

Review

Food safety regulations implementation and their impact on food security level in Malaysia: A review

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Abstract

The purpose of the present review paper is to provide a preliminary review related to current research on the implementation of food safety regulations, and the impact on three dimensions of food security level namely food resources, food production, and logistics. All 16 research papers published in 2016 - 2023 on implementation of food regulations among food industries in Malaysia were collected from Google Scholar and discussed herein. The main factors that contribute to low number of small and medium enterprises (SMEs) with food safety assurance certification are due to high certification and business renovation costs, language barrier between industries and authorities, as well as lack of motivation and knowledge among SMEs. In addition, the negligence of food manufacturers in following regulations leaves negative impact on Malaysia's food security level. The present review suggests future research on food fraud, food defence, and stability of food resources to secure higher level of food safety and security.

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Introduction

Every human being has the right to access safe food for daily consumption. However, the increase in foodborne outbreak and recent reports of scandals involving food, such as food fraud, trigger consumer to seek for safe and quality food. It was estimated that 600 million people (almost 1 in 10 people worldwide) fall sick after eating contaminated food, and 420,000 die every year, resulting in the loss of 33 million healthy life years (DALYs) (WHO, 2020). Meanwhile, in Malaysia, it was reported that the incidence rate (IR) of food poisoning was the highest at 47.3 per 100,000 populations (DOSM, 2016).

In Europe, a food fraud tool known as MediSys-FF has been developed to gather reports regarding food fraud. It was found that meat, seafood, milk, and alcohol are the top four most reported fraudulent commodities shown in the media (Bouzemrak *et al.*, 2018). Besides, with the recent technology and the accessibility of information, as well as improved living standards, consumers nowadays are aware of, and demand for a variety of

high-quality food competitive prices all year round (Kotsanopoulos and Arvanitoyannis, 2017; Smigic and Djekic, 2017; Guo *et al.*, 2019). Hence, food safety regulations are enforced worldwide to ensure the production of safe and quality food products.

The main objectives of food regulations are to protect the consumer's health, increase economic viability, and facilitate fair trade of foods, within and between nations (Smigic and Djekic, 2017). Basically, food safety regulations involve general principles for three stakeholders, which are public authorities, food establishments, and end consumers. The public authorities play an important role to enforce food safety laws, while food manufacturers have the obligations to implement the legal standards and take all reasonable precautions and practices to avoid failure (Kotsanopoulos and Arvanitoyannis, 2017; Smigic and Djekic, 2017). For instance, the public authorities responsible in formulating national food safety standards overseas are the Food Standards Agency of United Kingdom, the National Health and Family Planning Commission of China, and the United States Food and Drug Administration

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(USFDA) (Halabi and Lin, 2017; Liu *et al.*, 2019). In the meantime, the food safety regulations in Malaysia namely Food Act 1983, Food Regulations 1985, and Food Hygiene Regulations 2009 are set up by the Food Safety and Quality Division, Ministry of Health (MOH), Malaysia.

During the World Food Summit in 1996, food security has been defined as “food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. The definition of food security entails four (4) food security dimensions or pillars as follows:

- i. Food availability: The availability of sufficient quantities of food of decent quality, supplied through domestic production or being imported (including food aid).
- ii. Food access: Access by individuals to adequate resources (entitlement) to acquire decent food for a nutritious diet. Entitlement is defined as the set of all commodity bundles over which a person can establish command given the legal, political, economical, and social arrangements of the community in which they live (including traditional rights such as access to common resources).
- iii. Utilisation: Utilisation of food through adequate diet, clean water, sanitation, and healthcare to reach a state of nutritional wellbeing where all physiological needs are met. This brings out the importance of non-food inputs in food security.
- iv. Stability: To be food secure, a population, household, or individual must have access to adequate food at all times. They should not risk losing access to food due to sudden shocks (*e.g.*, an economic or climatic crisis) or cyclical events (*e.g.*: seasonal food insecurity). The stability concept can therefore refer to both the availability and access dimensions of food security (FAO, 2006).

