

Embedding Islamic dietary law into an HACCP approach for application to the poultry slaughtering and processing industry

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Abstract

Since early 2000, Malaysian food-export industries have recognised the demand for food compliant with Islamic dietary law (halal), with primary consumer choices based on quality and safety. The lack of documented monitoring for health hazards and haram substances led to the withdrawal of certification. The HACCP-based halal quality-assurance standards were developed as a result, using the HACCP criteria for safety, religious dietary requirement and quality. Halal critical control points (HICCP) are identified using HACCP criteria and a question tree on HALAL processing and storage. This approach harmonizes and unifies halal processing with the specific food industry via an HACCP-based halal quality-assurance system.

Keywords

HACCP

Halal critical control point

(HICCP)

Hazard control point (HCP)

Haram analysis

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Introduction

Increasingly, the food industry is being called upon to take more initiative in terms of halal quality and safety to protect their brands. In Malaysia, JAKIM (Malaysia Department of Islamic Development) certifies halal food producers based on MS 1500:2009 (Zunirah *et al.*, 2010); however, a unified implementation of guidelines is needed to create a sustainable certification system.

A major challenge in halal certification is the absence of a globally accepted halal standard. Very little mutual recognition exists between certification bodies globally (Kohilavani *et al.*, 2011). Although unifying halal certification bodies constitutes a major challenge, standardising the implementation system may yield a solution. Baines (2001) stated that standards are generally defined as a series of internally recognised guidelines for food and/or as consumer/commercial specifications. According to Ušćebrka *et al.* (2009), the food-safety criteria and elements of producers' standards are generally implemented in accordance with legislation. In addition to minimum quality standards, reference standards and standards of compatibility (Ušćebrka *et al.*, 2009), Islamic dietary law plays a vital role in ensuring standardisation of a halal processing system.

According to Macdonald and Engel (2001), the HACCP system can be applied to every step in industry operation, such as raw material procurement, supply, preparation, storage and distribution. Chen *et al.* (2007) state that HACCP can be a powerful tool for identifying hazards in any supply chain. Mortimore and Wallance (1998) also state that these techniques are flexible and can be applied to other areas or sectors like quality and to products beyond the food industries such as electronics, fashion, pharmaceuticals, etc.

While halal certification by JAKIM covers elements of food safety supported by MS 1480 and MS that are generally covered under Codex – “*Recommended International Code of Hygiene Practice. General Principles of Food Hygiene under CAC/RCP 1-1969, Rev. 4-2003*”, the effectiveness of a product-certification approach may be restricted by the modern dynamic landscape of food establishments. Halal critical control point (HICCP) is a method of identifying haram substances by using the steps in the HACCP system (Kohilavani *et al.*, 2013). Haram substance identification can be incorporated into the HACCP plan. This paper demonstrates development of HACCP-based halal standards to identify and establish haram critical control points.

