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Research Paper

Application and Evaluation of the HAL-Q System in Hospital Kitchens

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Abstract

After the outbreak of COVID-19, Thailand's public health has gained acceptance by many countries. As a result, more tourists and groups will be willing to travel to access public health services in Thailand. Therefore, there is a need for special foods. Among the types of special foods is Halal food, which complies with Islamic religious principles. Thus, hospital kitchens that meet safety and Halal standards are essential to meet the needs of hospital users, including patients and their relatives. However, a Halal management system in hospital kitchens is required to facilitate Halal food production and ensure quality and safety in terms of physical, chemical, biological, and Halal aspects. This independent study aims to investigate the implementation of the Halal Assurance and Liability Quality system, known as HAL-Q, in hospital kitchens to produce Halal food. This investigation involves a safety analysis consisting of four components: 1) a kitchen readiness assessment; 2) training courses to understand the Halal food production process; 3) on-site consulting to develop a QM manual for hospital kitchens; and 4) audits. Additionally, to verify contamination according to Halal standards, alcohol content and porcine DNA were determined. The results showed no contamination of alcohol and porcine DNA in any of the 20 raw materials used in the Halal kitchen. Chemical hazards were identified in the form of contamination with borax, pesticide residues, and formaldehyde in nine samples. However, the results showed no contamination of chemical hazards in any of the samples tested. Coliform bacteria were examined in 10 samples to monitor microbiological quality; however, no coliform bacteria were found. Furthermore, the results of the personal hygiene assessment of two cooks and employees involved in preparing Halal food indicated that both two cooks and employee passed the assessment for good personal hygiene. In conclusion, this study found that the Halal kitchen analyzed in the hospital has the potential and readiness to provide food services according to Halal standards.

Keywords *Halal Food, Halal Hospital's Kitchen, Halal Assurance and Liability Quality system*

INTRODUCTION

Thailand holds a prominent position on the global stage, offering a wide array of services within its borders and beyond. The country's unique culture and substantial potential for various industries make it a noteworthy destination. Thailand is recognized for its rich cultural diversity, particularly in its culinary offerings, owing to the abundance of ingredients contributing to its distinct cuisine. Moreover, Thailand has been acknowledged for being accommodating to Muslim tourists. The government has prioritized the development of tourism-related policies and services that cater to Muslim travellers' needs, resulting in Thailand consistently emerging as a preferred choice for tourists worldwide.

To support this endeavour, a comprehensive management system has been established to ensure the appropriate preparation of Halal food in accordance with Islamic provisions. This system includes clear guidelines that facilitate the learning process and promote an understanding of Halal food production. It also guides executives in developing hospital policies aligned with Halal

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principles and offers training to equip officials with the knowledge needed to perform their duties correctly in accordance with Islamic provisions. Additionally, the system collects detailed information about hospital kitchens, such as the raw materials used in the production process, the size and location of the hospital, the production process itself, and the food menus available to patients. This information is essential for ensuring operations adhere to Islamic standards, promoting appropriateness and reliability.

The Halal Science Center at Chulalongkorn University has been dedicated to the ongoing development of the Halal standard system since the introduction of the Halal-HACCP (Hazard Analysis and Critical Control Point) system in 2004. This integration of Halal principles into the food safety standard system primarily focuses on preventing contamination of items prohibited by Islamic provisions. Over time, it has evolved into the Halal-GMP (Good Manufacturing Practice) /HACCP safety standards tailored for food production kitchens. This development has culminated in the establishing of the comprehensive Halal standard system known as HAL-Q (Halal Assurance and Liability Quality system) for monitoring food quality in adherence to Halal standards.

In hospital kitchens, Halal practices play a vital role in bolstering consumer confidence, particularly among patients and their relatives (Attum et al., 2018). In this study, we initiate a comprehensive examination of the implementation of the HAL-Q system within hospital kitchens and its subsequent evaluation. The study focused on evaluating the HAL-Q system implemented in hospital kitchens, aiming to significantly contribute to the wider acceptance of Halal products and services. Additionally, we recommend the implementation of hospital surveillance and monitoring. The integration of science, technology, and Halal innovations within healthcare settings is imperative for elevating healthcare services. This comprehensive approach involves analyzing various aspects of Halal food production, including production processes, food hazard analysis, operator knowledge and comprehension, as well as the verification of raw materials and products using Halal forensic principles. These measures are vital in preventing contamination that might render food items non-Halal (Haram).

This study aims to show how this system enhances the safety and quality of Halal food production within hospitals. By scrutinizing its implementation and conducting a thorough evaluation, we seek to provide valuable insights that contribute to the ongoing refinement of Halal standards in the food industry, particularly in the critical context of hospital kitchens.