Recently, Béné (2020) reviewed the resilience concept of local food systems and links to food security in the context of COVID-19 outbreak and other shocks. Meanwhile, Marzuki and Jais (2020) reviewed the effect of urbanisation on food security through agricultural productivity. On the other hand,

Wong *et al.* (2017) reviewed the four food security dimensions of small-scale poultry at resource-poor settings in low- and middle- income countries (LMICs). The implications of climatic and non-climatic variables on food security in developing economies had been reviewed by Singh and Sharma (2018). However, the objectives of the present review are to discuss the current research on the implementation of food safety regulations, and explore its impact on three dimensions of food security level, namely food resources, food production, and logistics.

Figure 1 conceptualises the idea of the impact of food regulations implementation on food security level in Malaysia. In short, the food industrial players, from micro to large scale enterprises, need to adhere to the food regulations enforced by the government. Meanwhile, the Food Safety Assurance System is recommended to be applied so that the food manufacturers shall produce high quality and safe food products. The implementation of the food regulations in food industry will leave a positive impact on food security level in Malaysia. In contrast, the negligence of food manufacturers in following these regulations will result in negative impact on Malaysia’s food security level. The present review focuses on two dimensions of food security (food availability and food access) in terms of food resources, food production, and logistics. The abbreviations used in the present review are listed in Table 1.

Food safety regulations in Malaysia

To protect consumers from harmful food products, regulations are enforced to be followed by the food manufacturers. It is crucial for all food manufacturers to fulfil the implementation of food safety legislation throughout the food supply chain in order to establish an effective food safety system (FAO, 2004). In short, regulation is defined as legal intervention in the market by the government *via* administrative means (Guo *et al.*, 2019). The Ministry of Health, Malaysia had endorsed the Food Act 1983 to be applied consistent with Food Regulations 1985 and Food Hygiene Regulations 2009.

In Malaysia, both Food Act 1983 and Food Regulations 1985 are implemented at present as these legislations are the backbone of food safety programme that aim to safeguard the public against health hazard and fraud in the preparation, sale, and

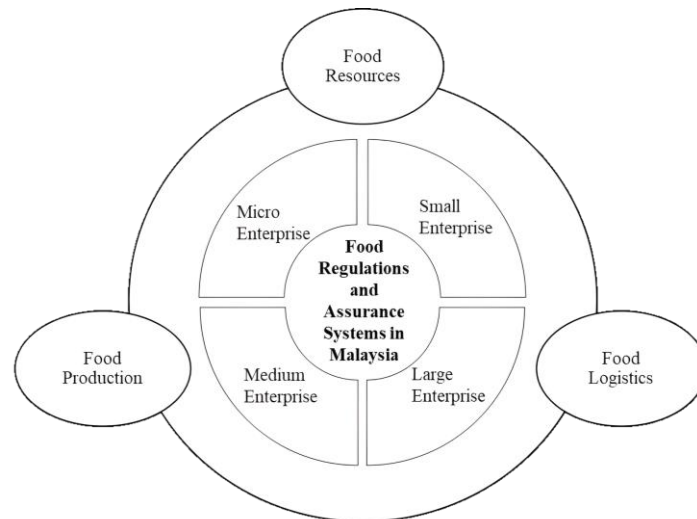


Figure 1. Impact of food regulations implementation on food security level in Malaysia (adapted from Wallace, 2017).

Table 1. List of abbreviations used.

Abbreviation	Full name
CCPs	Critical Control Points
COVID-19	Coronavirus Disease 2019
EDI	Electronic Data Interchange
FDA	Food and Drug Administration
FSI	Food Security Index
GHP	Good Hygiene Practice
GMP	Good Manufacturing Practice
GPS	Global Positioning System
HACCP	Hazard Analysis Critical Control Point
HAS	Halal Assurance System
IDR	Import Dependency Ratio
IHCS	Internal Halal Control System
IR	Incidence Rate
IT	Information Technology
JAIN	States Religious Authorities
JAKIM	<i>Jabatan Kemajuan Islam Malaysia</i> (Department of Islamic Development Malaysia)
LMICs	Low and Medium Income Countries
MeSTI	<i>Makanan Selamat Tanggungjawab Industri</i> (Food Safety is the Responsibility of the Industry)
MOH	Ministry of Health
MS	Malaysian Standard
NASA	National Aeronautics and Space Administration
OEM	Original Equipment Manufacturer
RFID	Radio Frequency Identification Device
SIRIM QAS	Standard and Industrial Research Institute of Malaysia; Quality Assurance Services
SMEs	Small and Medium Enterprises
SSR	Self Sufficiency Ratio
TMS	Transportation Management System
QGIS	QField Geographic Information System (QGIS)

use of food (FAO, 2004). The Food Regulations 1985 has been revised and updated by the Technical Advisory Committee chaired by the Director of the Food Quality Control Division, Ministry of Health.

