

# Issues in Halal Meat Product and Authentication Technology from Islamic Perspectives

**Afiqah Salahudin<sup>1</sup>, Mohd Anuar Ramli (PhD)<sup>2</sup>,  
Muhammad Izzul Syahmi Zulkepli<sup>1</sup> and Muhd Imran Abd Razak<sup>3</sup>**

<sup>1</sup>Postgraduate Student, Department of Fiqh and Usul, Academy of Islamic Studies, University of Malaya, Kuala Lumpur, Malaysia

<sup>2</sup>Senior Lecturer, Department of Fiqh and Usul, Academy of Islamic Studies, University of Malaya, Kuala Lumpur, Malaysia

<sup>3</sup>Lecturer, Academy of Contemporary Islamic Studies (ACIS), Universiti Teknologi MARA, Perak Branch, Tapah Campus, 35400 Tapah Road, Perak, Malaysia

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## Abstract

With the advancement in science and technology, food technology is growing rapidly with a variety of ingredients and new methods acquired to be used in the production of food products. Therefore, difficulties will arise in ascertaining halal status because our senses are incapable of identifying it. Besides that, with technological advances in the meat processing industry, adulteration and fraud have become common due to monetary benefit. The issues in halal meat have provided an opportunity for scientists, researchers, consumers, manufacturer and regulators to cooperate together in detecting whether materials such as processed meats, non-meats and also processed food ingredients are safe to consume and free from food-borne zoonotic threats, i.e. hazardous chemicals, heavy metals, poisons and toxins. Halal authentication technology can help address this problem and thus aid jurists in determining the status of the products with great accuracy. It is essential to detect the presence of illegal substances more accurately by using laboratory analysis. Although laboratory tests can verify the absence of materials contaminated with illegal substances, the results of these tests are unsubstantial to become the sole source of information for halal guarantees. However, scientific justification and the results of laboratory analysis have nevertheless provided additional information to scholars in assessing halal status. A guideline based on Shariah is required for decision-making regarding consumption of halal meat. Studies related to halal authentication technology are still at minimum levels while the questions that have arose at present are matters of urgency that demand attention. Therefore, a new study parallel with the development of science and technology is required in order to develop the character of Islamic law determination and offer comprehensive alternatives to solve new problems effectively.

**Keywords:** Meat, Authentication, Food Safety, *Halalan Tayyiban*, Shariah

## **Introduction**

Basically, all meats other than what have been prohibited in the Quran and hadith as well as from the views of Islamic scholars are considered halal. But the status of the meat may change according to the way of preparing it. To prepare halal meat, the animal should be slaughtered properly and prepared for consumption by the way of Shariah or Islamic practice.

Parallel with the rise of food and halal industries, many companies came into existence as manufacturers or producers for meat production. Due to this fact, it is hard for consumers and Islamic enforcement bodies to identify between haram and halal meat as some industrialists are not adhering to the instructions in preparing halal meat. This problem is often caused by the greed to earn more and the disregard of Muslim welfare. This issue has piqued the interest of the writer to review some of the issues pertaining to the preparation of halal meat in the food industry.

## **Definition of halal meat**

Halal is defined as lawful or permissible to use or to engage in, according to Quran and Sunnah. Meat is the edible flesh of poultry or other animals (sheep, calves and bullocks). It is made up of bundles of fine tubes containing water, protein, minerals and extractives. In addition, halal meat can be defined as the meat obtained from halal animals that have been slaughtered in accordance with Islamic Shariah (Qureshi et al., 2012).

## **Basic concepts of Islamic rules governing halal meat**

Based on the Quran, Muslims are obligated to eat the meat of an animal upon which Allah's name has been invoked (invocation during slaughtering of the animal).

"Therefore, eat of that upon which Allah's name has been mentioned if you are believers in His communications," (Al-Qur'an, 6: 118).