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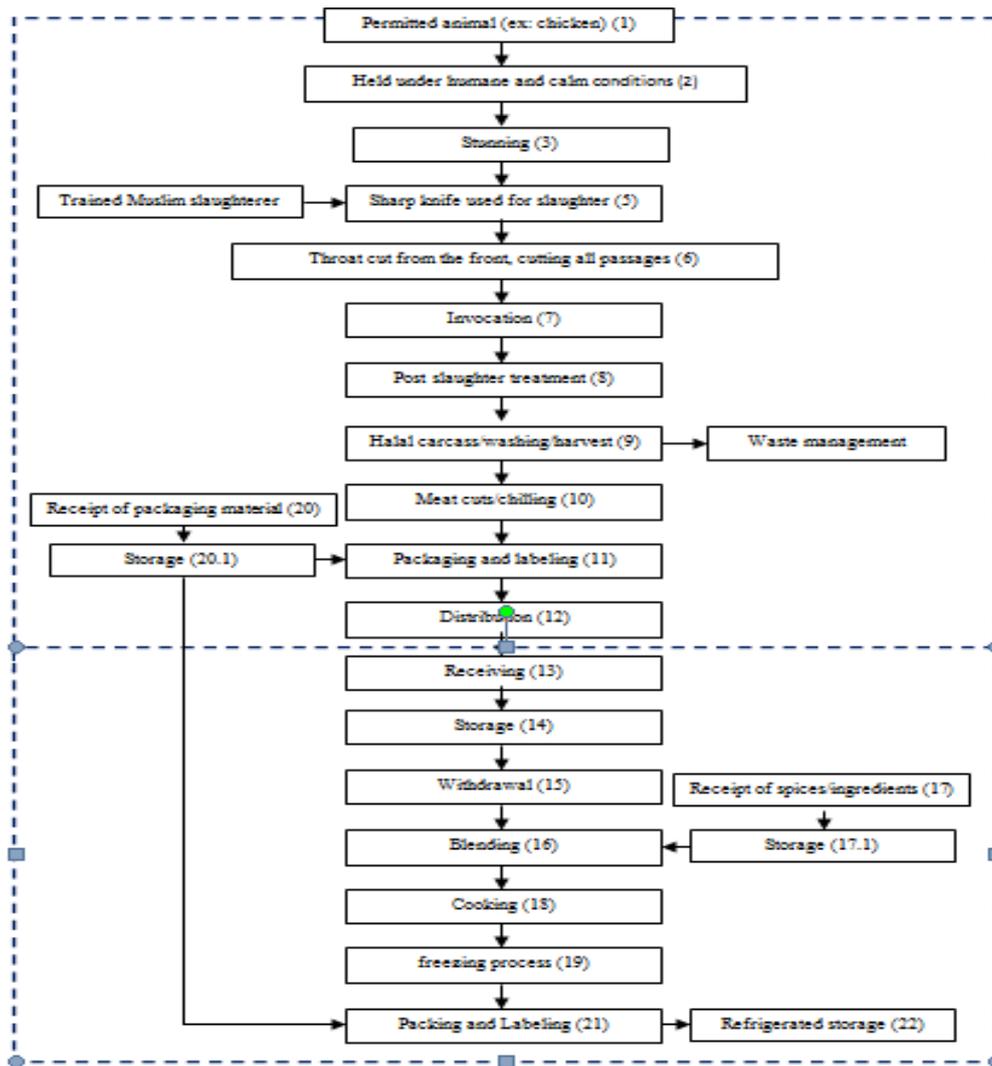


Figure 1. Generic halal slaughter, storage and processing flow diagram

Existing HACCP system

The steps used to develop the critical points in the HACCP system according to industry needs were described by Stevenson and Bernard (1999) and Kohilavani *et al.* (2013).

Application to processing and storage of halal food

As a working basis for Integrated Halal Implementation, the following prerequisite program and standards were used as references:

a) CAC / GL 24-1997, General Guidelines for Use of the Term “Halal” - General guidelines for use of the word “halal” (Codex Alimentarius CAC/GL 24-1997)

b) CAC / RCP 11-1993, Recommended Code of Hygienic Practice for Fresh Meat (Codex Alimentarius CAC / RCP 11. Rev 1-1993)

c) Legal Requirement: MS 1500:2004 Halal Food-Production, Preparation, Handling, And Storage-General Guidelines, Malaysia based on proactive prevention method.

e) ISO 9000:2001, Quality management systems – Fundamentals, vocabulary and concepts
f) The principles of Shariah - the Quran and Hadith

The HACCP plan clearly distinguishes among food safety, quality and Islamic dietary law.

Food safety = CCP/CP identifiers (Peters. 1998)

Quality = QCP/QP identifiers (Arvanitoyannis and Hadjicoastas, 2001; Hayati and Khairul 2009)

HARAM substances = HICCP/HICP identifiers (Riaz and Chaudry, 2004)

Suggested HACCP system

Task 1- (The halal team)

It is essential to form a halal team consisting of individuals with sufficient knowledge of Islamic dietary law and food safety.

Task 2 – (Halal product description)

Table 1. Determination of halal critical control point (HCCP) for chicken slaughtering

A/A	Step	Q1 Do they conduct Islamic halal slaughter?	Q2 Is the butcher trained in their task, and does he perform it according to Islamic dietary Law?	Q3 Is the animal stunned prior to slaughter?	Q4 Is the knife sharp and suitable?	Q5 After slaughtering, is the animal completely dead and fully exsanguinated?	Q6 Are the discarded blood and organs utilised?	HCCP/ HCP
1	Permitted Animal	Yes	-	-	-	-	-	HCCP 1
2	Hold under humane and calm	Yes	-	-	-	-	-	HCCP 2
3	Stunning	-	Yes	Yes	-	-	-	HCCP 3
4	Trained Muslims slaughter	Yes	No	-	-	-	-	HCCP 4
5	Sharp knife to slaughter	Yes	Yes	Yes	No	-	-	HCCP 5
6	Slaughtered the neck from the front side cutting all passages	Yes	Yes	Yes	Yes	No	-	HCCP 6
7	Invocation	Yes	Yes	-	-	-	-	HCCP 7
8	Post slaughter treatment	Yes	Yes	-	-	-	No	HCCP 8
9	Halal carcass/ washing/Harvest	Yes	Yes	-	-	-	-	HCP
10	Meat cuts/Chilling	Yes	Yes	-	-	-	-	HCP
11	Packaging and Labelling	Yes	-	-	-	-	-	HCCP 9
12	Distribution	Yes	-	-	-	-	-	HCCP 10

