat production adhere to the fundamental principles of halal slaughter. This entails guaranteeing the animal's health and life at the moment of slaughter, executing a rapid incision with a sharp blade, severing the jugular veins, carotid arteries, and trachea, and invoking the name of Allah prior to the incision, whether performed manually or via automated systems that replicate human invocation.

“Experienced employee and well-trained, the utilisation of sharp equipment and proper technique of slaughtering practices to ensure that the meat is halal to be consume.” – Representative B

“...the cut is made immediately by trained slaughtermen to sever the jugular veins and carotid arteries. This ensures rapid and complete bleeding, as required for halal compliance.” – Representative F

These statements from both Muslim and non-Muslim countries illustrate a collective dedication to the essential halal slaughtering requirements. Certification authorities, whether governmental or independent, generally require adherence to these religious stipulations. Despite variations in interpretation and enforcement depth, the objective to supply meat that is halal for Muslim consumers remains constant.

2.2 Heavy Focus on Animal Welfare

Animal welfare is a significant issue in both Muslim and non-Muslim countries' slaughtering practices. Islamic teachings underscore sympathy for animals, a principle reflected in modern animal welfare standards that condemn cruelty and advocate for compassionate treatment. Interview data from both

Muslim and non-Muslim countries reveal common apprehensions about pre-slaughter stress, overcrowding, thirst, and injuries incurred during transportation or confinement.

“Animals experience high levels of stress due to long journeys, overcrowding, improper handling, or unfamiliar environments... Rough handling, improper vehicle design... reducing meat quality and violating halal animal welfare principles.” – Representative H

The utilisation of proficient animal handlers, accessibility of sustenance and hydration, and arrangements for repose in the lairage are critical measures to mitigate stress, safeguard the animals' physical health, and enhance meat quality. These concepts align with Islamic idea of compassion (*ihsan*) and secular frameworks, like WOAHA guidelines.

2.3 Blood Drainage during Slaughter Process

A fundamental aspect of halal slaughter is the exsanguination of the animal, which fulfils religious, sanitary, and quality-related purposes. Both Muslim and non-Muslim halal-certified slaughterhouses implement protocols that optimise blood drainage shortly after the incision. Prompt and effective exsanguination guarantees that the meat is unadulterated, devoid of contaminants, and adheres to the Islamic prohibition on blood consumption.

“All staff needs to be ready when the animal entering the slaughter/restraining box... Everyone need to ensure that the slaughter will be perform when everyone is ready at their post.” – Representative C

“To minimise the time between restraint and bleeding, animals should be moved swiftly and calmly... which can affect blood flow and make the bleeding process less effective.” – Representative G

These synchronised methods aim to enhance meat quality while preserving the integrity of halal meat. Inadequate bleeding resulting from hasty or incorrect incisions may lead to meat contamination or disqualification according to halal requirements.

2.4 The Use of Global Standards

Halal slaughterhouses in Muslim and non-Muslim countries are progressively conforming to widely acknowledged quality assurance frameworks, including Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP). Moreover, nations involved in halal exports frequently adhere to standards established by the Standardisation and Metrology Institute for Islamic Countries (SMIIC), Codex Alimentarius, and other international food safety and halal compliance organisations.

These frameworks enable methodical risk evaluation, product traceability, and sanitary slaughtering procedures. Halal-specific modifications of existing systems, such the Halal Assurance System (HAS) and Halal Critical Control Points (HCCP), have been established to merge religious adherence with scientific food safety standards.

2.5 Increasing Use of Technology

Modern slaughterhouses progressively utilise sophisticated technology to guarantee that halal standards are fulfilled effectively and ethically. In both Muslim and non-Muslim countries, technology is utilised not just for production but also to maintain adherence to religious and welfare standards. Devices such as CCTV, EEG monitoring systems, animal handling equipment, and automated slaughtering lines are extensively utilised.