LITERATURE REVIEW

Halal signifies what is permissible, approved, and safe for Muslims to consume physically and spiritually. Therefore, it is imperative that one's soul remains free from contamination by forbidden substances (Haram). Islamic faith principles stipulate that the consumption of haram items can be detrimental to one's faith. Additionally, the intricacies of raw materials and industrial production processes increase the risk of haram contamination (Attum et al., 2018; Razak et al., 2018; Tajudeen et al., 2019). Hence, Muslim consumers diligently adhere to Halal standards, and quality Halal certification inspections have become integral to instilling consumer confidence in these standards.

Halal necessitates the implementation of safety systems such as SOP, GMP, HACCP, and others as foundational elements (Sani & Dahlan, 2015). To address this, the HSC has integrated Halal standards with food safety systems to ensure the correct production of Halal food, creating the Halal-GMP/HACCP system (Dahlan et al., 2013). This has evolved into the comprehensive HAL-Q, which serves as a quality management system guaranteeing the Halal integrity of products and services. It aligns with Islamic provisions and adheres to international standards, bolstering Muslim consumers' confidence in the Halal food produced within industrial plants, ensuring the absence of prohibited substances and compliance with Islamic principles. This, in turn, fosters health safety on multiple fronts, including spiritual well-being.

The Precision Halalization process and the utilization of digital technology for Halal raw materials and products in Thailand are central themes. A key focus is placed on ensuring product cleanliness and quality throughout the Halal value chain, including Halal certification, research and development, production, and export. Special emphasis is directed towards the Halal certification process in Thailand and the functionality of the Precision Halalization process in ensuring the quality and safety of Halal products. This text also elucidates the role of digital technologies in enhancing the Halal certification process and management at every stage (Dahlan et al., 2020).

Raw materials and chemicals employed in Halal industrial plants are diverse (Al-Mazeedi et al., 2013; Ermis, 2017). Today, many raw materials and chemicals are sourced from various origins, some of which could be considered Haram. However, with advancements in food production technology and chemical manufacturing for the food industry, newly developed substances undergo transformations in characteristics and nomenclature, making it challenging to trace their origins. Consequently, there is a risk of 'haram' ingredients being unintentionally used in Halal food production.

Certain raw materials commonly encountered in the Halal industry pose challenges. For instance, gelatin, a widely used substance, can be derived from pigs. Ethyl alcohol and raw materials or chemicals that have come into contact with ethyl alcohol can present concerns. Animal oils or fats and ingredients containing meat may be susceptible to porcine DNA contamination. These raw materials and chemicals can be analyzed by multiple techniques (Mahama et al., 2020).

RESEARCH METHOD

Selecting a Hospital Kitchen

To identify a suitable hospital kitchen for inclusion in the HAL-Q system, we employ specific criteria for hospitals participating in the HAL-Q system in 2022. These criteria require hospitals to receive HA quality certification and ISO 14001 environmental management certification. We prioritize hospitals located in residential areas with a significant Muslim population, particularly those in Bangkok, Thailand, where Muslim residents and tourists are prevalent. Our evaluation will focus on hospital kitchens' compliance with HAL-Q quality system requirements and guidelines (HAL-Q 5004:1442) between June and August 2022. This timeframe ensures a comprehensive assessment of their production of halal food.

Development of the questionnaire

We have created a questionnaire based on the 4 M's Establishment Assessment Form, covering Manpower, Materials, Money, and Management considerations. The form consists of two main sections:

1. General business information
2. Self-assessment of the hospital kitchen's readiness for system implementation

The hospital kitchen coordinator will complete the assessment form following the guidelines. Data collected through this survey will inform future planning.

Scoring Criteria for HAL-Q System Evaluation

The evaluation process employs a 40-question assessment form, with each question carrying a maximum score of 1 point, totalling 40 points. The establishment must demonstrate compliance with HAL-Q requirements in both production operations and quality manual documentation. The evaluation criteria are as follows:

Y (Yes): Indicates consistent compliance with the requirements, awarded 1 point
N (No): Denotes non-compliance with the requirements, resulting in 0 points

In cases of non-compliance, identified issues will trigger a Corrective Action Request (CAR). The audit team will document defects and then schedule a meeting with the establishment's management and quality team to review audit findings. This meeting allows for mutual acknowledgement, clarification, and addressing questions or disputes. If no questions or disputes arise, an authorized representative will sign to confirm the assessment results using HAL-Q system assessment form (Halal-CFGT).

Summary of Assessment Results

The evaluation results of the hospital's Halal food production kitchen, obtained from the HAL-Q system evaluation form (Halal-CFGT), provide a detailed overview of compliance or non-conformity with the 40 requirements. The assessment results are then converted into a percentage based on requirements 4-5, facilitating a comprehensive discussion of the overall evaluation outcome.