Note:

- a. Applicable for Permitted Animal according to Islamic dietary Law
- b. Decision tree used to identify the HCCP for slaughtering

It is necessary to generate a complete product description before conducting a hazard analysis. Food-grade and halal packaging materials must be used to pack the product. The labelling requirements and storage conditions must be clearly defined in the product description. Chicken, turkey, duck and other types of poultry are all produced by similar methods.

Task 3 – (Identify intended use)

The normal expected usage of the food or ingredients must be briefly described. To establish the acceptable risk level for a food, the target consumer must also be defined (Untermann, 1999). Information on allergens is also needed.

Task 4 – (Construct the process flow diagram)

Figure 1 defines the processing stages from the slaughter house through storage in detail. The process may vary by processing line. All steps must be included in the hazard analysis and haram-substance analysis.

As animals are accepted from flocks of varying quality, ante-mortem and post-mortem veterinary inspection alone cannot eliminate contamination without HACCP as a management tool (Mortimore and Wallace, 1998; Latip et al, 2013). Microbiological quality, hygiene in production and handling and correct cold-chain maintenance (Sandrou and Arvanitoyannis, 1999) determine the shelf life and wholesomeness of the poultry.

A detailed description of operations, including handling of raw materials and additives, equipment, procedures, design, training etc., is shown in a flow diagram, (Mortimore and Wallace, 2001). Figure 1 shows the generic flow diagram, which we consider

a foundation for applying HACCP and HALAL to analyse hazards and haram substances. Using it as a guideline, each slaughter house and processing plant must prepare a customised flow diagram to comply with the HACCP and halal requirements.

Task 5 – (On-site process flow confirmation and verification)

Adolfo and Alfonso (2009) defined on-site confirmation as walking the line to verify that all the steps, controls and activities are in place. All potential hazards are identified. Any required changes are to be made immediately and documented. After the five preliminary tasks have been completed, the seven HACCP criteria are applied (Corlett, 1998).

Task 6 – Principle 1 (Conduct a hazard and haram substance analysis)

According to the HACCP Guidebook (USDA, 1999), a hazard analysis is the identification of biological, chemical or physical properties in raw materials and processing line and an assessment of the likelihood of their occurrence and potential to render food unfit for consumption. In this study, haram substances were categorised as a hazard, and zero tolerance was practiced when a haram substance was identified. Risks were assessed by the team members after the identification of hazards (Corlett, 1998) and haram substances and after appropriate control measures were identified.

Classical Foodborne Pathogens of Poultry Poultry products are naturally exposed to contamination during preparation and handling. *Salmonella* spp., *C. jejuni*, *Escherichia coli*, *Campylobacter* and *Listeria monocytogenes* are commonly reported in poultry

Table 2. Determination of halal critical control point (HCCP) for Ingredient and process control

A/A	Step	Q1 Do all raw materials have halal certification ?	Q2 Is there any possibility of cross-contamination by haram substances?	Q3 Are noncertified products used in the process?	Q4 Do the materials contain any haram substances?	Q5 Is the specific production line and storage area for certified and non-certified process and ingredients?	Q6 Could sanitation procedures eliminate the fat, smell, colour and taste?	Q7 Is there any potential for cross-contamination by haram substances?	HCCP/ HCP
13	Receiving	Yes	Yes	No	-	-	-	-	HCCP 11
14	Storage	Yes	Yes	-	-	Yes	-	-	HCP
15	Withdrawal	Yes	No	Yes	No	Yes	-	-	HCP
16	Blending	Yes	Yes	No	No	-	No	Yes	HCCP 12
17	Receipt of spices/ingredients	Yes	Yes	No	-	-	-	-	HCCP 13
17.1	Storage	Yes	Yes	-	-	Yes	-	-	HCP
18	Cooking	Yes	No	No	No	No	Yes	No	HCP
19	Blast freezing	Yes	No	No	No	No	Yes	No	HCP
20	Receipt of packaging material	Yes	Yes	No	-	-	-	-	HCCP 14
20.1	Storage	Yes	Yes	-	-	Yes	-	-	HCP
21	Packing and labelling	Yes	Yes	No	No	Yes	-	-	HCCP 15
22	Refrigerated storage	Yes	Yes	-	-	Yes	-	-	HCP