Halal meat must not come from the prohibited meat as mentioned in the Quran:

"Forbidden to you is that which *dies of itself, blood, and flesh of swine*, and that on which any other name than that of Allah has been invoked, and the strangled (animals) and beaten to death, and that killed by a fall and that killed by being smitten with the horn, and that which wild beasts have eaten, except what you slaughter before, and what is sacrificed on stones set up (for idols); and that you divide by the arrows, that is transgression. This day, those who disbelieved have despaired of your religion, so fear them not, and fear Me. This day, I have perfected for you your religion and completed My favour on you and chosen for you Islam as the religion, but whoever is compelled by hunger, not inclining wilfully to sin, then surely Allah is Forgiving, Merciful (Al-Quran, 5: 3).

Consequently, halal meat must be obtained from halal sources only. All land animals are halal except for pigs, dogs, and carnivorous animals that slash and kill such as tigers, lions, bears, cats and similar animals; animals with tusks such as elephants; and animals that are permissible to be exterminated in Islam such as rats, centipedes, scorpions and other similar

animals. Likewise, all birds are halal except for scavengers and birds of prey, that are, those with claws and that feed by snatching and tearing like eagles; and also birds that are forbidden to be killed in Islam such as woodpeckers (Department of Standard Malaysia, 2009). So, to get halal meat, halal species of animals must be slaughtered using a halal slaughtering method (Nakyinsige et al., 2012).

### **Halal meat Adulteration Issues**

Adulteration is defined as the addition of undeclared substances or materials so as to increase bulk product or weight, making the product appear more valuable than it actually is (Hargin, 1996). In the case of meat and meat articles, adulteration not only refers to the replacement of ingredients but also to inappropriate information concerning the origin of raw materials (Montowska & Pospiech, 2014). Literature studies have shown that there are various issues related to adulteration of food products, especially halal meat. Issues related to food adulteration in Malaysia are mostly reported in mass media especially newspapers, however very few scientific studies pertaining to these issues have been conducted. Some halal meat issues that have arisen are:

#### **a. Formalin meat**

Meat has been immersed in a kind of chemical called formalin. Formalin is a 30-40 percent formaldehyde solution in water that is usually used to treat dead bodies or carcasses. However, this formalin if used in foodstuffs can be harmful because this formalin contains carcinogenic substances that can cause cancer (Ashriq, 2010). Additionally, meat contains formalin can cause the user to get asthma and skin diseases. Most formalin is used in chicken meat to provide resistance to the chicken from decomposition even if it is placed two days at room temperature as well as to avoid the flies (Sulistyo & Fikri, 2014).

#### **b. Carrcass**

Carcass is the term referring to animals that have died, either caused by accidents or from diseases. The animal's death without slaughter is usually due to two reasons; First, the animal dies alone without the cause of human interference such as disease, secondly, the animal dies because humans who do not meet the requirements of slaughter according to the Shariah (Manan & Muhd Izawan, 2016). The dead carcass or animal before being slaughtered cannot be eaten because of its non-halal status (Riaz & Chaudry, 2004). For example, cases that occur in Malaysia, chickens are likely to drown as a result of discharge in the water and there are also cases of some slaughtered chicken twice after the first slaughter is imperfect and there is a chicken already dead before slaughtered.

#### **c. Mixing meat**

Mixed meat usually involves two types of animals, which are expensive and halal meat mixed with cheap and haram meat. For example, the mixing of meat between beef and pork is often done by butchers solely for the benefit of gaining extra profit because pork is cheaper than beef. However, it will bring difficulties to differentiate between beef and pork via visual

inspection. As reported, Penang State Health Department officers had detected manufacturers that mixed fish meat with pork belly in making fish balls (Zakariya, 2008). Examples of cases occurring abroad are in 2013, the Chinese Ministry of Public Safety seized rat meat for sale as goat meat in Shanghai. Even rats and foxes are also sold as goat meat (Harun, 2014).