“If you work with animal, especially large ruminants... you will need a ‘cattle talker’. The use of this tool would efficiently assist in animal handling work.” – Representative C

“CCTV Monitoring Systems... ensuring humane treatment and detecting any issues that could cause distress or injury.” – Representative G

Despite the reservations of certain scholars and regulators in Muslim countries regarding mechanisation and automation, innovations such as mechanised bismillah invocation systems and halal-compliant robotics are progressively being embraced, dependent upon rigorous oversight and certification by qualified Islamic authorities.

2.6 Post-Slaughter Procedure

In both Muslim and non-Muslim countries, the post-slaughter period is managed meticulously to guarantee food safety, adherence to standards, and meat quality. This includes freezing, post-mortem examinations, microbiological analysis, and contamination management. These measures are crucial for preserving the purity of halal meat across the supply chain. Random samples of meat will be collected and analysed for common diseases such as Salmonella, E. coli, and Listeria.

Furthermore, any product, apparatus, or establishment harbouring a haram substance must be eradicated and disposed of in compliance with Islamic dietary laws. Corrective Action Plans (CAPs) are employed in both HACCP and HAS systems to address deviations from established requirements. Moreover, hygiene protocols including the utilisation of personal protective equipment, segregation of halal and non-halal manufacturing lines, and traceable labelling are implemented to uphold consumer confidence and avert contamination.

3. Discussion

3.1 Issue of Animal Welfare

Animal welfare in halal slaughter is not only a regulation issue but also a spiritual obligation. In Islam, the virtue of compassion (*rahmah*) requires compassionate treatment of all animals, even those bred and slaughtered for consumption (Aghwan & Regenstein, 2019). The Prophet Muhammad (PBUH) underscored the importance of compassion in the act of slaughter: *“Verily, Allah has prescribed excellence in all things... so if you slaughter, then slaughter well.”*

However, a disparity persists between these principles and their implementation. Inadequate transport management, overcrowding, and insufficient rest prior to slaughtering are persistent issues in both Muslim and non-Muslim countries. These stressors increase cortisol levels in animals, impacting both welfare and meat quality. The occurrence of PSE or DFD meat is frequently associated with pre-slaughter stress, diminishing shelf life and marketability. The physiological justification further corroborates religious mandates. Permitting animals to rest enhances muscle glycogen stores, therefore lowering ultimate meat pH. This impedes bacterial proliferation and averts deterioration. Conditions like “bone taint” or unpleasant odours in meat can be mitigated with sufficient rest and reduced pre-slaughter stress (Awan & Sohaib, 2016).

Nonetheless, the application of pre-slaughter stunning continues to be contentious. Some religious authorities regard it as an innovation that alleviates animal suffering, while others consider it incompatible with halal if it results in premature death or lasting damage. Fuseini et al. (2017) identified issues including the animal's death before slaughter, inadequate blood loss, and the inability to sever major arteries as one of the main concerns.

Representatives from non-Muslim countries, such as Australia, support for stunning as both an ethical and legal necessity, contingent upon the animal's survival. This dual methodology integrates welfare science with religious adherence. The discourse indicates that animal welfare and halal integrity may coexist, if there is evidence-based guidance and mutual respect between scientists and religious authorities. Additionally, in Australia, they have the Exporter Supply Chain Assurance System (ESCAS). This system exhibits a thorough commitment to animal care. Representative E states that ESCAS consists of

four principles: animal welfare, supply chain management, traceability, and independent auditing. It guarantees that cattle exported to halal markets comply with both religious and humane treatment criteria.

3.2 Halal Slaughtering Practices (HSPs)

HSPs are fundamentally grounded in the ethical obligation to reduce animal suffering. Notwithstanding cultural and technological disparities, the experience of pain and behavioural reactions of animals undergoing slaughter remain biologically uniform (Sinclair et al., 2023). Consequently, both Muslim and non-Muslim countries' frameworks must be assessed via theological and scientific perspectives.

The fundamental principle of halal slaughter is *niyyah*, a rapid and precise incision, accompanied by complete blood exsanguination. Conventional approaches prioritise human-directed, spiritual involvement. Nonetheless, extensive production in non-Muslim countries requires mechanical slaughtering, which may raise apprehensions among scholars regarding possible deficiencies in invocation, incision accuracy, or animal awareness.