Note:

a. Decision tree used to identify the HCCP for ingredient and process control

Table 3. Determination of critical control points (CCPs) for slaughter, ingredients and processing control

A/A	Step	Q1 Do control measures(s) exist?	Q2 Is the step specifically designed to eliminate or reduce the occurrence of a hazard to an acceptable level?	Q3 Could contamination with identified hazards(s) occur in excess of acceptable level(s)?	Q4 Will a subsequent step eliminate identified hazards or reduce the likelihood of their occurrence to acceptable levels?	CCP/CP
1	Permitted animal	Yes	No	No	-	CP
2	Held under humane and calm conditions	Yes	No	No	-	CP
3	Stunning	Yes	No	No	-	CP
4	Trained Muslim butcher	Yes	No	No	-	CP
5	Sharp knife used for slaughter	Yes	No	No	-	CP
6	Throat cut from the front Cutting all passages	Yes	No	No	-	CP
7	Invocation	Yes	No	No	-	CP
8	Post-slaughter treatment	Yes	Yes	-	-	CCP 1
9	Halal carcass/washing/harvest	Yes	No	No	-	CP
10	Meat cuts/chilling	Yes	Yes	-	-	CCP 2
11	Packaging and labelling	Yes	No	No	-	CP
12	Distribution	Yes	Yes	-	-	CCP 3
13	Receiving	Yes	Yes	-	-	CCP 4
14	Storage	Yes	No	No	-	CP
15	Withdrawal	Yes	No	No	-	CP
16	Blending	Yes	No	No	-	CP
17	Receipt of spices/ingredients	Yes	No	No	-	CP
17.1	Storage	Yes	No	No	-	CP
18	Cooking	Yes	Yes	-	-	CCP 5
19	Blast freezing	Yes	Yes	-	-	CCP 6
20	Receipt of packaging material	Yes	No	No	-	CP
20.1	Storage	Yes	No	No	-	CP
21	Packing and labelling	Yes	No	No	-	CP
22	Refrigerated storage	Yes	Yes	-	-	CCP 7

products. The identification of the infection source has made control possible. The studies concluded that the outbreak of illness occurred due to insufficient hygiene and inadequate cooling. The hazards are analysed based on risk assessment and suitability of the food safety protocol to eliminate or reduce the microbial load. Upton (1996) also stated that the condition of the poultry at slaughter, contamination during slaughter and processing, storage time, temperature and distribution determine the quality of the poultry products.

Chemical and Physical Hazards Chemical hazards, including veterinary drugs, hormones, vitamins, antibiotics, protein supplements, digestive enhancers (Ropkins *et al.*, 2003), pesticides, cleaning chemicals, allergens, materials in contact with

food, additives and preservatives were considered. Karouna-Renier *et al.* (2007) recommended that inorganic chemical hazards such as arsenic, mercury, cadmium and zinc be included. Physical hazards are foreign particles that may cause choking or injury to the mouth or internal organs. Bone particles larger than 20 mm can cause injury to consumers (FSIS, 1995). The severity of the physical hazards is based on the product specification and condition.

Task 7 – Principle 2 (Determination of critical control point and halal critical control point)

A decision tree was used to determine the CCPs in the production flow diagram to identify and reduce or eliminate potential hazards based on sound evidence. A halal decision tree was used to determine the

Table 4. CCPs of HACCP and HCCPs of Islamic dietary law for slaughter, ingredient handling and process control

A/A	Step	CCP/CP	HCCP/ HCP
1	Permitted Animal	CP	HCCP 1
2	Hold under humane and calm	CP	HCCP 2
3	Stunning	CP	HCCP 3
4	Trained Muslim butcher	CP	HCCP 4
5	Sharp knife used for slaughter	CP	HCCP 5
6	Slaughtered the neck from the front side cutting all passages	CP	HCCP 6
7	Invocation	CP	HCCP 7
8	Post-slaughter treatment	CCP 1	HCCP 8
9	Halal carcass/ washing/harvest	CP	HCP
10	Meat cuts/chilling	CCP 2	HCP
11	Packaging and labelling	CP	HCCP 9
12	Distribution	CCP 3	HCCP 10
13	Receiving	CCP 4	HCCP 11
14	Storage	CP	HCP
15	Withdrawal	CP	HCP
16	Blending	CP	HCCP 12
17	Receipt of spices/ingredients	CP	HCCP 13
17.1	Storage	CP	HCP
18	Cooking	CCP 5	HCP
19	Blast freezing	CCP 6	HCP
20	Receipt of packaging material	CP	HCCP 14
20.1	Storage	CP	HCP
21	Packing and Labelling	CP	HCCP 15
22	Refrigerated storage	CCP 7	HCP

HICCPs to discard haram substances or procedures or replace them according to the Islamic dietary law. A zero-tolerance approach was used in determining the HICCPs, while the codex specifies acceptable hazard levels.

