

## Halal Meat: A Niche Product in the Food Market

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**Abstract.** Religion is a fundamental factor in determining food avoidance, taboos and special regulation with respect to meat. A quarter of the world population is made up Muslims. Muslims have unique dietary requirements and are very keen to uphold the tenets of their religion. This group of consumers is scattered around all countries of the world and have a high purchasing power estimated at US\$ 2.1 trillion. In order to tap into this lucrative market, the food industry must understand the Muslim requirements for halal food, particularly meat and meat products. Unlike other consumer groups whose purchasing decision is guided by aspects of lifestyle, culture, diet and health concerns, the purchasing decision of Muslims is normally guided by the halal status of the meat. Many Muslims may check for the halal logo of the product before even checking the expiry date. Although the halal status of meat is often believed to be equivalent to the application of halal slaughter, practically it is much more than that. The production of halal meat consists of many critical control points from farm to table in order to ensure that the meat is produced in the acceptable manner and there is no cross contamination with non-halal materials at all unit operations. Unfortunately, the food industry is often unaware of the requirements of the Muslim consumer or often indulges in adulteration for monetary benefits. Halal certifying authorities need robust analytical techniques in areas where fraud is most likely to occur. This paper sets out to highlight the requirements of the halal food chain as well as give an overview of the methods used to authenticate halal meat products.

**Key words:** Meat, Halal, Muslim consumers, Authenticity

### 1. Introduction

Islam is a comprehensive religion that guides the lives of its followers through a set of rules (shariah law) governing moral, social and economic aspects. The primary sources of Islamic law are the Holy Quran and Hadith (the practice of Prophet Muhammad, peace be upon him). These basic principles of the Islamic law remain definite and unaltered. However, their interpretation and application may change according to two other sources of jurisprudence, namely Ijma (a consensus of legal opinion) and Qiyas (reasoning by analogy) to suit the time, place, and circumstances (Regenstein et al., 2003) [1]. For Muslims, eating is an act of worship and it is the obligation of every Muslim to obtain halal food. Meat is one of the major sources of proteins in the diet and it is a medium rich in social meaning due to its association with cultural habits and rituals, both religious and secular (Fiddes, 1992) [2]. The consumers'

one of the major sources of proteins in the diet and it is a medium rich in social meaning due to its association with cultural habits and rituals, both religious and secular (Fiddes, 1992) [2]. The consumers' decision to purchase meat is often guided by the perception of healthiness, safety and such sensory traits such as colour, tenderness, juiciness and aroma or flavor. However, from the Muslims' point of view, decision to purchase meat does not depend on any other factor except its halal status.

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Halal is an Arabic term which means permitted, allowed, authorized, approved, sanctioned, lawful, legal or legitimate. When used in relation to food or other consumer goods, it means permissible for consumption and use by Muslims. The term halal has become more common in the food industry due to increased consumer demand for halal products. In 1997, at its 22<sup>nd</sup> session in Rome, the Codex Alimentarius Commission, a joint FAO/WHO subsidiary body responsible for developing international food standards adopted general guidelines for the use of the term “halal” (CAC/GL 24-1997) [3]. The purpose of this standard is to protect the health of consumers and ensure fair practices in food trade globally, particularly, regarding the use of the term *halal* and equivalent terms in claims as defined in the General Standards for the Labeling of Prepackaged Foods. With the world Muslim population close to two billion, the provision of halal meat for the Muslim community has become important both ethically and economically. The consumer base for halal products is estimated to be US\$ 2.1 trillion; with food products estimated US\$ 580 billion (Ministry of International Trade and Industry Malaysia, 2006) [4]. The sheer number of Muslims globally and the general shortage of food in many regions with large Muslim population makes this group a prime market for the food industry (Chaudry, 1992) [5]. This has made it imperative for the food industry to understand the requirements of Muslim consumers. Henceforth, the purpose of this paper is to show the economic worth of halal food trade, highlight key requirements for the production of halal meat and meat products and give an overview of the techniques that can be used to differentiate and authenticate halal meat and meat products.

