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MICROBIOLOGICAL HALAL FOOD QUALITY IN THE LIGHT OF THE QURAN: A STUDY OF ANIMAL SLAUGHTERING AND ENVIRONMENTAL POLLUTION(*)

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ABSTRACT

Animals slaughtered for believers' consumptions must meet requirements stated in the Islamic Holy book. Halal (HL) meat is the only food permitted for Muslims in accordance with the Islamic law and Sharia. This study aimed to present the major rules of HL food that were well-defined in Sharia to persist undamaged and intact meat through slaughtering process. The study revealed that the Islamic HL slaughtering process in this study exhibited the highest weight of blood-out assembled while the Electrical stunning (ES) slaughtering process decreased it. Therefore, meat processors prefer slaughtering methods that produce better quality meat and more profound effect for environment.

Keywords: *Animals, Halal, Stunning, Environment, Slaughtering*

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1. Introduction

There are many possible English translations for the Arabic word Halal (HL) such as trustworthy, valid, lawful, allowed, legal, authorized, permissible, and sanctioned or approved[5]. It is a word that is mentioned several times in main holy manuscript of Islam, *the Holy Quran* (the great manuscript from Allah to the messenger Muhammad to all mankind). The Muslims slaughtering process for animals is constructed on HL slaughtering and Islamic laws (Sharia) that is mentioned in the *Holy Quran* and the Hadith, the sayings of the messenger Muhammad Peace be upon him (PBUH) and monitored by local religious establishments.

HL meat basically is a meat that Muslims are allowed to consume for only certain types of meat of HL species (excluding Non-Halal (NHL) animals such as pork). HL food is able to be consumed and must be made in a certain approach. It is also important to mention that halal food is not made with NHL as there is a hazard of cross contamination if the person who cooks unintentionally uses the same knife to cut the various types of meat. Depending on HL process, the animal proposed for slaughter should be alive during slaughtering. This way of bleeding cause death through cutting critical blood vessels. Hence, the animals pass away due to deficiency of circulating blood and subsequent cerebral anoxia[6].

The stun slaughtering of animal's method, especially, electric stunning (ES) is widely used in some countries, for instance, South Africa, Australia, Brazil and

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5 Khattak, J. Z. K., Mir, A., Anwar, Z., Abbas, G., Khattak, H. Z. K., & Ismatullah, H. (2011). Concept of halal food and biotechnology. *Advance Journal of Food Science and Technology*, *3*(5), 385–389.

6 Von Holleben, K., Von Wenzlawowicz, M., Gregory, N., Anil, H., Velarde, A., Rodriguez, P., ... & Lambooij, B. (2010). Report on good and adverse practices: Animal welfare concerns in relation to slaughter practices from the viewpoint of veterinary sciences. Dialrel Deliverable, (1.3).

New Zealand (WHC 2013). It is not allowed in the mainstream of Muslims countries because of the realization of falling into doubtful performs[7].

Nonetheless, numerous results appeared some drawbacks for the above-mentioned stunning methods while they were applied to creatures. It has been stated that with the application of head-only ES, the stunning's period may not be long sufficient to permit passing to happen as a result of blood loss before the stunning wearing off[8]. Furthermore, the head-only ES used for execution creatures' unconsciousness was reported to produce a higher incidence of bleeding and cracked skeletons in birds[9].

Sazili et al. revealed opposing effect on shear force principles, color of meat, and greater phospholipid oxidations in longissimus muscles and semitendinosus[10]. In addition, Zulkifli et al. stated many negative effects after subjecting the creatures to a post-cut stunning. Muslims (oppose stunning) claim HL slaughtering technique persist the greatest humane, pointing out that many stunning

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7 Nakyinsige, K., Man, Y. C., Aghwan, Z. A., Zulkifli, I., Goh, Y. M., Bakar, F. A., ... & Sazili, A. Q. (2013). Stunning and animal welfare from Islamic and scientific perspectives. *Meat Science, 95*(2), 352–361. https://doi.org/10.1016/j.meatsci.2013.04.006

8 Small, A., McLean, D., Owen, J. S., & Ralph, J. (2013). Electromagnetic induction of insensibility in animals: A review. *Animal Welfare, 22*(2), 287–290. https://doi.org/10.7120/09627286.22.2.287

9 Fletcher, D. L. (2002). Poultry meat quality. *World's Poultry Science Journal, 58*(2), 131–145.
Fuseini, A., Knowles, T. G., Hadley, P. J., & Wotton, S. B. (2016). Halal stunning and slaughter: Criteria for the assessment of dead animals. *Meat Science*, 119, 132–137.

10 Sazili, A. Q., Norbaiyah, B., Zulkifli, I., Goh, Y. M., Lotfi, M., & Small, A. H. (2013). Quality assessment of longissimus and semitendinosus muscles from beef cattle subjected to non-penetrative and penetrative percussive stunning methods. *Asian-Australasian Journal of Animal Sciences, 26*(5), 723–730. https://doi.org/10.5713/ajas.2013.13018

approaches have been forbidden because they do not support animals' welfare values[11].

Religious slaughtering remains a debatable issue among groups of religion, governments, scientists, welfare organizations and the public. To overcome the previous debate, there is a requirement to reconsider the regions where religious slaughters might essentially contribute to developments of economy and foodstuff protection depended on scientific proofs, rather than being emotional, for the benefit of all particularly the consumers. One of the central topics of contention in the Islamic communities is whether or not to permit pre-stunning prior to slaughtering[12].