**d. “Glonggong” meat and meat injected with water**

“Glonggong” derived from Indonesian terminology, which literally means a water injection into the body of cattle. The cattle have been forced to drink as much as possible before being slaughtered to increase the weight of its meat. The quality of “glonggong” meat is often reduced and can easily become rotten and contaminated with microbes that can harm humans. “Glonggong” cows may possibly turn into carcasses due to death before slaughter caused by water entering its lungs and also from stomach rupture (Prasetyo et al., 2009). Meats are injected with water either directly into the meat or inserted through the mouth of the carcass. In China, goat meats are injected using water from contaminated sources to increase the weight of the meat and can cause harm to humans (Norhana, 2014).

**e. Fake meat**

Fake meat refers to a substitution of physical characteristics, textures and taste of meat to be a new physical, texture and taste of others meat. In China, there is a way to substitute a pork into beef by using chemical cow flavouring. However, this chemical will inflict long term effects on humans such as poisoning, defects and cancer. Besides that, there are also cases involving butchers who sell artificial beef and mutton, which are taken from rats and foxes (Md. Equb Ali et al., 2015). Meanwhile, in Japan, a team of researchers have created fake meat from recycled human waste.

**f. Meat from wild animals**

The exotic meat from wild animal species, mostly from terrestrial mammals to birds and reptiles, is mostly referred to as bush or game meat (Sandalj et al., 2016). Meats of protected wild animals like wild boars, elks, deer and pythons are sold illegally and publicly in Sarawak (The Borneo Post, 2014). The people who hunt, handle and consume bushmeat put their lives at risk due to diseases. The hunting and butchering of bushmeat, particularly primates, have been implicated in the transmission of several zoonotic pathogens to humans, including simian immunodeficiency virus (SIV, a zoonotic form of HIV), Ebola, and severe acute respiratory syndrome (SARS) (Cawthorn & Hoffman, 2015).

**g. Meat from diseased animals and meat containing zoonotic threats**

Meats from infected animals are also sold in the market. The mad cow disease or also known as Bovine Spongiform Encephalopathy (BSE) is an example of cow disease. The consumption of meat from an animal which is afflicted by BSE disease will increase the risk of Creutzfeldt-Jakob disease (vCJD). This disease will cause shrinkage of the human brain (Nur Illiyin & Yanty Noorzianna, 2014). Zoonotic threats are infections or diseases that can be transmitted directly

or indirectly between animals and humans, for instance, by consuming contaminated foodstuffs or through contact with infected animals.

#### **h. Fraud Meat**

Basically, it's produced by dishonest manufacturers or butchers to increase sales profits. In Malaysia, venison is replaced by imported buffalo meat because the price of venison is higher than beef and buffalo meats (Shahni Farhana, 2015). Meanwhile, a test done by the British food industry on 2501 samples of beef pasta for horse adulteration had revealed more than 1% of horse meat merged with beef (www.nytimes, 2013). Although the horsemeat and venison scandals did not involve food safety or impose risks on human health, meat were being sold as misleading products that are not parallel with their actual ingredients by replacing high quality meat with low quality meat. Besides that, meat from dogs, cats, rats and macaques are potential adulterants in halal meat since stray dogs and cats are available in many countries without any existing price and found easily in huge populations in alleys. There have been reports of dog meat consumption in certain countries such as Vietnam, South Korea and China.

#### **i. Meat containing drug residue**

Residues from drug usage on animals like beta-agonist can cause side effects to the people who consume the meat (P. Jeyaletchumi, 2003). Side effects include irregular heart function, muscle shivering, headache and difficulty to sleep. Based on reports done by Ministry of Health, breeders are still using beta-agonist for breeding (APTVM 16, 2016) even though the substance can harm humans.