Assessing Halal Food Safety in Hospital Kitchens

To instil confidence in food products served to hospital patients, an analysis of raw materials and products is conducted within the laboratories. This analysis assesses the presence of Halal contaminants and effective hazard surveillance measures in hospital kitchens established under the HAL-Q standard. The process involves:

1. Raw Material Analysis: Twenty raw material samples used as ingredients in hospital kitchen food production are tested for contaminants. These samples undergo the Halal forensic laboratory analysis at the Halal Science Center, Chulalongkorn University. The analysis includes alcohol content assessment (GLC: AOAC973.23) and detection of porcine DNA (Mahama et al., 2020)
2. Area Inspection*:* An inspection of the hospital kitchen area ensures the implementation of effective hazard surveillance measures.

Monitoring Cleanliness and Safety of Food Produced by Hospital Kitchens

To ensure the highest standards of cleanliness and safety in food production kitchens, the following measures are implemented and monitored:

Evaluation of Personal Hygiene Control:

In Halal kitchens certified under the HAL-Q standard, operational guidelines and document forms are established to control personal hygiene effectively. This includes the implementation of routine health examinations for employees in the food production kitchen. The assessment involves an annual review of employee health examination results, personal hygiene forms, random stool culture checks, and the results of random Swab Tests for employees in food production areas. Additionally, cleaning plans for equipment and production locations are formulated as practical guidelines within the food production kitchen.

Chemical quality analysis in food

Random chemical quality analysis is conducted on three samples/parameters representing raw materials used in cooking in hospital kitchens. This analysis encompasses the assessment of borax levels, pesticide residues in food, and the presence of formalin in food. These evaluations ensure the chemical safety and quality of the ingredients used in food preparation.

FINDINGS AND DISCUSSION

Selection of a Hospital Kitchen and HAL-Q System Implementation

Selection of a Hospital Kitchen in Bangkok, Thailand

The process of choosing a hospital kitchen to participate in the installation of the HAL-Q system in 2022 is focused on the Bangkok area. The assessment aligns with HAL-Q quality system requirements and encompasses prepared food for patients and the general public.

As part of the preparation for establishing the HAL-Q standard, an establishment assessment form is distributed, consisting of two parts:

Part 1: General Information

1. Information provider details.
2. Establishment particulars.
3. Location.
4. Establishment characteristics.
5. Number of production workers.

Part 2: Production Information

1. Production capacity.
2. Marketing details.

The hospital kitchen coordinator completes a self-assessment form in preparation for system placement. The collected information guides the development of action plans as outlined in Table 1. Table 1 shows that the hospital kitchen's self-assessment results align with the preparation for implementing the HAL-Q. The highest self-assessment score is in the monetary aspect, with a perfect score of 100. The mechanic's aspect follows closely with 85.71 percent, while the lowest score is in the human aspect at 60.00 percent. The human aspect of the self-assessment form indicates minimal compliance, primarily due to the absence of an established Halal policy, the absence of a Halal working group, inefficient raw material procurement practices, and a limited understanding of the correct Najis cleansing process in accordance with Islamic provisions. This self-assessment informs the planning process for HAL-Q standard implementation.

Table 1. Illustrates the Establishment Assessment Form, specifically Part 2, which pertains to the Hospital Kitchen Self-Assessment Form. This form is designed to facilitate the preparatory measures for the implementation of the system.

Preparation of the establishment	**Self-evaluation**	
In setting up the HAL-Q system	**Yes (%)**	**No (%)**
A. Man	60.00	40.00
B. Materials	75.00	25.00
C. Mechanisms	85.71	14.29
D. Monetary System	100.00	0.00

Note: Yes (%) means the percentage of performance scores consistent with the requirements.
No (%) means the percentage of performance scores that do not conform to the requirements.

Hal-Q standard implementation

The advisory committee, tasked with implementing the HAL-Q system in the hospital's Halal food kitchen, provided guidance and recommendations to ensure the production of Halal food in full compliance with the HAL-Q standard requirements. The non-conforming defects that required Corrective Action Requests (CAR) were summarized in Table 2.

Upon reviewing Table 2, it becomes evident that the hospital kitchen exhibits deficiencies that do not align with the requirements. These discrepancies trigger Corrective Action Requests (CARs) during both the consultation (Pre-audit) and assessment (post-audit) phases. Specifically, the hospital kitchen does not adhere to the recommendations provided by the consulting team, resulting in a failure to cover Halal food production practices adequately. Consequently, the assessment process has identified a higher number of defects due to this non-compliance.