2. Halal (HL) Concept in the Meat Production Process

Islam is the religion in the world that guides their embracers to have a good and healthy lifestyle[13]. It is being the way of life as mentioned in the prescribed texts of the *Holy Quran* and in traditional acts of the messenger Muhammad (Peace be upon him). Therefore, all Muslims must consume food that has been certified as Halal (HL) (a permissible food)[14]. It is mainly because the wellness and characteristics of food which are determined by the quality of consumption. On the contrary, the food that is Haram (a non-permissible food) is strictly

11 Zulkifli, I., Goh, Y. M., Norbaiyah, B., Sazili, A. Q., Lotfi, M., Soleimani, A. F., & Small, A. H. (2014). Changes in blood parameters and electroencephalogram of cattle as affected by different stunning and slaughter methods in cattle. *Animal Production Science, 54*(2), 187–193. https://doi.org/10.1071/AN12345

12 Mason, C. (2006). Comparison of halal slaughter with captive bolt stunning and neck cutting in cattle: Exsanguination and quality parameters. *Animal Welfare*, 15, 325–330.

13 Haghighi, M., Rahmati-Najarkolaei, F., & Ansarian, A. (2015). Correlation between spiritual wellbeing and religious orientation among staff of one military medical university. *Journal of Health Policy and Sustainable Health, 1*(4).

14 Riaz, M. N., & Chaudry, M. M. (2003). *Halal food production.* CRC Press. Rubtcova, M., & Pavenkov, O. (2018). Influence of Islam on investment activity. In *The 5th International Conference on Socio-Cultural Relationship and Education Pedagogy Learning Sciences (The 5th SOCIO-CULTURAL 2018), Jakarta, Indonesia.* SSRN. https://ssrn.com/abstract=3106412

forbidden, as in accordance with the *Holy Quran*, Sunnah (the lifetime, actions and teachings of messenger Muhammad), as well as the consensus of Muslim jurists (Ijma)[15].

3. HL Food

3.1. HL Food Laws and Regulations

The term of Halal refers to Arabic origin that means allowed, authorized, permitted, approved, sanctioned, licit, lawful, legal or legitimate[16]. The guidelines that ensure HL is bestowed through Allah at the *Holy Quran*[17]. Besides, the overall guidance of the *Holy Quran* asserts that most diets are indeed HL, excluding the ones specified as Haram, as depicted in the subsequent verse from the *Holy Quran*: "*O you that have believed, consume the good thing which we have provided for you, and be thankful to God, if it is (indeed) him that you worship.*" [Qur'an, 2:172]. With that, Sharia has ruled that pork meat as well as its derivatives have been strictly prohibited from consumption among Muslims[18] as vividly portrayed in the *Holy Quran.*

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15 Chandia, M., & Soon, J. M. (2018). The variations in religious and legal understandings on halal slaughter. *British Food Journal, 120*(3), 714–730.

16 Shahnazari, A. (2018). Halal branding: A new trend in Islamic marketing. In *Digital marketing and consumer engagement: Concepts, methodologies, tools, and applications* (pp. 20–37). IGI Global. https://doi.org/10.4018/978-1-5225-5187-4.ch002

17 Nakyinsige, K., Man, Y. B. C., & Sazili, A. Q. (2012). Halal authenticity issues in meat and meat products. *Meat Science, 91*(3), 207–214. https://doi.org/10.1016/j.meatsci.2012.02.015

18 Fadzlillah, N. A., Man, Y. B. C., Jamaludin, M. A., Rahman, S. A., & Al-Kahtani, H. A. (2011). Halal food issues from Islamic and modern science perspectives. *Proceedings of the International Conference on Humanities, Historical and Social Sciences*, 17, 159–163. IACSIT Press.

Essentially, HL food refers to lawful consumption permitted for Muslims[19], in accordance with the *Holy Quran* and Sunnah which form the Islamic law. The Islamic law is known as 'Sharia' that has been critically analyzed and interpreted by Muslim scholars over the centuries. The fundamental guidelines of HL food were outlined by the laws of Islam. They have remained intact and definite although some alterations may be occurred due to the variations of time, place, or certain conditions. Besides, apart from two elementary bases of Islamic laws; the *Holy Quran* and Sunnah, another two reliable sources have been referred in ascertaining foods that are permissible, which are the Ijma (The consensus of authorized opinions) and Qiyas (The reasoning by analogy). Qiyas, a process is known as Ijtihad, or the drive to arrive at a solution of unknown things, has been implemented in the Muslims life. In short, it is imminent that any food was derived from animal products, such as emulsifiers, tallow, and enzymes, are HL[20].

3.2. HL Food Requirements

The HL food involves the distinguishing between Halal and Haram that is stated clearly in the *Holy Quran and Sunnah* as well as slaughter processes of HL animals[21].

For example, the birds' meat, which do not apply claws to hold down foodstuff like turkeys, chicken, ducks, geese, quails, doves, pigeons, partridges, sparrows, ostriches and emus, is not prohibited and considered HL animals as explained in versus. Meanwhile, the slaughtering process should be accomplished for HL species using some necessary good qualifications to increase the quality of process and yield a healthy food for people at the end. Firstly, the slaughter ought to be

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19 Eliasi, J. R., & Dwyer, J. T. (2002). Kosher and Halal: Religious observances affecting dietary intakes. *Journal of the Academy of Nutrition and Dietetics, 102*(7), 911.