#### **Authentication techniques for detection of meat products**

The development of current technology enables the product of the food produced to be analysed in terms of its contents accurately and so on, the determination of illegal halal can be done effectively (Jamaludin & Radzi, 2009). Scientists have introduced various halal authentication techniques. For example, Enzyme Linked Immunosorbent Assays (ELISA), Radio Immunoassays (RIA), HPLC, FTIR, Electronic Nose coupled with GC-MS and PCR assays have been applied to analysing harmful meat, pathogens and chemicals in either processed and unprocessed food. For example, the use of instruments such as the Fourier Transform Infrared (FTIR) spectroscopy to detect pig derivatives in meat products (Che Man & Mirghani, 2001). Analytical methods can provide accurate results in determining the deterioration of a food product. Among the methods used in halal authentication are:

1. Microscopy is a method of meat-based analysis of food such as meat or bones. This method can distinguish between foodstuffs derived from plants or animals, but this method cannot accurately identify specific species of animals if there is a food ingredient resulting from mixed animals (Ali et al., 2012).

2. FTIR spectroscopy (Fourier Transform Infrared (FTIR) Spectroscopy) is a technique used to measure the vibration of the bonds in molecular functional groups (Rahman & Che Man, 2011). Infrared (IR) has been used to generate information on molecular composition and structure of

various types of materials including fats and oils. FTIR techniques and chemo metric analysis can detect and measure pig fat levels in food samples (Yusof et al., 2007). Here is an example of using FTIR in food products:

Method	Sample	Issue	Research
FTIR	Meat	Pork lard mixed with other meat	(Che Man & Mirghani, 2001)
		Pork identification	(Al- Jowder et al., 1997)
		Pork lard mixing	(Jaswir et al., 2003)

3. Electronic Nose (E-Nose) known as "electronic nose" is a combination of electronic chemical detector series and pattern identification system used to identify illegal odour detector (Rahman & Che Man, 2011). The E-Nose is an instrument that includes electronic chemical detectors and is capable of detecting simple or complex scents or odours (Yusof et al., 2007). Here is an example of a study conducted using this method:

Method	Sample	Issue	Research
E-Nose	Edible oils	Detection of lard adulteration	(Che Man et al., 2005)
	Meat and sausage	Detection of pork from beef, goat and sausage	(Nurjuliana et al., 2011)
	Pork lard	Pork meat	(Nurjuliana et al., 2011)

4. ELISA is a protein-based immunochemical technique that is capable of expediting the screening process with the presence of 'analyte' or antibody (Rahman & Che Man, 2011). Here is an example of a study that uses this method:

Method	Sample	Issue	Research
ELISA	Meat and food product	Quantification of pork	(Chen & Hsieh, 2000)
	Meat	Meat substitution (species)	(Koppelman et al., 2004)

5. Differential Scanning Calorimetry (DSC), calorimetry method is a kind of thermos analytical technique used to detect changes in physical and chemical properties of the material by detection of heat changes (Rahman & Che Man, 2011).

Method	Sample	Issue	Research
DSC	Ghee and butter	Goat fat adulteration	(Lambelet et al., 1980)
		Adulteration of beef fat from cattle and buffalo with pig	(Lambelet & Ganguli, 1983)
		Detection of pigs and animal fat contaminated with pork fat	(Kowalski, 1989)

6. PCR (Polymerase chain reaction) means the chain action using polymerase DNA enzymes and in principle is DNA fragmentation using specific primers. PCR is regarded as one of the most sensitive methods in identifying the identity of a substance. PCR is capable of detecting DNA even in small quantities by applying target ranges to DNA moulding and the advantage of this method is that it is highly sensitive and able to detect illegal substances in a short period of time (Mustafa et al., 2008). PCR (Polymerase Chain reaction) is also a "chain action using DNA polymerase enzymes" that are used to differentiate between animal species. PCR can be divided into two types:

1. Conventional PCR

There are three main steps in the conventional method of PCR i.e. the extraction of DNA from the sample to be studied, the preparation of PCR reactions (PCR reactions can be divided into three main processes i.e. denaturation, annealing and extension) and detection of reaction results using agarose gel electrophoresis.