## 2. The Economic Worth of the Halal Food Market

Both the Muslim and the secular world are concerned about halal food alike because halal is an important component of the food business yet a great number of people in the food industry are unaware of the Muslim requirements for halal food. Although, there exists excellent opportunities worth realizing in the secular states’ halal market, even more compelling opportunities exist world wide as the food industry moves to more global business model [1]. The global Muslim population is estimated to be above 1.5 billion people and is expected to grow at a rate of 3% annually (Che Man& Sazili, 2010) [6]. The highest densities of Muslim populations are located in South East Asia, North Africa and the Middle East. All these regions are net importers of food, particularly meat. In most of these countries, halal certification has become mandatory for all imported meat products. Additionally, halal meat is consumed by not only Muslims but also Non-Muslims. For instance, Gregory (2008) [7] reported that in the UK, there are 2 million Muslims yet there are 6 million consumers of halal meat.

Interest in the consumption of halal meat has increased tremendously. Apart from Islam being the world’s second largest and fastest growing religion, there is increased awareness of Muslims to uphold the tenets of their religion. The growing purchasing power of Muslims around the world has resulted in the increased consumption of halal foods. The global halal food market is estimated at US\$ 580 billion annually [4]. The increased Islamic awareness of halal food worldwide coupled with the increased rate of immigration of Muslims into Non-Muslim countries will create new and larger markets for halal food products. Food manufactures, especially the meat industry with the intention to explore the lucrative halal market must understand the requirements of halal food products.

## 3. Requirements for the Production of Halal Meat

The basic requirements for the production of halal meat are obtained from the Holy Quran. Allah informs the believers of what is prohibited as well as reminds them to eat food that is halal (accepted).

*“O you who believe! Eat of the lawful things that We have provided you with, and be grateful to Allah, if it is indeed He Whom you worship. He has forbidden you only the dead animals, and blood, and the flesh of swine, and that which is slaughtered as a sacrifice for others than Allah (or has been slaughtered for idols, on which Allah’s Name has not been mentioned while slaughtering)”* Al- Baqarah, 2: 172-173.

First and foremost, the source of halal meat should be from accepted species. All land animals are halal except pigs and dogs and their descendants, animals with tusks like elephants, animals with long pointed teeth which are used to kill prey such as tigers, bears, lions, cats, and similar animals, scavengers and birds of prey, that is, those with claws and those that feed by snatching and tearing like eagles, pests and animals

which are permitted to be killed in Islam such as rats, centipedes, scorpions and other similar animals, repulsive creatures such as lice and flies and animals which are forbidden to be killed in Islam such as bees and wood peckers. All aquatic animals are halal except those that are poisonous, intoxicating or hazardous to human health. Animals that live and survive on both land and water such as hippopotamus, crocodiles, turtles, frogs and toads are not halal (Department of Standards Malaysia, 2004 [8]; Department of Standards Malaysia, 2009 [9]; [3]). It is important to note that halal animals may become haram during breeding in case the animals are treated with any product derived from haram sources or obtained biotechnologically through genetic engineering using components from haram species [8]; [9].

Unlike aquatic animals which do not require slaughtering, land animals must be slaughtered according to the shariah law. Practically, live animals or those deemed to be alive at the time of slaughter (in case pre-slaughter stunning is used) must be slaughtered by a sane adult Muslim by severing the trachea, esophagus, jugular vein and carotid artery in a single swipe using a sharp knife, upon recitation of the phrase “*Bismillah, Allahu Akbar*” (In the Name of Allah, Allah is Greatest) or “*Bismillahi Rahman Rahim*” (In the Name of Allah, The Most Gracious, The Most Merciful). Water bath stunning for poultry, head-only-electrical stunning and non-penetrative captive bolt stunning for ruminants may be used before exanguination, however it is beyond the scope of this paper to discuss the Shariah requirements for stunning. Scalding for poultry and carcass dressing for ruminants should only commence after the animal is deemed dead as a result of slaughter as well as bleeding is completed. Slaughtering lines and tools should be dedicated to halal slaughter only and the premises should be physically separated from the non-halal. If the equipment that was used for non-halal slaughter is to be converted to halal slaughter, ritual cleansing is mandatory. The Islamic ritual cleansing (dibagh) involves washing the equipment seven times, one of which consisting of pure natural water mixed with soil that is free from impurities [8]; [9].