Task 8 – Principle 3 (Establish critical limits for each CCP and HICCP)

HICCPs are the control points in the process of ensuring compliance with Islamic dietary law. In Tables 1 and 2, 10 steps were identified as HICCP, and all are enforced with zero tolerance. Any haram substance will be considered a breach of compliance with Islamic dietary law. Any processing plant that wishes to obtain halal certification, they must ensure that unfit or haram substance are eliminated from the process.

HICCP1 – The animal must be of a halal species, alive and free of diseases and defects. Non-halal species are not permitted, even if they are slaughtered in a halal manner (Riaz and Chaudry 2004; Kohilavani, 2015).

HICCP2 – The ritual slaughter guidelines recommended by Regenstein and Gradin (2002) ensures the animals are not stressed or excited.

HICCP3 - If the animals are stunned, stunning must follow the legal requirements. The animal must be alive at the point of slaughter.

HICCP4 – The trained Muslim slaughterer must be of sound mind.

HICCP5 – The size of the knife need to be proportionate to the slaughtered animal, and the

blade must be sharp.

HICCP6 – Slaughter must be carried out in accordance with the steps referred to in MS 1500, and the throat must be cut without reaching the bone.

HICCP7- While cutting the throat of each animal, it is mandatory to pronounce Bismillah (in the name of ALLAH).

HICCP8- After slaughter, there is zero tolerance for visible faecal matter. Other steps are taken to ensure food safety.

HICCP9- Clean and safe packaging with clear identification of the slaughterhouse code and batch numbers are affixed to the product with halal markings.

The critical limits for CCP1 address microbial hazards (Table 3 and 4), and post-slaughter handling must ensure zero faecal contamination to reduce the risk of microbial contamination. The chlorine concentration in the water must be high enough to remove organic materials and microorganisms. Tools must be sanitised and stored adequately. During portioning, the major hazard is the redistribution of pathogenic bacteria from the carcass to the work environment (MAF, 2000). The facility, including the work table, cutting board, knives and workers clothes must be sanitised according to good manufacturing practices. Temperature is the key to food safety, with chilling, freezing and cooking applied during processing, storage or distribution to destroy and slow the growth of pathogens in the product.

Task 9 – Principle 4 (Establish a monitoring procedure)

Monitoring is required to ensure the critical measures are within the desired and appropriate levels (Hulebak and Schlooser, 2002). Monitoring procedures were unified with food-safety standards and Islamic dietary law. The required accuracy, suitability and frequency of monitoring and the responsible persons are clearly identified by the reference standards and by legislative and religious requirements. GMP and GAP are used to identify problems at each control point.

Task 10 – Principle 5 (Establish corrective actions)

Corrective actions carried out to modify, isolate or eliminate any violations. The corrective actions for religious and food-safety requirements differ due to the differing tolerance levels. No deviation from religious requirements is acceptable. If the established corrective actions fail to correct the problem, they must be reassessed and reestablished.

Task 11 – Principle 6 (Verify the HACCP plan)

The HACCP plan was verified through audit and systematic examination of the established control measures and operations. Documentation, HICCP and CCP monitoring, and on-site observation are required. Valid halal certification and third-party audit reports give assurance of and confidence in the safety and halalness of the product and process.

Task 12 – Principle 7 (Record keeping)

The control measures for safety, wholesomeness and halal have been unified. Documentation allows for effective control without redundancy and are easily referenced. Real-time recording of activities generates data that can be continuously referenced to analyse the effectiveness of the system. Records also promote continuous improvement according to changing needs.

Conclusion

This study confirmed that the HICCP could be established using HACCP criteria and concepts. Furthermore, a unified system gives an advantage to the manufacturer and monitoring body and confidence to the customer due to the standards and sustained system along the food chain. This methodology harmonizes and unifies halal processing with an HACCP-based halal quality-assurance system for application to the poultry slaughtering and processing industry

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