Table 2. Summary of non-conforming defects (Corrective Action Request (CAR))

No	Non-compliance	Observation
	Consulting (Pre-test)	
1		Recommendation: Organize raw materials by type and use clear signs.
2		It is recommended to place raw materials and equipment that come into contact with food at a height of 60 centimetres above the floor.
3		Consider sourcing alternative raw materials for items without Halal certification.
4		Create a manual and designate a Halal/HAL-Q team.
5		Prepare a table listing raw materials used in the production process.
	Assessment (Post-test)	
1	The HAL-Q documentation was found unsigned and incomplete, failing to meet the requirements of 4.1	Post a notice in the policy section regarding Halal in food production.
2	In the kitchen producing Halal food, raw materials were found without Halal certification marks.	For the kitchen producing Halal food, it is recommended to utilize foot-pedal trash cans.
3		Recommendation: Install identification signs in areas where raw materials and chemicals are stored
4		Recommendation: Separate employee storage areas from the production area to prevent mixing.

The evaluation results are then reported using the HAL-Q Audit Form to summarize the assessment outcomes and address identified shortcomings. In this assessment, two defects were identified:

1. The HAL-Q manual document was found unsigned and incomplete.
2. Raw materials without Halal markings were discovered in Halal food production kitchens.

Additionally, four recommendations were made:

1. Post an announcement in the Halal food policy section in the food production kitchen.
2. Utilize foot-pedal trash cans in Halal food production kitchens.
3. Install signs indicating areas where raw materials and chemicals are stored.
4. Implement the separation of employee storage points to prevent mixing with the production area.

Summary of assessment results

The evaluation results of the hospital's Halal food production kitchen establishments, obtained from the HAL-Q system evaluation form (Halal-CFGT), provide a comprehensive overview of compliance or non-conformity with the 40 requirements. Following this evaluation, the percentage of compliance with requirements 4 - 5 is calculated, and an in-depth discussion of the assessment results is conducted.

Furthermore, defects identified during the inspection of each establishment are totalled, and the average defect rate is calculated. Results are presented as percentages, reflecting the level of compliance and non-compliance with the requirements of the HAL-Q. These findings are presented in Table 3.

Table 3. provides a percentage comparison of evaluation results (Audit) between the consultation (Pre-audit) and evaluation (post-audit) phases of hospital kitchens

Halal standard requirements HAL-Q (Halal-CFGT)	**Consulting Pre-audit**		**Assessment Post-audit**	
	Yes (%)	**No (%)**	**Yes (%)**	**No (%)**
4. Halal food preparation management system	20.00	80.00	40.00	60.00
5. Requirements for preparing Halal food	91.43	8.57	94.29	5.71

Note:
"Yes (%)" indicates the percentage of performance scores in compliance with the requirements.
"No (%)" indicates the percentage of performance scores not conforming to the requirements.

Table 3 shows that the hospital's Halal kitchen operates in accordance with the fourth requirement of the Halal food preparation management system, albeit with room for improvement. The compliance percentages in the consultation period (Pre-audit) and the audit (post-audit) are 20.00 percent and 40.00 percent, respectively. Consequently, revisions have been made to align with Halal standard requirements HAL-Q (Halal-CFGT). Regarding operations that do not meet the requirements, further enhancements are necessary to ensure appropriateness and efficiency. In addition, deficiencies were also noted in the Halal food production process, particularly in achieving comprehensive coverage of Halal operations. These findings indicate non-compliance with requirement 4th of the Halal food preparation management system. Key areas for improvement include:

1. Developing a quality manual that encompasses the Halal policy.
2. Appointing a Halal Management Representative (HMR) and a dedicated team.
3. Strengthening the hospital's internal communication system, particularly through counseling sessions.

In the hospital kitchen, ensuring the preparation of Halal food in accordance with

requirements is crucial. During the compliance assessment with the fifth specification, it became apparent that certain ingredients lacked Halal markings, primarily due to a lack of awareness regarding Halal management among production line employees. To address this issue, it is essential to recommend and educate the purchasing department or those responsible for raw material procurement about the importance of sourcing raw materials that adhere to Halal food production standards. This ensures that a valid Halal certificate accompanies every raw material or bears the Halal mark on the product.

Analysis of Guidelines for Establishing a Halal Kitchen in a Hospital with a Focus on Food Safety and Halal Compliance

To initiate our analysis of critical points demanding Halal control within the hospital kitchen's production line, we begin by scrutinizing several essential factors:

1. Production process flowchart (flow diagram): This flowchart, presented in Figure 1, outlines the various stages of the production process, from the entry of raw materials to the completion of the final product.
2. Product specifics (product description): Information provides detailed insights into the specific products produced.
3. Production Processes (Standard Operating Procedure): Table 4 offers comprehensive insights into the standard operating procedures governing the production processes.