During processing, handling, manufacturing, packaging, storage, transportation and display, halal meat products should be physically separated from the non-halal ones. Equipment used in all unit operations should be solely dedicated for halal production. Care must be taken to avoid cross contamination of halal meat and meat products with non-halal substances. Halal meat and meat products must be suitably packaged with packaging materials that are decreed as acceptable by the Shariah law. For such products like frankfurters or sausages that require casings as processing moulds, primary packages during handling and shipping, and as merchandizing units during display, the casings for halal products are those made from cellulose, collagen and intestines from halal animals that have been slaughtered according to the Shariah law or synthetic ones. Casings from pork intestines or collagen from animals which are not slaughtered according to shariah laws are haram. In addition to being halal, the package in direct contact with the meat product should be non-hazardous to health and each secondary package or container should be marked legibly.

All the ingredients used in the processing of halal meat products must be halal. All ingredients derived from forbidden sources such as porcine derivatives and substances derived from animals which are not slaughtered according to Shariah law are not halal. Blood and blood-based ingredients are not halal too. A number of food ingredients have been declared as haram (prohibited) by Islamic authorities and these include bacon or natural bacon flavor, (Riaz and Chaudry, 2004) [10], gelatin that is classified as food according to EEC's Codex Alimentarius and derived from animals unless the label says "Halal gelatin", glycerin and lecithin from animal fat, ingredients made from pork fat such as lard, mono & diglycerides, sodium stearoyl lactylate, and polysorbate 60 or 80, enzymes derived from haram animals, grain/plant based ingredients with pig based carrier such as Beta carotene (pig Gelatin) and butylated hydroxyl anisole/butylated hydroxyl toluene (pig based carrier), alcohol, (Riaz, 1999) [11], blood plasma and blood plasma enzymes (Grundy et al., 2008 [12]; Grundy et al., 2007) [13]. Some ingredients such as yeast extract from brewer's yeast and cochineal/carmine colour have been classified as doubtful by Islamic authorities. Avoiding them is highly encouraged. Prophet Muhammad (peace be upon him) in a hadith narrated by Bukhari and Muslim advised the believers to avoid doubtful things.

*“Both halal and haram things are clear but in between them there are doubtful (suspicious) things and most of the people have no knowledge about them. So whoever saves himself from these suspicious things saves his religion and his honour. And whoever indulges in these suspicious things is like a shepherd who grazes (his animals) near the Hima (private pasture) of someone else and at any moment he is liable to get in it. (O*

people!) Beware! Every king has a Hima and the Hima of Allah on the earth is His illegal (forbidden) things.” (Al-Qaradawi, 1995) [14].

Other than fulfilling the halal requirements, halal meat must meet other international standards regarding safety and quality. The production process should meet all the requirements for Hazard Analysis Critical Control Points (HACCP) and Good Manufacturing Practices (GMPs). Halal food should be acceptable (halal) and of good quality, wholesome and safe (thoyyib). The “Halalan Thoyyiban” concept has been mentioned severally in The Holy Quran.

“O mankind! Eat of that which is lawful and good on the earth, and follow not the footsteps of Satan. Verily, he is to you an enemy” Al-Baqarah, 2: 168 [15].

“So eat of the lawful and good food which Allah has provided for you. And be grateful for the Favour of Allah, if it is He Whom you worship” Al-Nahl, 16:114 [15].

In short halal is healthy, halal is clean, halal is natural (organic), halal is a premium product, halal is humane to animals and halal is environmentally friendly. The production of halal meat and meat products follows the “from farm to fork” conception. The whole supply chain as shown in Figure 1 should be halal compliant.

It is recommended that all companies that meet halal requirements obtain halal certificates from credible Islamic authorities. There are a number of halal certifying organizations in different countries such as Central Islamic Committee of Thailand (CICT), Department of Islamic Development Malaysia (Jabatan Kemajuan Islam Malaysia) (JAKIM) , Halal Food Authority (HFA) in UK, Islamic Food and Nutrition Council of America (IFANCA), Halal Food Council International (HFCI), Australian Federation of Islamic Council (AFIC), Federation of Islamic Association of New Zealand (FIANZ), Islamic Religious Council of Singapore (MUIS), Ulama Council of Indonesia (Majelis Ulama Indonesia) (MUI) and many more. Upon application, auditing and issuance of the halal certificate, the company is free to use the halal logo of the certifying authority on its products. Today, some importing countries, particularly in the Middle East, East Asia and North Africa require that all imported meat and meat products be halal certified. The halal certificate attests that the product is halal compliant and acceptable for Muslim consumption.