Representative G's characterisation of EEG monitoring to ascertain unconsciousness exemplifies a scientific endeavour to ensure compliance. This technological technique may not address theological issues unless endorsed by recognised Islamic authorities. Meanwhile, representative B articulated concerns regarding the implementation of new technology without scholars approval, highlighting the conflict between innovation and tradition.

Another crucial element is blood drainage. Insufficient bleeding may lead to bacterial contamination, elevated pH levels, and a non-halal status. This is because blood deteriorates swiftly and presents considerable health hazards, characterised by its elevated pH and protein content. Moreover, visible blood might adversely affect consumer impression and the halal status. Consequently, slaughterhouse personnel must be educated in appropriate techniques, adequate equipment utilisation, and synchronised timing to guarantee optimal exsanguination.

Training should encompass scientific understanding by instructing slaughtermen on the reasoning behind each action, from incision to the verification of death (Abd El-Rahim, n.d.). Technologies ought to be regarded as instruments to augment rather than replace religious principles. With adequate supervision by Islamic scholars, automated slaughtering can satisfy both spiritual and technological criteria.

3.3 Post-Slaughtering Process

Post-slaughter procedures, frequently neglected in religious discussions, are essential for preserving halal integrity. Even if slaughtering adheres to Islamic standards, additional errors such as cross-contamination, mislabeling, or inadequate hygiene can constitute the product haram or doubtful.

Participants in this study emphasised extensive dependence on HACCP and GMP systems for post-slaughter surveillance. These systems must identify, monitor, and eradicate any contamination from non-halal sources or substances, such as inappropriate cleaning agents, haram-derived processing aids, or pork-derived gelatin packaging. Representative H's apprehension regarding counterfeit halal logos and mislabeling in Malaysia highlights the necessity for traceability and transparency. A thorough traceability system must encompass product origin, slaughter date, certifying authority, and shipping conditions (Sarhani et al., 2024). Labels must distinctly indicate halal status, processing information, and proof of compliance from authorised organisations.

Additionally, slaughterhouses must adhere to rigorous hygiene standards. Inadequate methods during the evisceration and packaging processes can introduce microbiological contaminants, therefore contravening food safety and halal regulations. The utilisation of personal protective equipment (PPE), cleanliness techniques, and regular pathogen screening should be established as standard working procedures (Ayuni Adawiyah et al., 2021).

3.4 Technological Advancements

Technology in halal meat production presents both opportunities and challenges (Othman & Aghwan, 2025). Automation, data analytics, and traceability technologies can improve accuracy, efficiency, and compliance. Conversely, swift innovation without of theological consideration jeopardises the sanctity of religious boundaries.

Technologies like RFID (Radio Frequency Identification) and blockchain have revolutionised traceability. These systems may monitor a meat product from production to consumption, recording each phase of handling, certification, and storage (Azmar et al., 2024). In Malaysia, blockchain-based halal traceability has been effectively tested, providing transparency and immutable certification records (Dashti et al., 2024). RFID facilitates real-time tracking, even in adverse conditions like cold storage or transportation. It eradicates human mistake and enhances supervision, particularly with halal exports (Mohammed Alkahtani et al., 2024).

However, individuals from Muslim countries shown reluctance. Concerns arose that automation may compromise *niyyah*, or that dependence on non-Muslim authorities might result in failures in halal monitoring. This underscores the necessity for a cohesive ethical framework created collaboratively by academics, technologists, and industry stakeholders. Malaysia's blockchain model illustrates that the involvement of scholars in the innovation process transforms technology into a means of enhancement rather than a challenge to Islamic principles.