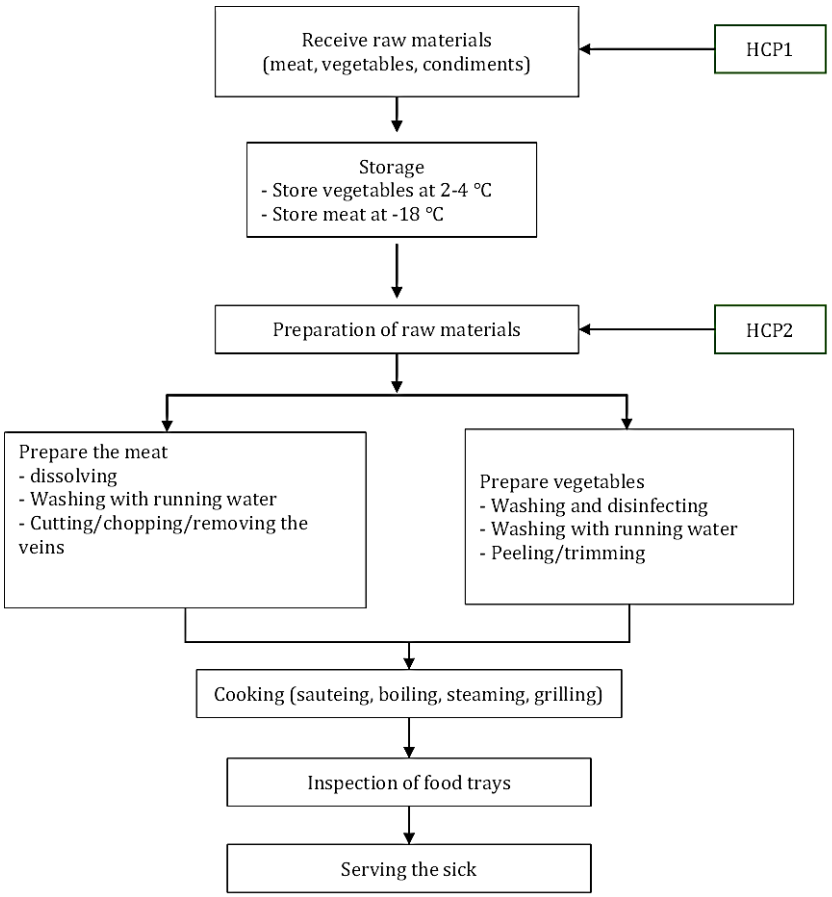

Figure 1. Production Process Flow Diagram (Flow Diagram) for Halal Food Production in a Hospital Kitchen.

According to Figure 1, the flow chart visually represents the sequential production steps. It starts with the entry of raw materials into the production process and concludes upon its completion.

Table 4. Comprehensive Operating Procedures for Each Step Outlined in the Halal Food Production Chart.

Number	Step Name	Step Details	Related documents
		Who, what, where, when, how, record	QP/WI/FM
1	Receiving raw materials	Employees responsible for randomly inspecting fresh and dried agricultural raw materials, condiments, and meat for every received lot must conduct inspections based on a random plan and adhere to specifications such as Certificate of Analysis (COA), Acceptable Vendor Lists (AVLs), and temperature requirements.	Halal Sampling Inspection plan and record of Halal raw materials sampling inspection
4, 5	Washing with running water	The kitchen staff takes the received ingredients and washes them in the raw material sink by allowing water to flow through. They also inspect the meat for blood stains and trim it according to specified guidelines.	Guide to purifying Najis (Impure Substances)

Note:
QP: Quality Procedure
WI: Work Instruction Manual
FM: Form (Form)
Details of the COA process: Certificate of Analysis (Certificate of Analysis)
AVLs: Approved Vendor List (AVL), the company's vendor register

As indicated in Table 4, we meticulously assessed potential hazards inherent to each production stage. By identifying these vulnerabilities, we pinpointed critical control points requiring Halal oversight, as outlined in Table 5. Additionally, we developed a comprehensive Halal Control Points Plan, depicted in Table 6, with reference to the Halal Manual used for certification requests. This assessment also thoroughly considers the sources of all raw materials employed in the production process.

Table 5. Halal Control Points According to Halal Food Production Process

Number	**Name of Procedure**	**Concern According to Halal Principles**	**Control Measures**
1	Fresh/dried agricultural raw materials	- Haram or Najis contaminants that may accompany fresh/dried agricultural raw materials. - Contamination occurs during transportation.	- Notify suppliers about raw material standards, including the requirement for Halal certification of additives and compliance with Halal shipping standards during transportation. - Select and assess sellers for Halal compliance.
2	Seasoning ingredients	- Haram or Najis contaminants that may originate from seasoning ingredients.	- Inform the supplier of the standards for additives and transportation, emphasizing that additives must have Halal

Table 5. Halal Control Points According to Halal Food Production Process

Number	Name of Procedure	Concern According to Halal Principles	Control Measures
		- Contamination during transportation.	certification and that transportation must adhere to Halal product transportation standards. - Proceed with the selection and assessment of sellers.
3	Meat raw materials	- Haram or Najis contaminants that may be present in meat raw materials. - Contamination during transportation.	- Communicate the standards for raw materials and transportation to the supplier, highlighting the requirement for Halal certification of additives and adherence to Halal shipping standards during transportation. - Proceed with the selection and evaluation of sellers.
4, 5	Washing raw materials (vegetables and meat)	- Haram or Najis contaminants that may be associated with raw materials.	- Conduct training sessions for employees to impart knowledge and understanding of the correct cleaning procedures.