20 Regenstein, J. M., Chaudry, M. M., & Regenstein, C. E. (2003). The kosher and halal food laws. *Comprehensive Reviews in Food Science and Food Safety, 2*(3), 111–127. https://doi.org/10.1111/j.1541-4337.2003.tb00013.x

21 Apandi, A. A. A., Ooi, I. U., Rahman, F. A., & Muhammad, A. (2018). MS2400-1: 2010 certification for hauliers: A risks mitigating solution? In *Proceedings of the 3rd International Halal Conference (INHAC 2016)* (pp. 247–257). Springer.

carried out by one who is adult, sane, and Muslim. Secondly, the name of Allah must be appealed during slaughtering. Thirdly, the slaughter is carried out by slicing throat, including the internal jugular vein, to induce the quick death and complete bleeding[22]. This common technique refers to the cutting at least 3 or 4 elements such as Carotids, jugular vein, trachea, and esophagus. Otherwise, the slaughter equipments must be sharped and not rusted. Moreover, the slaughter machines were accepted by some Muslim scholars according to the Qyas. However, the increasing in the trend of slaughtering using hand as done previously becomes a preferable technique in the recent years[23]. Otherwise, in Sharia of Islam, the slaughtered meat is termed as 'zabiha' (or "dhabiha') meat, in which the Prophet Muhammad outlined guide to handle the slaughter of animals properly. He claimed, "Verily Allah has recommended proficiency in all things. Consequently, if you slaughter, slaughter well: and if you accomplish dhabiha, perform it perfectly. Let each one of you sharpen his blade and let him spare suffering to the animals lie slays."[24].

In addition, the practice of Islam highlights the gentle and humane handling of slaughter animals. Islam asserts positive conditions such as provision of the proper rest and water to the slaughter animals to hinder stress as well as avoidance of handling slaughter equipment before the animals. Upon and after the slaughter process i.e. all the blood had been drained out and the carcass is ready to be dismembered of its parts. Nevertheless, unlike kosher, carcass soaking and salting are not part of the criteria for HL because HL meat is like any other meats sold in the market. On the contrary, fish species that live in water do not need to undergo the strict slaughter process. Besides, the carcass that dies naturally, for instance, gored by another thing, strangled, fell down from a height place, beaten,

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22 Patil, S. S., Deokar, R. B., Vidhate, S. G., & Tyagi, S. (2016). An atypical case of suicidal cut throat injury. *Egyptian Journal of Forensic Sciences, 6*(4), 492–495. https://doi.org/10.1016/j.ejfs.2016.07.007

23 Regenstein, J. M., Chaudry, M. M., & Regenstein, C. E. (2003). The kosher and halal food laws. *Comprehensive Reviews in Food Science and Food Safety, 2*(3), 111–127. https://doi.org/10.1111/j.1541-4337.2003.tb00013.x

24 Fuseini, A., Knowles, T. G., Hadley, P. J., & Wotton, S. B. (2016). Halal stunning and slaughter: Criteria for the assessment of dead animals. *Meat Science,* 119, 132–137.

or slaughtered by wild animals, is strictly prohibited. On the other hand, it is allowed to consume fish that is already dead, unless it has decayed[25].

3.3. HL Food and the Blood

The pouring blood that is known as 'dam' in Sharia of Islam is banned for human intake. It comprises blood of and non- allowed animals alike. As *Holy Quran* said *"He has banned you Only the Maitah (deceased animals), and blood, and the meat of swine, and that which is slaughtered as a sacrifice for others than Allah"* [Qur'an, 2:173], *"Forbidden to your (for food) are: Al-Maitah (the deceased animals, cattle, beasts not slaughtered), blood, the flesh of swine, and that on which Allah's Name has not been mentioned while slaughtering…* "[Qur'an, 5:3] and Say (O Muhammad): I find not in that has been exposed to me anything prohibited to be consumed by one who wishes to consume it, unless it is been a Maytah (the dead animal) or blood poured forth (by slaughtering or the like), or the meat of swine (pork); for that assuredly, is not pure or impious (unlawful) meat (of animals) that is slaughtered as a sacrifice for others than God (*or has been slaughtered for idols, or on which Allah's Name has not been stated while slaughtering*)" [al-An'aam 6:145].

Liquid blood is commonly not offered for sale or consumed through Muslims or non-Muslims[26]. There is a common agreement amongst Muslim researchers that if anything was complete from blood, it would be an unacceptable and prohibited food as mentioned in the *Holy Quran* and Sunnah except the liver and spleen of HL meat. Products such as blood sausage and constituents (blood albumin) are either prohibited or questionable at the best condition and it should be avoided

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25 Regenstein, J. M., Chaudry, M. M., & Regenstein, C. E. (2003). The kosher and halal food laws. *Comprehensive Reviews in Food Science and Food Safety, 2*(3), 111–127. https://doi.org/10.1111/j.1541-4337.2003.tb00013.x

26 Regenstein, J. M., & Chaudry, M. (2001). A brief introduction to some of the practical aspects of the kosher and halal laws for the poultry industry. In *Poultry meat processing* (pp. 281–295). CRC Press.

for food product formulation[27]. This is agreed with the study of Talib et al. that proved the disadvantages of consumption of liquid blood that leads to many diseases[28].