3.5 Consistency of Halal Standards

The variability of halal standards among countries and certifying organisations is a significant challenge in international halal trade. Although countries such as Brunei, Malaysia, and Indonesia have established extensive national standards, they often need to obtain several certifications, which escalates expenses and imposes logistical challenges. Presently, organisations like SMIIC, affiliated with the OIC, are leading initiatives to establish unified standards. SMIIC's halal rules entail cooperation among numerous countries and the International Islamic Fiqh Academy (IIFA), ensuring jurisprudential legitimacy (Mustafa, 2023). In contrast to unilateral standards, SMIIC standards are founded on collective *ijtihad* and aim to promote the global circulation of halal products.

Nonetheless, the variety of Islamic jurisprudence further complicates harmonisation. Scholars from various *madhhabs* may disagree on matters such as mechanised slaughtering stunning, or contamination limits. Evans (2011), as referenced in Gul et al. (2022), observed that the absence of agreement among Islamic authorities hinders the establishment of a uniform standard. However, to address current fragmentation, countries must synchronise national legislation with worldwide halal standards. Mutual recognition agreements (MRAs), standard harmonisation, and collaborative auditing processes can mitigate redundancy. A cohesive halal system would advantage producers, certifiers, and consumers, fostering trust and improving market access.

3.6 Role of Government

Governments are essential in influencing the halal ecosystem. In Muslim countries, halal management is frequently formalised via ministries or national fatwa bodies. For example, JAKIM and MUI supervise all aspects from certification to public education (Ruzulan et al., 2021). They guarantee that halal practices conform to Islamic standards and are legally binding.

In numerous non-Muslim and certain Muslim countries, halal supervision is delegated to private certifiers, leading to inadequate enforcement, irregular audits, and diminished consumer protection. This decentralisation compromises halal integrity and public confidence. Representative D's reference to unannounced audits provides an indication of responsibility; nonetheless, these practices are not universally implemented. As a result, government must transition from passive observers to proactive custodians of halal integrity. This encompasses (Mohd Daud et al., 2023):

- (i) Enacting halal standards within national food laws
- (ii) Forming regulatory agencies with religious and scientific expertise
- (iii) Financing training and awareness initiatives
- (iv) Advocating for digital traceability systems
- (v) Collaborating with global halal organisations.

RECOMMENDATIONS

To address inconsistencies in HSPs, particularly in non-Muslim countries, there is an urgent requirement for standardised global halal regulations. Engagement with Islamic authorities, food technologists, and animal welfare experts is crucial for establishing standardised, Islamic-compliant methods. Governments and certifying organisations ought to synchronise local frameworks with worldwide entities like SMIIC to guarantee global acknowledgement and consumer confidence. Moreover, MRAs among certifiers might diminish trade barriers and facilitate halal exports. Transparent supply chains, autonomous audits, and the implementation of traceability technologies like RFID and blockchain can enhance halal assurance. Further research study will be essential to enhance standards, pinpoint deficiencies, and bolster cross-border uniformity in halal meat production.

CONCLUSION

This study reveals that although both Muslim and non-Muslim countries adhere to fundamental halal criteria, including humane treatment, efficient blood drainage, and hygiene, significant disparities remain in certification, regulation, and stunning procedures. Muslim nations depend on centralised, Shariah-compliant frameworks, whereas non-Muslim nations implement fragmented, market-oriented strategies that frequently emphasise efficiency and welfare policies over theological coherence. These divergences undermine trust and complicate cross-border halal trade.

Enhanced uniformity is necessary for the global halal meat industry. Policymakers and industry stakeholders should engage with international organisations such as SMIIC and OIC to standardise regulations, improve traceability using digital technologies, and implement more robust monitoring mechanisms. By harmonising religious requirements with technology and regulatory frameworks, the sector can enhance consumer trust, mitigate fraud, and secure the enduring integrity of global halal meat production.

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CONFLICT OF INTEREST STATEMENT

The authors disclose no relevant competing interests for the content of this article. No financial, institutional, or personal affiliations have impacted the development, analysis, or publishing of this article.

AUTHOR'S CONTRIBUTIONS

Zahirah Azmar initiated the study design, performed the literature review, gathered and analysed the data, and written the article. Zeiad Amjad Aghwan supervised the research process, offered academic and

technical guidance, and facilitated communication with potential responders. Both authors examined and approved the final article.

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