On February 28, 2009, Food Hygiene Regulations 2009 had been gazetted by the government of Malaysia to ensure food safety and quality for consumers, and combat the outbreak of foodborne diseases (MyHealth, 2017). Besides the legislations, there are other legislations related to food safety in Malaysia, which are the Pesticides Act 1974, the Fisheries Act 1983, the Veterinary Surgeons Act 1974, the Animal Act 1953, and the Trade Descriptions Act 2011.

Food safety assurance system in Malaysia

The Food Safety and Quality Division, Ministry of Health, Malaysia had set up a system known as Food Safety Assurance Program to protect consumers from harmful food products. This programme comprises Good Manufacturing Practice (GMP) and Hazard Analysis Critical Control Point (HACCP) which are to be implemented by the food industry. Such systems, despite being known to ensure promising, safe, and quality food products, lead to difficulties to abide by and obtain the certifications among many food manufacturers especially the small and medium enterprises (SMEs). Hence, Malaysian government under the Ministry of Health has introduced a scheme known as Food Safety is the Responsibility of the Industry (MeSTI) as the minimum assurance criteria to be implemented by the food manufacturers in Malaysia (MOH, 2016; Ahamat *et al.*, 2019). In addition, the food policies, standards, regulations, and guidelines are always revised and updated. These developments will lead to complexity and confusion if not tailored to the global policies and standards (King *et al.*, 2017). Therefore, it is a responsibility to the local government and authorities to set up and update such guidelines to be aligned to the global standards.

Good Manufacturing Practice (GMP)

One of the food quality management systems applied in Malaysia is the Good Manufacturing Practice (GMP). GMP is defined as the regulations which describe the methods, equipment, facilities, and controls in producing processed food (FDA, 2004). GMP certification is an official recognition given to the food industries that comply with GMP

aspects, and meet the requirements to fulfil consumers' needs. In general, there are 11 elements of GMP stipulated in MS 1514:2022 (DSM, 2022): (i) design and facilities; (ii) control of operation; (iii) maintenance, cleaning, and sanitation; (iv) personal hygiene; (v) training; (vi) product information and traceability; (vii) transportation; (viii) internal inspection; (ix) management review; (x) documentation and records; and (xi) legal requirements. GMP helps to boost consumers' belief, and expand product market of the food industry, both locally and internationally. In addition, GMP is a pre-requisite for the food industrial players to apply for HACCP certification. Both quality assurance systems provide strength and support of other assurance systems such as ISO and Malaysian Halal Certification.

Hazard Analysis Critical Control Point (HACCP)

Hazard Analysis and Critical Control Points (HACCP) is the quality assurance system that involves seven principles that aim to control biological, chemical, and physical hazards throughout the food manufacturing process (Nor *et al.*, 2016). Historically, the HACCP system was first set up by the Pillsbury Corporation due to demand from the National Aeronautics and Space Administration (NASA) to ascertain formal assurance on food security (Razzif and Norzaidi, 2020b). The HACCP Certification Scheme had been launched in 2001 to provide recognition to the local food manufacturers that successfully adopt and maintain the HACCP system for their food products.

To obtain the HACCP certification, the food manufacturers must comply with all HACCP principles and elements of GMP, as stated in MS 1514:2009, MS 1480:2019, and MS 1514:2022 (DSM, 2009; 2019a; 2022) before being audited by the auditor appointed by the Food and Safety Quality Division, Ministry of Health, Malaysia. Often, it is found that both GMP and HACCP are implemented as food safety management system by the medium and large food companies, but rarely adopted by the small food companies. The small players in food industry usually only implement GMP management system due to limited financial resources (Kim-Soon *et al.*, 2020; Abidin *et al.*, 2020).