Another important Islamic principle to be on focus is that any Muslim must not create Haram what God has prepared HL. One important inquiry remains: Is there a maximum on how much blood is acceptable to be retained in the meat? Tafsir Ibn Kathir, in the commentary of verse 5:3, mentioned the subsequent hadith reported by Ahmad and Ibn Majah. *Ibn 'Umar (May Allah be pleased with him) narrated by Allah's Messenger (peace be upon him) who said, "Two kinds of dead animals and two types of bloods have been made lawful for us. The two kinds of dead animals are locust and fish (seafood) while the two types of bloods are the liver and the spleen".*

Therefore, there are two essential organs from the cardiovascular system specifically liver and spleen. The liver is the place of blood that is processed, filtered and stored whereas the spleen is the place that the red blood cells are created, warehoused and removed[29].

Consequently, it can be argued from a HL perspective that the residual quantity of blood acceptable in meat should not go beyond that found customarily in the liver or the spleen. There are contradictory reports regarding to the acceptability

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27 Regenstein, J. M., Chaudry, M. M., & Regenstein, C. E. (2003). The kosher and halal food laws. *Comprehensive Reviews in Food Science and Food Safety, 2*(3), 111–127. https://doi.org/10.1111/j.1541-4337.2003.tb00013.x

28 Talib, Z., Zailani, S., & Zainuddin, Y. (2010). Conceptualizations on the dimensions for halal orientation for food manufacturers: A study in the context of Malaysia. *Pakistan Journal of Social Sciences, 7*(2), 56–61.

29 Gottlieb, Y., Topaz, O., Cohen, L. A., Yakov, L. D., Haber, T., Morgenstern, A., Weiss, A., Chait Berman, K., Fibach, E., & Meyron-Holtz, E. G. (2012). Physiologically aged red blood cells undergo erythrophagocytosis in vivo but not in vitro. *Haematologica*. https://doi.org/haematol-2011

of cutting the spinal cord during HL slaughter. It is undesirable because carcass convulsion is necessary to squeeze totally blood out of the meat[30].

4. HL Issues

4.1. HL Food Issues

Based on a previous study was carried out by [31], the trend of consumer consumption to date has not only evaluated in HL products, but also in its related processes. Besides, Shafie and Othman 2006 claimed that issues related to HL revolved around its definition, verification of various logos, use of Arabic/Islamic/Quran terms as brands, as well as the poor enforcement by the regulators[32]. If these issues are dismissed without rectification, the HL industry might be faced a huge problem in the consumptions. Furthermore, Tieman further highlighted issues related to HL logistics within the contexts of logistics firm, its products, supply chain, and value chain. Moreover, the HL issues were closely linked to HL certification processes, integrity, transparency issues, and limited certified HL logistics service providers[33]. Additionally, while the other issues were uncovered through Shafie and Tieman, they were supported in a study conducted through Iberahim[34].

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30 Khan, G. M. (1991). *Al-Dhabḥ: Slaying animals for food the mimic way*. Abdul-Qasim Bookstore.
Khattak, J. Z. K., Mir, A., Anwar, Z., Abbas, G., Khattak, H. Z. K., & Ismatullah, H. (2011). Concept of halal food and biotechnology. *Advance Journal of Food Science and Technology*, *3*(5), 385–389.

31 Kamaruddin, R., Iberahim, H., & Shabudin, A. (2012). Halal compliance critical control point (HCCCP) analysis of processed food. In *2012 IEEE Business Engineering and Industrial Applications Colloquium (BEIAC)* (pp. 383–387). IEEE. https://doi.org/10.1109/BEIAC.2012.6226061

32 Shafie, S., & Othman, M. N. (2006, September). Halal certification: International marketing issues and challenges. In *Proceedings of the International IFSAM VIIIth World Congress* (pp. 28–30).

33 Tieman, M. (2011). The application of halal in supply chain management: In-depth interviews. *Journal of Islamic Marketing*, *2*(2), 186–195. https://doi.org/10.1108/17590831111139893

34 Iberahim, H., Kamaruddin, R., & Shabudin, A. (2012, September). Halal development system: The institutional framework, issues, and challenges for halal

4.2. HL Certification and HL Packaging Issues

The lacking standard guidelines for HL specifications have led to certain constraints in the HL industry, inclusive of HL logistics. Moreover, maintaining the HL supply chain is rather challenging, especially when there is no universal HL logo. Some of 122 HL regulators are available worldwide, which are comprised of frames from governments, non-governmental organizations, Islamic communities and mosques[35]. It is likely that a universal HL logo would facilitate consumers in purchasing HL food products. This is because; there have been cases of misusing HL logo on product packages within the logistics area[36]. On top of that, Ab Talib and Johan discovered several issues concerning HL packaging, for example, HL certification on packaging, techniques of handling HL products as well as traceability of the packages[37]. It is deemed significant that the HL logo is displayed on the package to ascertain safety and cleanliness for consumption. Furthermore, the logo of HL is more essential than others as the International Standard of Organization certification (ISO)[38].

Additional emerging issue related to HL industry is packaging. It is due to the packaging materials that are made of non-Halal (NHL) products[39]. Some plastic,

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logistics. In *2012 IEEE Symposium on Business, Engineering, and Industrial Applications (ISBEIA)* (pp. 760–765). IEEE. https://doi.org/10.1109/ISBEIA.2012.6423001

35 Ab Talib, M. S. B., Rubin, L., & Zhengyi, V. K. (2013). Qualitative research on critical issues in halal logistics. *Journal of Emerging Economies and Islamic Research, 1*(2).

36 Farouk, A. E., Batcha, M. F., Greiner, R., Salleh, H. M., Salleh, M. R., & Sirajudin, A. R. (2006). The use of a molecular technique for the detection of porcine ingredients in the Malaysian food market. *Saudi Medical Journal, 27*(9), 1397–1400.