According to Table 5, it was found that the production process includes two critical Halal control points involving the receipt of raw materials (such as agricultural condiments and raw meat materials) and the washing of these raw materials. Compliance with Islamic guidelines is essential in these stages to ensure correctness.

Determination of Critical Points According to Food Standards

This process involves identifying critical points based on food standards. Additionally, a comprehensive plan for controlling and monitoring contamination was developed and is detailed in Table 6.

Here, the summary of hazards is presented in Table 7. The results obtained from the assessment of potential risks, as outlined in the document 'Risk Assessment of Potential Hazard: Ingredient, Package, Chemical, and Process,' classify these hazards as Major/Critical and raise significant concerns.

Table 6. Halal Food Production Process Control Plan

HCPs	HL Limits	Monitoring Procedures				Corrective Actions	Records	Verification
		What?	How?	Frequency	Who?			
1, Fresh/dried agricultural raw materials	- Imported raw materials are certified as Halal. - The supplier delivering raw materials is registered in the Approved Vendor List (AVL).	- List of suppliers who deliver raw materials in each lot	Check the intake documents against the Raw Materials Register and Vendor Register (AVL).	All Lot	Officials inspect raw materials	- Notify the purchasing officer - Return to seller	Halal raw material control record	- Review inspection records Track and record Edited once a week by Quality control officer
1, seasoning ingredients	- Imported raw materials are Halal certified. - The supplier delivering raw materials is registered in the Approved Vendor List (AVL).	- Halal certification document or COA	Check the expiration date of the Halal Certificate. Every time before admission	All Lot	Officials inspect raw materials	- Notify the purchasing officer - Return to seller	Halal raw material control record	- Review audit records and correction records once a week by Quality control officer

HCPs	HL Limits	Monitoring Procedures				Corrective Actions	Records	Verification
		What?	How?	Frequency	Who?			
1, meat raw materials	- Imported raw materials are certified as Halal. - The supplier delivering raw materials is registered in the Approved Vendor List (AVL).	- List of suppliers who deliver raw materials in each lot	Check the expiration date of the Halal Certificate. Every time before admission	All Lot	Officials inspect raw materials	- Notify the purchasing officer - Return to seller	Halal raw material control record	- Review notes Corrections are monitored and recorded once a week by a quality control officer.
4, 5 Washing raw materials (vegetables, meat	- The raw materials brought are not contaminated according to Islamic principles.	- Cleanliness of raw materials	Washing with running water of all raw materials	Every time it is used	Staff prepare raw materials	- Wash raw materials with running water. - Wash again in case it is not clean.	Record of raw material cleaning control	- Review audit records and correction records once a week by production officer

Table 7. The Summary of Hazards Likely to Occur with the Products.

B: Biological hazards	C: Chemical hazard	P: Physical hazard	H: Haram hazard
B: Biological hazards encompass bacteria, viruses, parasites, and environmental pathogens.	C: Chemical hazards, including radiological hazards, encompass substances like pesticides and drug residues, natural toxins, decomposition, and unapproved food or colour additives. This also includes Allergen hazards, comprising food allergens and ingredient allergens.	P: Physical hazards encompass potentially harmful extraneous matter that has the potential to cause choking, injury, or other adverse health effects.	H: Haram hazards include Najis or any contamination by Najis, as well as any parts or products of animals that are non-halal or not slaughtered according to Shariah law.
- *Salmonella* - *Staphylococcus aureus* - *Bacillus cereus* - *Listeria monocytogenes*	- Pb - Aflatoxin M1 - Tin - Allergan	- scrap wood - plastic scraps - rope	Ingredients that are Najis/Haram: - Raw materials lack Halal certification. - Raw materials with expired Halal certificates. - Washing/cleaning that does not adhere to Islamic provisions.

Analysis of Verification of Hazardous Contamination According to Food Safety Standards

An analysis of Halal contaminants was conducted on raw material samples from 20 products used as ingredients in food production within hospital kitchens that have implemented the Halal standard system, HAL-Q. This analysis was thoroughly examined and successfully passed the Halal Forensic Laboratory at the Halal Science Center, Chulalongkorn University. The results of the alcohol and DNA analysis are presented in Table 8 and Table 9.

