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A REVIEW ON INCIDENCES OF FOODBORNE DISEASES AND INTERVENTIONS FOR A BETTER NATIONAL FOOD SAFETY SYSTEM IN MALAYSIA

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ABSTRACT

This paper reviews the trend and possible contributing factors that cause the incidence of foodborne illnesses as it is the major concern of food safety issues in Malaysia. Surveillance and monitoring done by the enforcement authorities have improved the food safety as the percentage of contravened samples and food premises closures have been decreased. Some factors that contribute to the emergence of the foodborne pathogens are cross contamination of foods and food handlers, eating behaviour and technology, globalisation, antimicrobial resistance bacteria and climate change. Main problems that contribute to the high rates of foodborne illnesses are poor practices of food handlers and lack of public awareness. Various interventions have been initiated by the Food Safety and Quality Division, Ministry of Health (MoH) to improve national food safety system through food handlers training programme, the establishment of Food Safety Information System of Malaysia (FOSIM) and Malaysia Foodborne Disease Network (MyFoodNet) as parts of strengthening the surveillance system and improving the effective enforcement of legislation and regulations. Continous collaboration between government and private sectors are crucial for a sustainable improvement for a better health of the nation.

Key words: Foodborne diseases, surveillance, globalization, antimicrobial resistance bacteria, climate change

INTRODUCTION

Different part of the world and different kind of human races affect the types, severity and impacts of foodborne diseases that occur. World Health Organization (WHO) Department of Food Safety, Zoonosis and Foodborne Diseases (FOS) together with its partners launched the 'Initiative to Estimate the Global Burden of Foodborne Diseases (WHO, 2015). WHO has released the first report on foodborne disease incidence, mortality and disease burden in terms of Disability Adjusted Life Years (DALYs) done by WHO Foodborne Disease Burden Epidemiology Reference Group (FERG). The most vulnerable groups being affected by foodborne disease are the children below 5 years (that is 40% of the burden overall, although it represents only 9% of the global population) and people in the low-income countries. Other groups that can easily be affected are pregnant women, the elderly and the immuno-compromised persons. The report highlighted the current burden of foodborne diseases in the South East Asia region that consist of non-typhoidal *Salmonella*, pathogenic *Escherichia coli* and norovirus (WHO, 2015).

According to WHO (2015), 3% of mortality was caused by diarrhoeal disease globally. Non-typhoidal *Salmonella enterica* had caused 230,000 deaths, with diarrhoeal and invasive disease (WHO, 2015). WHO has recommended for countries that is in the process to enhance the national food strategies to combine their national data with the global estimation. It is estimated that 30% of the population in developed countries may be affected by the foodborne illness (WHO, 2003). The

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incidence rates of foodborne diseases per 100,000 population are; 1210 cases in France, 2600 cases in the United Kingdom, more than 25,000 cases in Australia and also more than 25,000 cases in the United States (Teisl & Roe, 2010).

Some countries in Asia region have not fully developed their national food control systems yet and as consequences, foodborne disease remains as one of the major health hazards problems. In order to ensure safe food are produced, all each national governments should aim to have efficient food surveillance systems nationally that cover the whole food chain. These are includes cooperation among related authorities that involved in food safety control, risk-based regulatory frameworks, laboratory-based surveillance, inspection of food, education on consumer and effective response system in the case of food safety emergency. In Malaysia, the foodborne cases is underestimated because most of the incidences were not reported and a lot of procedures are required before the case be brought to the authority (Soon *et al.,* 2011). Not all the foodborne disease victims seek for treatment at hospital or clinic. Therefore, only part of them receives appropriate medical treatment and being reported by public health authorities.

Lack of accurate data on the occurrence and cost of the foodborne disease caused the delay of resources allocation and difficulty for policy makers to improve the current policies or regulations. All the information of the foodborne diseases outbreaks is important as this information may help to enhance the effectiveness of public health priorities and food safety measures (WHO, 2015). Accurate and reliable data are much needed from developing countries to enhance the knowledge on diverse cases of foodborne diseases (Haagsma *et al.,* 2013; Pires *et al*., 2015). In some part of the region, obstacles occur in reporting the incidence, such as the patient did not seek medical treatment because of economic and health insurance problems. In order to assess the burden of the disease, efficient method of surveillance is crucial (Dewaal *et al.,* 2010).

Economic growth of the country can be affected by the changes of buying patterns of consumers as consequences of the incidence of foodborne disease (Palma *et al.,* 2010). There is limited study has been done on cost of foodborne disease and economic burden in Malaysia (Sharifa-Ezat *et al.,* 2013). The evaluation on burden of foodborne disease is important to calculate its impact on economic value. Foodborne disease can cause various expenses in term of medical treatment, legal action, investigations of the outbreaks, and recall of food products and loss of public trust (Dewaal *et al.,* 2010).