37 Ab Talib, M. S., & Johan, M. R. M. (2012). Issues in halal packaging: A conceptual paper. *International Business and Management, 5*(2), 94–98.

38 Shafie, S., & Othman, M. N. (2006, September). Halal certification: International marketing issues and challenges. In *Proceedings at the International IFSAM VIIIth World Congress* (pp. 28–30).

39 Soong, S. F. V. (2007). Managing halal quality in food service industry. (Unpublished master's dissertation). University of Nevada Las Vegas, Singapore.

paper boxes, and microwaveable containers have been found unclean to have elements of NHL. In addition, escalating reports that have been received for products contaminated with porcine due to the inclusion of animal fat as lubricants in producing packaging materials[40].

4.3. HL Warehousing and Transportation Issues

The activities of transportation within the HL logistics field have an imminent function as the impurity of HL products that could be occurred at this phase. Besides, at the stage of delivering and distributing, the HL chain could be interrupted by NHL elements[41]. Furthermore, these transportation activities are deemed a difficult process to retain HL logistics because of limited collaboration among service providers for logistics. The HL logistics would be ascertained the adherence to Sharia law but transfer to a different party could jeopardize the HL aspect.

5. Islamic Slaughtering Method (Dhabh or Zabh) and their Conditions

Dhabh refers to the animal slaughter technique for human consumption[42]. The term 'dhabh' or 'dhakaat' originates from Arabic and holds 'purification or rendering something good or complete' meaning. In addition, the conditions of dhabh must be adhered to in meeting the Sharia law[43] as the following stages:

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40 Farouk, A. E., Batcha, M. F., Greiner, R., Salleh, H. M., Salleh, M. R., & Sirajudin, A. R. (2006). The use of a molecular technique for the detection of porcine ingredients in the Malaysian food market. *Saudi Medical Journal*, *27*(9), 1397–1400.

41 Jaafar, H. S., Endut, I. R., Faisol, N., & Omar, E. N. (2011). Innovation in logistics services–halal logistics. *Procedia - Social and Behavioral Sciences*, *36*, 308–312.

42 Golnaz, R., Zainalabidin, M., Mad Nasir, S., & Eddie Chiew, F. C. (2010). Non-Muslims' awareness of Halal principles and related food products in Malaysia. *International Food Research Journal*, *17*(3), 667–674.

43 Ali, A., Ali, A., Xiaoling, G., Sherwani, M., & Hussain, S. (2018). Expanding the theory of planned behaviour to predict Chinese Muslims halal meat purchase intention. *British Food Journal*, *120*(1), 2–17.

1) The Butcher

It is compulsory for the one who is carrying out the dhabh tool to be a sane Muslim adult, indifferent to gender. Hence, if someone loses competence due to intoxication or insanity, he/she is prohibited from performing dhabh. Besides, a non-believer, an idolater or one that has deviated from the Islamic teaching must not do dhabh because it will be unacceptable food as HL.

2) The Instrument

The instrument for dhabh is necessary to induce the death fast. It is commonly used the knife to make dhabh. The knife must be particularly sharp to ensure rapid external skin cutting and puncturing into vessels of blood especially the internal jugular vein for immediate flow of blood[44]. In precise, the slaughter has to generate massive and immediate hemorrhage.

The usage of an instrument to kill the creatures by cutting the skin without the jugular vein severing is considered as prohibited in the Islamic view. It is also an Islamic rule process not to sharpen the knife in front of the creatures that is being slaughtered[45].

3) Cutting

Customarily, camels are used to be slayed by creation an incision anywhere around the neck. However, the incision should be induced at some point below the glottis for animal. This route is called nahr, severing the Labbah (bottom end of the long neck)[46]. With the contemporary restraining approaches and stunning methods, this process may not be suitable any longer. The esophagus and the trachea must be cut together with the carotid arteries and the jugular veins. It was

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44 Patil, S. S., Deokar, R. B., Vidhate, S. G., & Tyagi, S. (2016). An atypical case of suicidal cut throat injury. *Egyptian Journal of Forensic Sciences*, *6*(4), 492–495. https://doi.org/10.1016/j.ejfs.2016.07.007.

45 Riaz, M. N., & Chaudry, M. M. (2003). *Halal food production.* CRC Press.

46 Jais, A. S., Isa, N. M., & Yusof, W. H. W. (2017). The usage of thoracic sticking method in halal slaughtering process. *Jurnal ILMI*, *7*(1).

perceived obviously that the kosher killed was very parallel to the rule Islamic technique of dhabh which was designated before.

4) The Invocations

Invocation or Tasmiyyah meaning is a pronouncing the name of Allah by saying Bismillah Allahu Akbar (by the term of Allah, Allah is great) or Bismillah (by the name of Allah) or prior to starting the slaughter directly[47]. Some opinions vary somewhat on the invocation issue in agreement with three of the earliest jurists. Depending on the opinion of Imam Malik, if the name of Allah was not stated over the animal prior to slaughtering, the meat of such animal would be Haram or prohibited whether he neglected to say Bismiilah purposely or unintentionally. Moreover, if anyone neglected intentionally to pronoun Bismillah, the meat would be Haram but if the omission was unintentional, the meat would be HL depending on the jurist Abu Hanifah's view. Nonetheless, the opinion of Imam Shafii was whether any person neglected to say Bismillah purposely or unintentionally prior to slaughtering, the meat would be HL so long as the person is competent to achieve dhabh[48]. It is also sufficient to state in this case that the overhead tradition does not verify that the saying of God's name is not compulsory in accomplishment dhabh. Certainly, the Islamic rule emphasized that the saying of God's name will be a commonly identified requirement or HL slaughtering and would be deliberated an important condition of dhabh[49].