Table 8. The Alcohol Content in Raw Materials Used in the Halal Hospital Kitchen

Raw materials	Alcohol content	Halal certificate
Soy Sauce Formula 1, Dek Sombun Brand	ND	Y
Sauce for use or dipping, Maggi brand	ND	Y
Chili sauce, Rosa brand	ND	Y
Green cap seasoning sauce, Phu Khao Thong brand	ND	Y
Salty pickled mustard greens, Hua Nam Chai, Pigeon brand	ND	Y
Heinz low-fat mayonnaise, Heinz brand	ND	Y
Cantonese sukiyaki sauce, Cantonese recipe, Phanthai Norasingha brand	ND	Y
Stir-fry sauce, KIKKOMAN brand	ND	N
Concentrated wet Kham water, Isaan Pasab brand	ND	N
Sauce Tahini Sauce Durra Brand	ND	N

Note: ND; Not detected means no alcohol content was found in the raw material.
Y = has Halal certificate
N = No Halal certificate

Table 9. The Porcine DNA Contamination in Raw Materials Used in the Hospital Kitchen.

List of raw materials DNA contamination	DNA contamination	Halal certificate
Tender chicken breast with garlic and fresh chilli, CP Delight brand	ND	Y
Compressed artificial crab meat, Deli Fresh brand	ND	Y
Phuket style fish balls, PFP brand	ND	Y
Sealect Tuna Sandwich in Spring Water, Sealect Brand	ND	Y
Mackerel in tomato sauce, Rosa brand	ND	Y
Mexican Chicken Wings, CP Brand	ND	Y
Bologna Spa Foods, S.P.A. Brand	ND	Y
Spa Foods Frankfurt Sausage, S.P.A. Brand	ND	Y
Chili Chicken Hot Dog Sausage, BKP Brand	ND	Y
Smoked sliced chicken breast, BKP brand	ND	Y

Note: ND; Not detected means no alcohol content was found in the raw material.
Y = has Halal certificate

From the results presented in Table 8, an alcohol content was conducted on a sample of 20 raw materials used in hospital kitchens. None of them exceeded the Halal food standard criteria (TIS 8400-2007) in the food group that undergoes fermentation. These standards say the alcohol

content must not exceed 1.0 g% (W/V). Additionally, no porcine DNA contamination was detected in any of the products, which is prohibited according to Islamic provisions (Table 9).

Monitoring Cleanliness and Safety in Food Production

In the Halal kitchen of the hospital that has successfully implemented the HAL-Q standard, the control of personal hygiene is rigorously examined and analyzed. This control is established through standardized work protocols and the preparation of document forms for work. It encompasses several elements, including:

1. Examination of the results of the hospital's annual health examination.
2. Assessment of personal hygiene using a designated form.
3. Evaluation of random Stool culture test results.
4. Assessment of random Swab Test results for employees in food production kitchens.

These assessments are conducted in accordance with the hospital's food safety standards, as outlined in the 2017 guidelines. A summary of these monitoring activities can be found in Table 10.

Table 10. Employee hygiene evaluation

Checked items	Annual health examination results		Stool culture		Swab test	
	Pass	Fail	Pass	Fail	Pass	Fail
1st cook	/		/		/	
2nd cook	/		/		/	
nutritionist	/		/		/	

As indicated in Table 10, the collected data encompassed annual health assessments and random inspections, including stool culture and swab tests. Notably, all three employees engaged in Halal food production successfully met all the criteria for analysis in accordance with the hospital's 2017 food safety standards.

Determination of Chemical Quality Analysis in Food

A chemical quality analysis was conducted on three samples representing raw materials used in the cooking process. This analysis encompassed three parameters: borax, pesticide residues, and formalin in food. Chemical testing was performed in the hospital kitchen using specialized kits designed for food analysis. The summarized results of these analyses are presented in Table 11.

Table 11. Summary of Chemical Contamination Analysis Results in Raw Material Samples

Borax			
No	**Food sample**	**Examination results**	
		Pass	Fail
1	Chicken meat	/	
2	Chicken sausage	/	
3	Chicken liver	/	
Pesticide residues			
No	**Food sample**	**Examination results**	
		Pass	Fail
1	long beans	/	
2	Cauliflower	/	

3	fresh chili	/

Formalin

No	Food sample	Examination results	
		Pass	Fail
1	Mackerel	/	
2	fresh squid	/	
3	Shrimp	/	

Microbiological Quality Analysis in Food

In the surveillance process, microbiological quality analysis was conducted by randomly sampling prepared food, water, utensils, equipment, and food handlers in hospital kitchens to check for coliform bacteria. Ten samples were tested using the SI-2 primary coliform test kit (Muadchim et al., 2023). The results are summarized in Table 12.