According to FDA (1997), there are seven principles of HACCP: (i) conduct hazard analysis; (ii) determine critical control points (CCPs); (iii)

establish critical limits; (iv) establish monitoring procedures; (v) establish corrective actions; (vi) establish verification procedures; and (vii) establish record-keeping and documentation procedures.

Regulations for halal food in Malaysia

Besides the GMP and HACCP certifications, the Malaysian Halal Certification is established to recognise the halal status of consumer food products and goods. This certification is authorised by the Department of Islamic Development, Malaysia (JAKIM) and States Religious Authorities (JAIN). According to Ahmed *et al.* (2018), the concept of halal varies and not limited to food, but it also encompasses personal care, cosmetics, and pharmaceutical products. Likewise, the Malaysian Halal Certification is not only limited to food products. To date, there are nine aspects covered under this certification, as highlighted in the Manual Procedure of Malaysian Halal Certification 2020 which are food and beverages, cosmetics, pharmaceuticals, food premises, consumer goods, logistic services, abattoirs/slaughterhouses, original equipment manufacturer (OEM), and medical devices.

Halal food

To be halal-certified food premises or products, the food industrial players should implement the halal guidelines (MS 1500:2019; DSM, 2019b) according to the Malaysian standards as well as the Manual Procedure for Malaysia Halal Certification (Domestic) 2020 guidelines prescribed by JAKIM. Recently, the MS 1500 series of standards had been revised three times, which were in 2004, 2009, and 2019. The latest revision of MS 1500 was harmonised with Codex Alimentarius which involves GMP, Good Hygienic Practice (GHP), and HACCP standards to minimise the inconsistencies between the existing food safety and quality standards and government's legislations (Ahmad *et al.*, 2018). Moreover, the implementation of MS 1500:2019 (DSM, 2019b) in line with the GMP and HACCP standards will improve the quality of the food manufactured (Ramli *et al.*, 2020).

Recently, JAKIM has enforced that the halal practice in premises need to be filed and documented for traceability and audit purposes. The Malaysian Halal Management System (JAKIM, 2020a) is published to be a reference for manufacturers to apply the Internal Halal Control System (IHCS) or Halal Assurance System (HAS). The difference is that IHCS needs to be applied by micro and small industries, whereas HAS is implemented for medium and large companies. The role of a Halal Executive in food industry is very crucial to carry out activities, such as shari'ah monitoring as well as assisting upper management in halal related matters. The hired Halal Executive should be certified by the Halal Professional Board, JAKIM (Rosli *et al.*, 2022). Ahmad *et al.* (2018) had discussed and described that there are five components for an effective national halal food control system namely halal food legislation, halal food management control, halal inspection and enforcement, halal laboratory, as well as halal information, education, communication, and training. Meanwhile, Yildirim (2019) had discussed the Malaysian Halal Certification involving the laws on criminal accountability, and the action taken by Malaysia as a halal hub.

Food safety assurance practices among food manufacturers in Malaysia

Food manufacturing companies in Malaysia are classified as micro, small, medium, and large. In general, small and medium enterprises (SMEs) make up the largest portion of the food industry in the country. The size of manufacturing industry is determined by the number of full-time employees or the total annual revenues. Table 2 further shows the category of industry in Malaysia. In terms of food safety assurance system implementation, most food companies aim to gain legal, technical, and financial benefits, as well as fulfilling consumers demand in terms of product quality certifications (Kotsanopoulos and Arvanitoyannis, 2017; Havinga and Verbruggen, 2017). The benefits will also drive the SMEs in food industry to apply for product and system certifications (Guo *et al.*, 2019).

Table 2. Categories of industry in Malaysia.

Category of industry	Micro	Small	Medium	Large
Number of full-time employee	< 5	5 < 75	75 ≤ 200	> 200
Total annual revenue (RM)	< 300,000	300,000 < 15 mil	15 mil ≤ 50 mil	> 50 mil

Source: SME Corp. Malaysia (2013).