5.1. Slaughtering Process

5.1.1 Stunning Slaughtering Processes

The stunning process is used to render the animal nonconscious before slaughtering. Many other approaches apart from electrical stunning (ES) are used comprising cervical dislocation, gas stunning using CO_2, and even no stunning because ES is not essential by law prior to slaughtering of poultry process. Gas

47 Armanios, F., & Ergene, B. (2018). *Halal food: A history*. Oxford University Press.

48 Khan, G. M. (1991). *Al-Dhabḥ: Slaying animals for food the mimic way*. Abdul-Qasim Bookstore.

49 Ibid.

stunning (CO_2) is a process used via the European Economic Commission because it can rapidly render the chicken nonconscious[50]. Moreover, ineffective stunning might occur due to differences in electrical resistance because of modifications in size of body, thicknesses of skull, muscles of body, fat contents and plumage conditions. Hence, such meat from those animals can be categorized as Haram (Prohibited) by Islamic law if the slaughter process is not carried out properly by Islamic rule[51].

5.1.2 The HL slaughtering process

Industrial HL poultry slaughtering can be achieved using hand slaughtering or a mechanical device. This depends on the available facilities and size of operation[52]. In Muslim cultures, the manual slaughter is dominant because it is simple and possible. However, the mechanical devices are widely used in a large-scale production where HL is not on the focus of the industrial poultry process of slaughtering. Productions of Poultry process and processing include a series of intermingled stages which is considered to convert domestic birds into ready-to-consume[53]. Good poultry slaughtering process must be fulfilled in a hygienic-sanitation condition.

In addition, the variation of the total protein of the chicken skeletal muscle appeared and affected by two previous methods of slaughtering using a sharp

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50 McNeal, W. D., Fletcher, D. L., & Buhr, R. J. (2003). Effects of stunning and decapitation on broiler activity during bleeding, blood loss, carcass, and breast meat quality. *Poultry Science*, *82*(1), 163–168. https://doi.org/10.1093/ps/82.1.163.

51 Bonne, K., & Verbeke, W. (2008). Religious values informing halal meat production and the control and delivery of halal credence quality. *Agriculture and Human Values*, *25*(1), 35–47.

52 Man, Y. B. C., & Sazili, A. Q. (2010). Food production from the halal perspective. In *Handbook of poultry science and technology* (pp. 183–215). Wiley.

53 Addeen, A., Benjakul, S., Wattanachant, S., & Maqsood, S. (2014). Effect of Islamic slaughtering on chemical compositions and post-mortem quality changes of broiler chicken meat. *International Food Research Journal*, *21*(3), 897.

knife[54]. The manual or mechanical methods of HL poultry slaughtering was reported in the study of[55]. In the manual method, the neck was partially cut with leaving the intact spinal cord and the body of animal was unrestricted immediately after slaughtering. Though in the mechanical method, the neck was completely cut off and the body was tied until the animal died.

Albeit the differences were not statistically significant, kosher samples consistently had lower microbial counts and slightly higher thiobarbituric acid (perioxide) values than its conventional counterpart. López assessed the welfare, bleeding efficiency and meat quality in rabbits subjected to either HL slaughtering without stun or electrically stunned before slaughtering; the authors found that HL slaughtered rabbits had higher blood loss and lower pH values in longissimus dorsi and biceps femora's muscles[56]. Similarly, Nakyinsige did not observe significant difference in meat quality of rabbits slaughtered through the HL procedure or gas stunning before slaughtering[57].

The EU (Europe) and the USA (United States of America) permitted the killing without stunning to permit Muslims or Jews to apply their beliefs of religions.

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54 Zaman, R., Nassir, H. M., Abdurrazq, N. B., Salleh, H. M., & Rahman, M. T. (2012). Effects of different methods of slaughtering on protein expression in chicken meat. *IIUM Engineering Journal*, *13*(1). https://doi.org/10.31436/iiumej.v13i1.93

55 Man, Y. B. C., & Sazili, A. Q. (2010). Food production from the halal perspective. In *Handbook of Poultry Science and Technology* (pp. 183–215). Wiley.

56 López, M., Carrilho, M. C., Campo, M. M., & Lafuente, R. (2008). Halal slaughter and electrical stunning in rabbits: Effect on welfare and muscle characteristics. In *Proceedings of the 9th World Rabbit Congress, Verona, Italy, 10–13 June 2008* (pp. 1201–1206). World Rabbit Science Association.

57 Nakyinsige, K., Man, Y. B. C., & Sazili, A. Q. (2012). Halal authenticity issues in meat and meat products. *Meat Science*, *91*(3), 207–214. https://doi.org/10.1016/j.meatsci.2012.02.015

On the other hand, some religious authorities accepted the stunning to improve animal welfare either directly before or after the throat was cut[58].

The traditional process of slaughtering in Islam by slitting the throats includes the cutting of the trachea, jugular veins, carotid arteries, and the esophagus devoid of cutting the head. After slaughtering process of birds was completed, they had to be defeathered through special conditions of defeathering. For example, temperature of water and chlorine levels which are the same of HL processing and the regular poultry processing. Furthermore, the slaughtered poultry must be totally separated throughout chilling, defeathering, eviscerating, processing and storing.