2. Real-time PCR (rt-PCR)

There are two steps involved in real-time PCR i.e. DNA extraction and PCR reactions. No step-by-step tracking of the reaction results using electrolysis gel agarose because the detection was performed during the reaction. Among the main advantages of using rt-PCR method is shorter analysis time, more sensitive results and do not involve harmful chemicals (Mustafa et al., 2008). Dooley et al. (2004) use the rt-PCR method to differentiate the species of cattle, goats, chickens, turkeys and pigs.

7. Biochip DNA or microarray DNA technology is a modern method that has the potential to detect one hundred or more thousand species simultaneously (Ali et al., 2012).

However these techniques have weaknesses as there are no methods found satisfactory in cost effectiveness, reliability and durability. For example, methods in identifying meat species are methods based on lipids, proteins and DNA. The lipid method is unreliable because the type and content will be manipulated during the cooking process. While DNA-based methods have grown as the most efficient method because of its high stability, and easily found DNA in most cells. The most noticeable DNA method is PCR because it is easy to operate and can produce many copies. DNA is a reliable method but cannot detect a short DNA target. Methods of using

fluorescent and radio labelling, can detect short targets but require high costs and also have high errors in the final result as not specific dye labels. This short DNA target is required because it has high durability and stability despite being in extreme temperatures. Hence, various techniques are developed in order to overcome these weaknesses.

### Discussion

The task of halal meat authentication cannot depend only on expertise from Shariah, but also other related technical fields such as food science and technology, chemistry and veterinary science (Van der Spiegel, 2012). Halal authentication cannot rely solely on physical inspection and documentation anymore, but must require the use of the latest highly sophisticated technology and analytical instrumentation. This is because adulteration of haram or *shubhah* ingredients in food products has been widespread and is difficult to be identified with the naked eyes (Nurulhidayah et al., 2012), in addition to new issues that are unprecedented in classical *fiqh*. In essence, this will impose difficulties to Muslim scholars or *mujtahid* to issue fatwa in response to these issues. Therefore, certain processes must be executed before issuing a precise fatwa or *hukm* by the *mujtahid*.

Based on the issues that have been discussed before, a holistic approach is necessitated in ruling a clear *hukm*. Thus, scientific values are required to aid in complementing the ruling of a *hukm* before a decision on the *hukm* is made.

Prior to this, Muslim scholars' ruling over a *hukm* is based on the capability of their own senses (observation) without the support of any scientific or empirical evidences because of limited technology at the time. Fundamentally, their views are no longer suitable to handle new issues which are rather complex and more complicated such as those happening at present. With advancement in technology, we can now detect pork by using FTIR and also determine the level of alcohol in foods by using gas chromatography. Besides that, some issues that are happening in this technological era are contemporary and never discussed before by classic Muslim scholars like the issue on meat burgers produced from laboratories.

Hence, to handle these issues, thorough scientific research is often needed to assist *mujtahid* in determining Islamic rulings through the collective *ijtihad* approach. Collective *Ijtihad* is rather applicable and practical in our context because some issues need efficient solutions, which include other fields that are impossible to master by one person from just one discipline (al-Qaradawi 1994; 1997). Therefore, in making Islamic ruling, Muslim scholars should cooperate with other scholars from other fields of study to determine a decision from *ijtihad* with efficacy.

### Conclusion

Islam strongly emphasizes the aspect of food consumption of its followers. The food intake in terms of meat consumption by a Muslim must be derived from halal animals that have been slaughtered based on Islamic practice as well as must not bring harm to humans and essentially



clean. Therefore, based on the issues that are arising in halal meat production, analytical methods performed by scientists are strongly needed to detect elements that are prohibited by Islam like pork and any other elements deemed harmful to humans. In short, it will assist in providing additional information to Muslim scholars such that they can issue a precise Islamic ruling pertaining to a particular issue.

### **Corresponding Author**

Afiqah Salahudin

Email: [afiqahsalahudin@gmail.com](mailto:afiqahsalahudin@gmail.com)

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