According to Razzif and Norzaidi (2020a), despite the benefits gained, there are several challenges for the SMEs in food industry in Malaysia to implement and obtain the certifications such as high costs, language barrier, and lack of motivation and knowledge in applying for the HACCP certification. Razzif and Norzaidi (2020b) reported that the HACCP-certified companies in Malaysia had increased by 29% from 2016 to 2017, while in 2018, the number of HACCP-certified companies had increased by 11%. However, this figure is still insignificant in comparison to the total SMEs in food industry in Malaysia.

To date, there are 253 GMP-certified food companies, where 143 of them still have the certification in force; whereas out of 820 HACCP-certified food companies in Malaysia, 691 still have the certification in force (MOH, 2021). Besides, 5,376 food companies in Malaysia have the Malaysian Halal Certification certified by JAKIM (2021). The data indicate that there is higher number of food companies that are aware of being halal-certified instead of gaining the GMP and HACCP certifications. In fact, the Malaysian standards for halal food (MS 1500:2019; DSM, 2019b) stipulates that the food manufacturers need to implement the standard according to GMP, GHP, HACCP, and other local food regulations enforced by the authorities.

Furthermore, since Malaysia is a country with majority of its population is Muslims, it makes sense that there are many halal-certified food manufactures. In addition, it gives advantage to Malaysia as a Muslim-friendly country. The research on food assurance system practices among food companies in Malaysia from 2016 to 2023 are listed in Table 3. The food assurance system involves halal, ISO 22000, GMP, GHP, MeSTI, HACCP, ISO 9001, and Total Quality Management (TQM).

Impact of food safety regulations implementation on food resources

Food resources are one of the main concerns of food security worldwide. A country will achieve food independence if it manages to produce food products domestically more than the amount needed by the people (Kulikov and Minakov, 2019). Research has found that the factors that affect the food resources nationally and globally are climate change, population growth, and economic development (Radulescu *et al.*, 2020). Besides, the implementation

of food safety regulations also causes impact on food resources. Indeed, the food safety regulations implemented in food safety assurance system are not only applied in the food premises or factories. The assurance needs to be monitored from farm to fork, in which the entire food supply chain must follow the guidelines and standards set by the government.

The coordination in the food supply chain from production to consumption is crucial to ensure the safety and quality of all types of food produced (Zhong *et al.*, 2017). Often, most of the regulations enforced in the food supply chain are complex, fragmented, and transnational in terms of scopes (Havinga and Verbruggen, 2017). In Malaysia for example, Trade Descriptions Act 2011, Food Act 1983, Food Regulations 1985, and Food Hygiene Regulations 2009 need to be implemented from the first stage of supply chain until the food reach the consumers' hands. In addition, any non-conformance at the beginning of the food supply chain will reduce the level of raw materials as food resources. For any regulation, non-conformance may occur from loading trucks, lorries, warehouse facilities, and personnel in-charge of supplying the food resources within the food supply chain (Zhong *et al.*, 2017). Consequently, lower level of raw materials leads to lesser food production in the food premises and factories. Hence, the government implementation of regulations and food safety assurance system is indeed significant to the food industry at all levels.

Another aspect to focus on is the status of food supply in Malaysia. According to the Supply and Utilization Accounts of Selected Agricultural Commodities, national self-sufficiency ratio (SSR) in Malaysia within 2015 - 2019 was only 57%, which was 4% lesser compared to the previous year. There were only 24 out of 42 agricultural commodities that recorded SSR of more than 100%. In addition, Malaysia still relies on imported crops, fisheries, and livestock. It was recorded that mutton had the highest import dependency ratio (IDR) (87.9%) in 2019 (DOSM, 2020). The data recorded are related to the government food regulations as all crops, fisheries, and livestock resources shall adhere to all regulations enforced by the government. Besides the budget allocated by the government to increase the supply of food resources, the food industrial players need to have the integrity to utilise the allocation given to optimise the production of food supply.

Table 3. Studies on food assurance system among food manufacturers in Malaysia.