Additional processing such as breading, marinating, and application of batters or nubs, should also be prepared under the monitoring of a qualified HL inspector via comprehensively clean equipments. Constituents (seasonings) must also be HL permitted[59]. One main argument in contradiction of pre-slaughter stunning depending on the Muslims was that the stunning route could delay blood loss and make a bloodshot because of muscular stunning changes. However, HL technique can cause sometimes a severe soreness to the creatures when using the small knife even with many attempts that are completed to cut all the vessels of neck[60].

5.2. Effects of Slaughtering Processes on the Quality of Slaughtered Meat

5.2.1 Factors Effect on Bleeding Efficiency at the Slaughtering Time

Usually, bleeding efficiency at the time of slaughtering is influenced by: (A) The removed of blood vessels, (B) patency of the sticking cut and size, (C) hear arrest

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58 Velarde, A., & Dalmau, A. (2012). Animal welfare assessment at slaughter in Europe: Moving from inputs to outputs. *Meat Science*, *92*(3), 244–251. https://doi.org/10.1016/j.meatsci.2012.04.009

59 Regenstein, J. M., & Chaudry, M. (2001). A brief introduction to some of the practical aspects of the kosher and halal laws for the poultry industry. In *Poultry meat processing* (pp. 281–295). CRC Press.

60 Grandin, T., & Regenstein, J. M. (1994). Religious slaughter and animal welfare: A discussion for meat scientists. *Meat Focus International*, *3*(1), 115–123.

at stunning period, (D) orientation of the carcass-positioned vertically or horizontally (E) squeezing blood capillaries, tonic muscle contractions and vessels, and (F) clinical activities producing movement of blood to the sticking wound that are totally determined through the slaughter process[61].

5.2.2 Effects of Slaughtering Process on Bleeding Efficiency and Meat Quality

There are a lot of slaughtering methods worldwide. They comprise HL method and stunning method. Islamic HL method appeared to be the best bleeding method when it was compared with the ES process. Hence, it was recommended to be used for slaughtering of the birds. The quantity of blood collected was varied after slaughtering the animals using the two various processes (Islamic HL and ES approaches) according to the study of Ali. The electrically stunned groups had the lowest blood weight whereas the Islamic HL slaughtered showed the highest weight of blood collected. The more bleeding in Islamic HL without stunning method may be attributed to the effects of gravity of blood stream in the blood vessel prior to coagulation[62].

In breast muscles Blood contents of animals was subjected to various slaughter actions which could be assessed via assessing the hemoglobin contents in aqueous tissues extract. There was certainly not major variance in the hemoglobin content amongst actions with regards to the used different slaughtering methods (CO_2 slaughtering, no stunning slaughtering, not bled ES, CO_2 stunning and ES with decapitation) that are displayed in the reported study of Alvarado. Hemoglobin in breast muscle was 13 to 17% not higher in extracts from animal breast muscles of blood birds as compared to un-bled birds. It was designated that bleeding

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61 Nakyinsige, K., Fatimah, A. B., Aghwan, Z. A., Zulkifli, I., Goh, Y. M., & Sazili, A. Q. (2014). Bleeding efficiency and meat oxidative stability and microbiological quality of New Zealand White rabbits subjected to halal slaughter without stunning and gas stun-killing. *Asian-Australasian Journal of Animal Sciences*, *27*(3), 406–413. https://doi.org/10.5713/ajas.2013.13428

62 Ali, S. A., Abdalla, H. O., Mahgoub, I. M., & Medani, W. (2011). Effect of slaughtering method on the keeping quality of broiler chickens' meat. *Egypt Poultry Science*, *31*(31), 727–736.

detached a little of blood from the breast muscles. This might elucidate why there is a reduced blood removal from breast muscles after bleeding. When the neck was cut to bleeding, the pressure of blood dropped quickly. Consequently, there is no adequate driving potency to unoccupied the several capillary beds inside the muscles[63].

ES has been related with a reduction in carcass blood loss[64]. The ES only affected on the rate of early blood loss, and it had slight effects on the ultimate carcass[65]. Decapitation methods produced a high pH at 24 hrs. Post-mortem had no effect on water-holding capacity, color, or tenderness of animal while it was comparing with the other approaches[66]. High frequency ES in poultry regularly resulted in a shorter- lasting stunning[67]. It could be related to the reduction of muscle tension during stunning. High frequency ES could also lead to less blood retention in the viscera[68]. The CO_2 stunning declined carcass defects and deprived quality meat

63 Alvarado, C. Z., Richards, M. P., O'Keefe, S. F., & Wang, H. (2007). The effect of blood removal on oxidation and shelf life of broiler breast meat. *Poultry Science*, *86*(1), 156–161.

64 Papinaho, P. A., & Fletcher, D. L. (1995). Effect of stunning amperage on broiler breast muscle rigor development and meat quality. *Poultry Science*, *74*(9), 1527–1532. https://doi.org/10.3382/ps.0741527

65 Wilkins, L. J., Gregory, N. G., Wotton, S. B., & Parkman, I. D. (1998). Effectiveness of electrical stunning applied using a variety of waveform-frequency combinations and consequences for carcass quality in broiler chickens. *British Poultry Science*, *39*(4), 511–518. https://doi.org/10.1080/00071669888611

66 McNeal, W. D., Fletcher, D. L., & Buhr, R. J. (2003). Effects of stunning and decapitation on broiler activity during bleeding, blood loss, carcass, and breast meat quality. *Poultry Science*, *82*(1), 163–168. https://doi.org/10.1093/ps/82.1.163

67 Hillebrand, S. J. W., Lambooy, E., & Veerkamp, C. H. (1996). The effects of alternative electrical and mechanical stunning methods on hemorrhaging and meat quality of broiler breast and thigh muscles. *Poultry Science*, *75*(5), 664–671.