Table 12. Microbial contamination in Kitchen Utensils

No	Food sample	Examination results		note
		Pass	Fail	
Category 1 Equipment containers				
1	Spoon-Fork	/		
2	knife	/		
3	cutting board	/		
Category 2 Food handlers				
4	Chef's hand 1	/		
5	Cook's hand 2	/		
Category 3 Food				
6	Drinking water	/		
7	Tap water	/		
8	Chicken porridge	/		
9	boiled rice	/		
10	Chicken with basil	/		

CONCLUSIONS

This study focuses on applying the Halal standard system (HAL-Q) within the confines of a medium-sized private hospital's kitchen. Data collection occurred before and after the HAL-Q implementation, spanning the years 2022 to 2023, with a specific examination of products within the scope of the HAL-Q standard certification. The implementation process of HAL-Q involved four key steps: preparation, training, consultation, and assessment. The assessment phase aimed to

identify both consistency and inconsistencies in work performance concerning standard requirements, ultimately preparing the hospital kitchen for HAL-Q certification. By following these proposed guidelines, hospital kitchens can effectively integrate Halal standards, ensuring the production of safe and compliant Halal food, thereby enhancing consumer confidence, and supporting the provision of quality healthcare services.

LIMITATION & FURTHER RESEARCH

Ensuring safe food services in hospital kitchens requires stringent standard controls throughout the entire process. This includes inspecting raw materials, monitoring food quality and safety with test kits, and managing the production environment effectively. Comprehensive measures should be implemented to prevent cross-contamination and Halal hazards.

Specific recommendations include:

1. Water Quality Testing: Increase the frequency of microbiological hazard testing for water quality from every three months to monthly checks. This aligns with the Department of Health standards and ensures food safety.
2. Technology and Innovation: Embrace science, technology, and Halal innovations within hospital kitchens. Leveraging these advancements enhances the ability to produce food that complies with food safety regulations and Halal standards.
3. Building Consumer Confidence: Implementing these measures not only ensures food safety but also boosts consumer confidence in the hospital's food services.

By incorporating these recommendations, hospital kitchens can maintain high standards of food safety, adhere to Halal requirements, and provide efficient and reliable healthcare services.

REFERENCES

Al-Mazeedi, H. M., Regenstein, J. M., & Riaz, M. N. (2013). The issue of undeclared ingredients in halal and kosher food production: A focus on processing aids. *Comprehensive Reviews in Food Science and Food Safety, 12*(2), 228-233. https://doi.org/10.1111/1541-4337.12002.

Attum, B., Hafiz, S., Malik, A., & Shamoon, Z. (2018). *Cultural competence in the care of Muslim patients and their families.* StatPearls. https://www.ncbi.nlm.nih.gov/books/NBK499933/.

Dahlan, W., Ariyapitipun, T., Sirikwanpong, S., Kunakom, B. S., Denyingyhot, A., & Nopponpunth, V. J. M.-E. J. o. S. R. (2013). Multi-approach management for halal security in HACCP-Compliant seafood enterprises in Thailand. *Middle East Journal of Scientific Research, 13*(4), 464-471. https://doi.org/10.5829/idosi.mejsr.2013.13.4.66120.

Dahlan, W., Santiworakun, N., Suksuwan, A., Katelakha, K., Mahamad, P., Sureephong, P., . . . Nungarlee, U. (2020). The Precision Halalization and Digitalization of Halal Materials and Products. *Proceeding of the 1st International Conference on Recent Innovations (ICRI 2018),* 2218-2224. https://doi.org/10.5220/0009941022182224.

Ermis, E. (2017). Halal status of enzymes used in food industry. *Trends in Food Science & Technology, 64*, 69-73. https://doi.org/10.1016/j.tifs.2017.04.008.

Mahama, S., Waloh, N., Chayutsatid, C., Sirikwanpong, S., Ayukhen, A., Marnpae, M., . . . Dahlan, W. (2020). Postmarket laboratory surveillance for forbidden substances in halal-certified foods in Thailand. *Journal of Food Protection, 83*(1), 147-154. https://doi.org/ 10.4315/0362-028X.JFP-19-051.

Muadchim, M., Jijai, S., Thongmak, N., & Boonkaew, R. (2023). *Assessment of drinking water quality and coliform bacteria contamination in food: A case study of child development centers of Muang Yala Municipality, Yala, Thailand.* Paper presented at the AIP Conference

Proceedings.

Razak, M. A. B. A., Ramli, M. A. B., Rosele, M. I., & Ariffin, M. F. M. (2018). *Consideration of 'Umūm Al-Balwā Method in Food Contamination from Halalan Toyyiban Perspectivūe.* Paper presented at the Proceedings of the 3rd International Halal Conference (INHAC 2016).

Sani, N. A., & Dahlan, H. A. (2015). *Current trend for food safety and halal measures.* Paper presented at the ASEAN Community Conference Bangi, Malaysia, 11-12 November.

Tajudeen, A. L., Abdul-Rahman, I. (2019). Contamination of halal food products. In *Muslim Piety as Economy.* Routledge.