Author	Type of food assurance system	Methodology	Respondent	Result
Nuratifah <i>et al.</i> (2019)	Halal	Close ended questionnaires	Halal managers in 71 companies in Sabah	The length of employment is an important factor for Halal Assurance System (HAS) knowledge level; ethnicity and product cluster are the influencing factors for <i>halalan toyyiban</i> practices level.
Kim-Soon <i>et al.</i> (2020)	GMP, GHP, MeSTI, HACCP, ISO 9001/ISO 22000, TQM	Questionnaire	306 food manufacturing companies in Malaysia	Quality Management Practices are significantly related to the operational and market performance of the food manufacturing companies in Malaysia.
Azmi <i>et al.</i> (2018)	Halal	E-mail survey	103 respondents from food companies in 15 states in Malaysia	Business performance of halal manufacturer can be improved by the context of technological, organisational, and environmental.
Razzif and Norzaiddi (2020b)	HACCP	Questionnaire	Owners of SMEs of food companies in Malaysia	The implementation of HACCP among SMEs of food companies are limited caused by insufficient technical resources, time, financial capability, as well as lacking in knowledge and training.
Talib and Chin (2018)	Halal	Partial least squares structural equation modelling technique	210 halal-certified food manufacturers involving local manufacturers and multinational firms in Malaysia	The internal factors on implementation of halal food standard are organisation's commitment, operational improvement, and marketing functions; while the external factors are government intervention and consumer pressure.
Mohamed <i>et al.</i> (2020)	Halal	Multiple linear regression	121 halal food industries in Malaysia	The halal supply chain of food and beverage industry as a significant effect on Halal Integrity Assurance.
Kim-Soon <i>et al.</i> (2017)	GMP, HACCP, ISO 9001, TQM	Questionnaire by email	Small-size food manufacturing companies in Malaysia	GMP scores the highest level of implementation among the small-size food manufacturing companies in Malaysia followed by HACCP, ISO 9001, and TQM.
Azmi <i>et al.</i> (2019)	Halal	Five-point questionnaire	103 halal food manufacturers in 14 states in Malaysia	There are three influence factors on food manufacturers' perception towards halal food supply chain primarily on expected business benefits followed by halal integrity and organisational readiness.
Mansor and Daud (2020)	Halal	Questionnaire by mail	297 of Malay-owned SME companies in Malaysia	There is significant relationship between entrepreneurial resources and organisational effectiveness and growth in halal food industries.

Author	Type of food assurance system	Methodology	Respondent	Result
Jali <i>et al.</i> (2016)	GMP	Ethnographic method	3 food and beverage companies in Malaysia	There are some confusions prevailing in the industry regarding the design and facilities for the first element of GMP system. This confusion extends from building materials, design and construction features, and facilities.
Rashid and Bojoi (2020)	Halal	Questionnaire	127 halal food and beverage companies in Malaysia	The highest adoptions of halal traceability system are among the producer and end user, meanwhile economic and socio-cultural factors influence the halal industry environmental factors the most.
Talib <i>et al.</i> (2017)	Halal	Questionnaire	210 halal certified food manufacturing companies in Malaysia	Halal food certification has a positive relationship with operational performance which links to financial performance of the food companies.
Kuan <i>et al.</i> (2023)	HACCP, GMP, MeSTI	QField geographic information system (QGIS) application method	4972 datasets of food factories in Malaysia obtained from Ministry of Health's Food Safety and Quality Division database	The MeSTI certification is the highest followed by HACCP and GMP respectively in all regions of Malaysia. The Penang state has the most HACCP certified companies in fish and fish product category, whereas Selangor is the highest for confectionery industry and Sabah for food services.
Xuan <i>et al.</i> (2023)	HACCP	Failure mode and effect analysis	Raw unclean edible bird's nest processing plant in Malaysia	Two critical control points (CCPs) were identified namely heat treatment and moisture check of edible bird's nest.
Mabkhot (2023)	Halal	Partial least squares method	212 respondents from Malaysian halal-certified companies	Positive and significant impacts are noted on supply chain integration, health consciousness, and process quality improvement on sustainable product performance in halal food industry in Malaysia.
Saiman and Yusma (2022)	Halal	Semi-structured interview	Higher officer of the Department of Islamic Development Malaysia (JAKIM)	The factors of Muslim entrepreneurs not interested to apply for Malaysia halal certification are comfortable with their Muslim status, perception that the application is complicated, and the entrepreneurs do not meet minimum requirement for the application.