68 Turcsán, Z. S., Varga, L., Szigeti, J., Turcsán, J., Csurák, I., & Szalai, M. (2003). Effects of electrical stunning frequency and voltage combinations on the presence of engorged blood vessels in goose liver. *Poultry Science*, *82*(11), 1816–1819. https://doi.org/10.1093/ps/82.11.1816

when it was compared with ES[69] designated that CO_2 stunning reduced the incidence of carcass defects. Otherwise, the *Holy Quran* and former Islamic scriptures detail some significance necessities that must be met through HL slaughter to be considered fit for intake to Muslims. The most important of these necessities is that the bird or animal must be alive at the period of cutting which is opposing of ES slaughter method[70].

5.2.3. The Environmental Impacts of Slaughterhouses

One of the main causes of water contamination and environmental deterioration is slaughterhouses. For the sake of the animals slaughtered in the process, the employees who put their lives in danger, and the environmental health and safety of nearby populations, laws governing these operations are lax and ineffectively implemented. Large amounts of pollutants are discharged into rivers by industrial livestock and poultry slaughter and processing facilities (sometimes known as "slaughterhouses"), endangering both human health and the environment. Therefore, further approaches are required to enhance waste prevention (USDA.2021). But by reducing the quantity of animals processed, slaughterhouses can have less of an impact on the environment. It is possible to lessen the burden on the system of abattoir waste and contamination of natural resources by addressing overconsumption and unsustainable demand for meat, dairy, and seafood.

5.2.4. Microbiological quality of meat produced in a traditional slaughterhouse

The Microbiological quality of meat and meat products can be of great importance to public health important. There are many studies of foodborne

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69 Kim, G. D., Lee, H. S., Jung, E. Y., Lim, H. J., Seo, H. W., Lee, Y. H., & Yang, H. S. (2013). The effects of CO2 gas stunning on meat quality of cattle compared with captive bolt stunning. *Livestock Science*, *157*(1), 312–316. https://doi.org/10.1016/j.livsci.2013.07.008

70 Fuseini, A., Knowles, T. G., Hadley, P. J., & Wotton, S. B. (2016). Halal stunning and slaughter: Criteria for the assessment of dead animals. *Meat Science*, *119*, 132–137.

disease outbreaks due to meat consumption[71]. The meat is potentially subjected to contamination from a variety of sources within and outside the meat during slaughter and throughout the season sell it. In living organisms, the surface in contact with the environment is the home of many microorganisms[72]. The contaminating organisms are derived specifically from the disguise of the animal and the feces. The location of slaughter, the surroundings of the slaughter residence. The ground of the retail outlet, the air withinside the outlet and the car used for the delivery of the beef from the slaughter residence to the retail outlet act because the outside reasserts for the infection of the beef.

Microbial hazards in food are constantly changing. Humans, livestock, wildlife and microorganisms, pathogenic and non-pathogenic, live in a changing environment and represent a dynamic ecosystem and connected links. Changes in cooking habits or consumption patterns can create new opportunities for the introduction, proliferation, and transmission of pathogens[73].

Considerable development has been made in lowering infection at slaughter and thereby extending the shelf-lifestyles of meat. In contrast, global data nonetheless virtually display that meat and meat merchandise are liable for a prime share of all foodborne infections. This latter issue isn't decided through the general wide variety of microorganisms gift however through the bacterial composition of the animal's intestine plant life at slaughter. Preventive first-class warranty alongside the complete productions and processing line is consequently the handiest

71 Lee, H., & Yoon, Y. (2021). Etiological agents implicated in foodborne illness worldwide. *Food Science of Animal Resources*, *41*(1), 1–7. https://doi.org/10.5851/kosfa.2020.e75

72 Kumar, P., Rao, J., & Haribabu, Y. (2014). Microbiological quality of meat collected from municipal slaughterhouses and retail meat shops from Hyderabad Karnataka region, India. *APCBEE Procedia*, *8*, 364–369. https://doi.org/10.1016/j.apcbee.2014.03.022

73 King, T., Cole, M., Farber, J. M., Eisenbrand, G., Zabaras, D., Fox, E. M., & Hill, J. P. (2017). Food safety for food security: Relationship between global megatrends and developments in food safety. *Trends in Food Science & Technology*, *68*, 160–175. https://doi.org/10.1016/j.tifs.2017.08.015

powerful method of controlling the microbiological protection and first-class of meat. This consists of threat evaluation strategies to perceive essential manipulate factors and tactics for tracking the microbiological fame of each animal and carcasses when you consider that maximum of the essential factors can't be controlled. At early tiers withinside the manufacturing line, colonization of meat animals with pathogens ought to be prevented. Subsequently, appropriate slaughter practices will make certain carcasses of appropriate common microbiological quality.

6. Conclusion

Animals must be slaughtered for a healthy meat for human consumption. Religious slaughter of animals has been exposed to a much controversy and received attention in the current years. In this article, the effect of Islamic Halal and stunning slaughtering processes on the quality and stability of meat exhibited a varied consequence. It has been proven that Islamic HL slaughtering was a complete bleeding off the animal when the cutting of throat with the internal jugular vein was performed. It was leading to a rapid death without suffering. In addition, the objective evaluation criteria such as pH and color, eating quality, effective microbiology, and dietary health effects revealed improved and healthier effects.

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