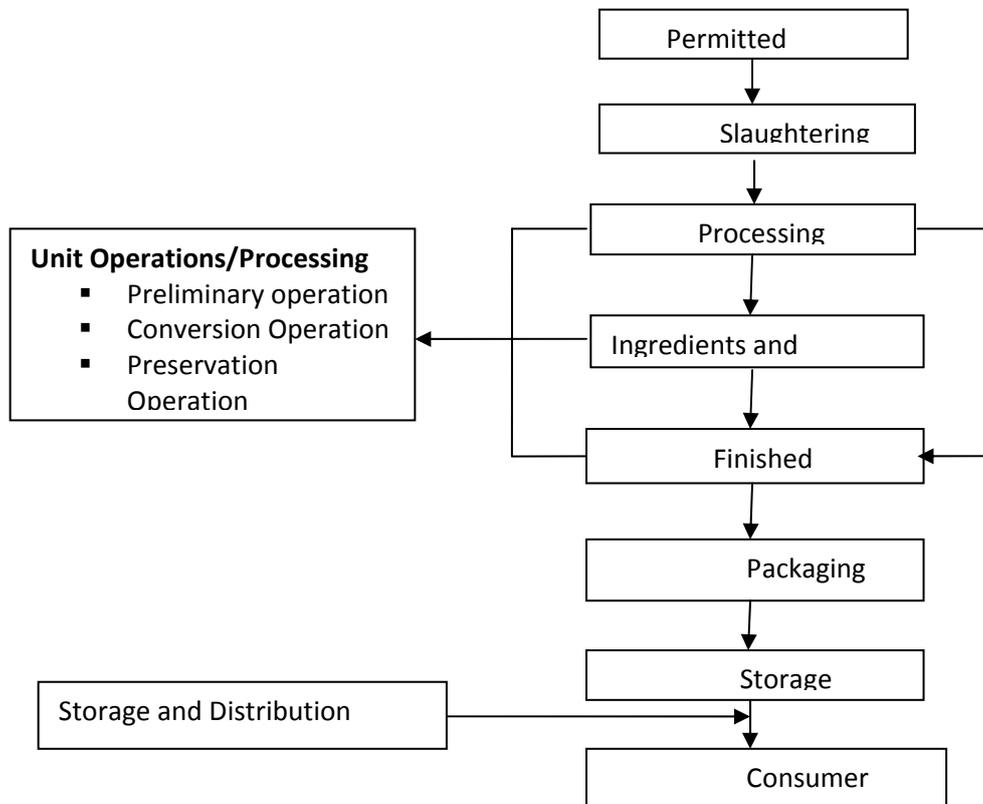


Figure 1: Halal Meat Supply Chain

#### 4. Techniques for Authentication of Halal Meat Products

Historically, meat for Muslim consumption was not widely associated with adulteration and halal certification was not necessary since meat was sold fresh at easily recognizable joints. However, in late 70's or early 80's, countries with Muslim minorities like South African, and Fiji, Muslim countries like Brunei, Malaysia and Indonesia, and Arab countries in the Middle East or North Africa started importing meat or meat products from various countries such as USA, Europe and China. This made halal certification of meat and meat products very important. Today, the food chain has become so long and immensely complex. Food adulteration is not uncommon. This trend has resulted in Muslim consumers being worried about the food they obtained from shelves, thus the need for traceability of meat origin. Analytical techniques have been developed, each appropriate and specific to deal with a particular problem. The most suitable technique for any particular sample is often determined by the nature of the sample itself, for instance whether it is raw or cooked, whole muscle or comminuted (Hargin, 1996) [16].

Authentication is the process by which a food is verified as complying with its label description (Dennis, 1998) [17]. For Muslim consumers, the major authenticity concerns in meat and meat products include pork substitution, undeclared blood plasma, pork intestine casings, non-halal methods of slaughter and utilization of prohibited ingredients. Much attention has been paid to the detection of pork adulteration for verification of halal meat and meat products. This is because worldwide, porcine derivatives are the commonest non-halal materials fraudulently used by meat processors. In most countries, food manufactures choose to use porcine derivatives because they are cheap and readily available (Aida et al., 2005) [18]. Pork adulteration is the major concern for Muslim consumers. Consequently, a number of techniques have been developed to for detection of pork adulteration. The analytical methods used for halal authentication of meat and meat products include polymerase chain reaction, enzyme linked immunosorbent assays (ELISA), mass spectrometry, chromatography, electronic nose and spectroscopy. The commonly used analytical techniques for pork detection are given in Table 1.