Impact of food safety regulations implementation on food production

In general, the food production processes in food premises and factories should implement the food safety regulations set by the government, and follow the food safety assurance system according to the HACCP, GMP, and halal certifications in Malaysia. Basically, the critical parts in HACCP certification are Principle 1 (conduct a hazard analysis) and Principle 2 (determine the critical control points); whereas for GMP certification, Element 1 (designs and facilities) is the most critical of all. Element 1 covers the entire food premises such as location, design and layout, floor, walls, ceiling, doors, windows, surfaces in contact with food, water supply, drainage, toilets, changing rooms, personnel hygiene facilities, air quality and ventilation, lighting, and storage (Jali *et al.*, 2016). In terms of Malaysian Halal Certification, the entire food supply chain is crucial, especially in handling the raw materials because they need to be free from any contaminants prohibited by the Islamic law (JAKIM, 2020b).

The food companies with food safety assurance certifications will be audited from time to time by the authorised auditors. Food manufacturers should take corrective actions in the event of any non-conformance reported by the auditors. According to the Department of Islamic Development Malaysia (JAKIM, 2020b), non-conformance may be due to the procurement area, processing area, storage area, pest control area, and personnel hygiene. The failure to rectify such non-conformance will result in suspension, and worse, withdrawal of the certificates. Research had shown that when food companies are certified and implement all regulations stipulated, this helps in gaining the trust of the consumers (Azmi *et al.*, 2019). However, the suspension or withdrawal of these certificates would cause the consumers to lose confidence towards the food products.

The food security level is deemed acceptable when the people can get enough food with good nutrition at all times. In fact, consumers will get enough food if the production by food manufacturers meets the consumers' demand. According to the Global Food Security Index (GFSI, 2019), Malaysia was at 28th out of 113 countries worldwide with overall score of 73.8%, availability score of 67.7%, and quality and safety score of 70.6%. Based on the data, this demonstrates the country's ability to supply food to more than 2/3 of the total population. Its national Food Security Index (FSI) is expected to

increase if the government food regulations are enforced and implemented in its entirety in the long term by all local food companies.

Impact of food safety regulations implementation on logistics

The interconnection of food supply chain management is a result of food production, logistics, and consumption globally which plays an important role to ensure the sustainability of highly safe and quality food products (Zhong *et al.*, 2017). The food safety regulations set by the government do not only involve food resources and food production, in fact, it covers the entire food supply chain including logistics. When it comes to logistics, traceability system needs to be looked at. In the event of non-conformance of regulations, track and trace is to be conducted together with the logistics within the food supply chain. Nowadays, information technology (IT) applications such as the transportation management system (TMS), warehouse management system (WMS), electronic data interchange (EDI), and global positioning system (GPS), as well as radio frequency identification device (RFID) do help in the logistics traceability system (Rashid and Bojei, 2020).

As Malaysia adopts halal industry practice, the preparedness of business in terms of logistics in halal requirements is focused on several factors such as company readiness from the aspects of knowledge, intention, availability of Muslim workers, management support, the implementation of halal assurance system, environment, and employee acceptance (Azmi *et al.*, 2018). Thus, there is a need of employee awareness towards halal logistics by conducting specific training course. In fact, it is easier to implement the food safety regulations of food products in the logistics section to supply safe and quality food.

Conclusion

Food safety and quality must always be the national priority to provide healthy, nutritious, and quality food products to the consumers. This action includes an ongoing enforcement by the government and authorities to maintain the food safety and security nationwide. In the present review paper, government legislations and food safety assurance systems were discussed, as well as the impact of the implementation of those regulations on food security

level in terms of food resources, food production, and logistics. It can be concluded that there is a strong interconnection between Malaysia food regulations and food security level, where when non-conformance of food regulations takes place, raw materials are not sufficient to be supplied, so lesser food products are manufactured, thus disturbing the food supply chain. Consequently, the food supply will not meet consumers' demand, and reduce the food industry capacity, as well as the country's revenue. However, when these consequences occur, the enforcement of government policies remain unchanged. Future research in food fraud, food defence, and stability of food resources are recommended to secure a higher level of food safety and Food Security Index.

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