The analytical techniques currently used for detecting pork adulteration rely on either protein or DNA analysis. ELISA is the most commonly used protein based technique and a number of commercial immunoassays or ELISA kits are available. Other protein based methods include; electrophoresis, Fourier transform infrared (FTIR) spectroscopy, near- infrared spectroscopy, electronic nose and chromatography. However, protein based techniques have numerous limitations. In addition to being limited when assaying heat treated products (due to denaturation of proteins during thermal processing), analyses of immunoassays that rely on the use of antibodies raised against a specific protein are often hindered by cross- reactions occurring among closely related species (Fajardo et al., 2010) [19].

Due to the advantages DNA based techniques have over Protein based techniques; there is a shift from protein to DNA analysis. Degeneracy of DNA offers the advantage of differentiating among different animal species solely using DNA analysis. In addition to DNA being a stable molecule that allows analysis of processed and heat treated products, it is present in majority of cells and the information content of DNA is not only greater than that of protein but it can also be extracted from all kinds of tissues (Ballin, 2010) [20]. Polymerase chain reaction (PCR) has the capacity to amplify a few copies of DNA and its detection limit is much lower than what is observed with protein based assays. The basis of PCR amplification is the hybridization of specific oligonucleotides to a target DNA and synthesis of million copies flanked by these primers. Detection of species with PCR involves choosing adequate genetic markers, either nuclear or mitochondrial genes to develop the assay. Techniques that are commonly used to detect species for halal authentication include; Polymerase chain reaction (PCR) amplification of mitochondrial DNA, PCR-restriction fragment length polymorphism (RFLP) analysis, PCR using species-specific primers, Real time PCR, random amplified polymorphic DNA (RAPD) analysis and PCR sequencing (Nakyinsige et al in press) [21].

Recently, immunochromatographic assays using nano-sized colloidal gold particles were developed. These assays can rapidly detect pork in both raw and cooked samples at low cost without using any special equipment or requiring skilful techniques, by just observing colour change (Ali et al., 2012) [22]. The method is best suited for conducting preliminary screening of large numbers of routine samples before using the traditional DNA or protein based methods for confirmation, which can enable an enhanced surveillance

program of the halal meat products supply. Analytical methods for verification of halal meat products have been reviewed by Nakyinsige et al. (in press) [21].

Table 1: Summary of Analytical Techniques Applicable in the Halal Authentication of Meat and Meat Products.

Authenticity issue	Analytical technique	References
Pork adulteration		
Species identification	PCR-RFLP	Murugaiah et al. (2009); Aida et al. (2007); Aida et al. (2005)
	Real time PCR	Martin et al. (2009), Kesmen et al. (2009); Tanabe et al. (2007); Fumeire et al. (2006); Lopez-Andreo et al. (2006)
	Species-specific PCR	Soares et al. (2010); Alaraidh, (2008); Che Man et al. (2006); Montiel-sosa et al. (2000).
	RAPD	Martinez and Yman (1998).
	PCR sequencing	Karlsson and Holmlud (2007)
	Gold nanoparticles	Ali et al (2012)
Pork protein	ELISA	Chen and Hsein (2000); Chen and Hsein (2000)
	Chromatography	Chou et al. (2007)
	Peptide examination	Aristoy and Toldra (2004)
	Isoelectric focusing	Hofmann (1985)
Pork fat (lard)	FTIR spectroscopy	Rohman et al. (2011); Che Man et al., 2010; Rohman and Che Man (2011a&b); Rohman and Che Man (2009); Che Man et al. (2005); Che Man and Mirghan, (2001).
	DSC	Marikka et al (2003); Marikka et al (2001)
	Electronic nose	Nurjuliana et al (2011a); Nurjuliana et al. (2011b); Che Man et al. (2005).

Source: Nakyinsige et al (in press).

## 5. Conclusion

Halal status of meat is a credence attribute, which cannot be ascertained by the consumer even upon consumption of the meat. It is the responsibility of the meat processing industry as well as certifying authorities to protect the integrity of halal. To achieve this, all stake holders in the meat industry should be knowledgeable in the Shariah requirements for production of halal meat as well as halal certifying authorities should be equipped with quick, reliable and cost friendly analytical techniques to differentiate halal meat from the non-halal.

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