FACTORS CONTRIBUTING TO THE EMERGENCE OF FOODBORNE DISEASES

Cross contamination of foods and unhygienic food handlers

There were 60 episodes of food poisoning from 2325 cases reported with 47 of the food poisoning episodes involved schools and institution under the Ministry of Education. Food poisoning incidences at schools have increased 57% from 30 in 2015 to 45 in 2016 (MOH, 2016). Most of the incidences involved the school canteens and kitchens. Main factors that contribute to the food poisoning were; contaminated raw materials, cross contamination during handling, food that being prepared too early before serving (more than four hours of serving time) as well as temperature abuse during processing, transportation, sales and storage. The incidences of food poisoning in Malaysia have significantly increased from 2005 till 2013 and also involved some mortality cases (A'aishah, 2014).

Foodborne outbreaks are very much related to the food handlers as the attitudes and culture in their working places can affect their behaviour (Todd *et al.,* 2007). Improper handling of raw foods during food preparation in the kitchen can cause transmission of foodborne bacteria (EFSA 2014). Other than that, unclean water supply, inappropriate environment and unhygienic food handlers can also contribute to foodborne disease (Meftahuddin, 2002). Some keys to effectively reduce foodborne outbreaks is to increase motivation, improve attitudes and increase safe food practices in food safety training module. Effective food safety training is a powerful tool to educate the food operators to fulfil the food safety standard. This is based on assumption that knowledge, attitudes and practices can change the behaviour (Egan *et al.,* 2007).

However, knowledge increment does not necessarily direct to the changes of the behaviour (Ehiri *et al.,* 1997). To enhance the effectiveness of food hygiene training programme, the food handlers' behaviour must be firstly understood. Then, the interaction of their behaviour with their beliefs and levels of knowledge can also be understood. This information can increase the effectiveness of educational materials that will be used in the training (Nieto-Montenegro *et al.*, 2008).

Other important thing is the environment that continuously promote food safety attitude that can be created by the food services management through displaying poster and reminders (especially in the workers' native language) (Soon *et al.,* 2013). Food handlers' training programmes can focus on the knowledge retention and change of the behaviour

in practices over a period after training. Refresher training programmes and follow up assessment can measure the effectiveness of the training (Egan *et al.,* 2007). Campos *et al.* (2009) emphasised that, food handlers' level of practice in the kitchen has important impact on cross contamination of harmful microorganisms.

Neglecting of the importance of food premise hygiene and good sanitation can increase the risk of foodborne illness (Abdul Mutalib *et al.*, 2015). In a study done by Nik Rosmawati *et al.* (2014) on the cleanliness in the primary school canteens, 46.9% of the food handlers did not wear appropriate outfit and 28.1% have improper personal hygiene. The microbiological status in the school canteens were also unsatisfactory with 62% of the Total Plate Count (TPC) and 55% of the coliform count results were positive, respectively. Whereas, 5% of the samples been detected with *Bacillus cereus* and *Escherichia coli*. From this study, it is obvious that good food hygiene practices play an important role to control the incidence of foodborne diseases.

Besides that, the comprehensive regular food premises inspection is compulsory as it can give remarkable impact on the food poisoning incidence rate. This is in agreement with data in Figure 1 that shows the significant increase of food poisoning incidence rate when the food premises inspection decreased. Otherwise, when more food premises inspection done, the food poisoning rate decreased accordingly. This may be contributed by the food safety awareness from the food handlers after being alerted and advice by the authority. Consequently, the better cleanliness being practised, the better food safety will be achieved.

Eating behaviour and technology

Urbanization has increased urban population and changed the lifestyles of the population. Nowadays, more people are spending time eating out and takeaways food due the hectic lifestyles. Eating out trend has become something common to the Malaysian population. During peak hours and at night, food premises is full house and this kind of situation can exposed the customers to cross contamination if the food handlers are not aware with the cleanliness of the premise. Many of the food premises use road outside their premises as eating area at night despite the food cleanliness issue (Ali & Abdullah, 2012).Although the open eating areas offer some cosiness to the customer, they are not aware of exposure to the pollutants such as dust and combustion from vehicles passing by. Besides that, food that been prepared hours before consumed and kept at abuse temperature can also contribute to the foodborne disease (Sharifa-Ezat *et al.*, 2013).

Inappropriate behaviour of consumers when choosing food premises by considering low price food is more priority than the cleanliness of the food premises. This decision may put them into the risk of foodborne illness incidence (Abdul Mutalib *et al.,* 2015). As to fulfil the demand of increasing cost of living, more people are turning into online

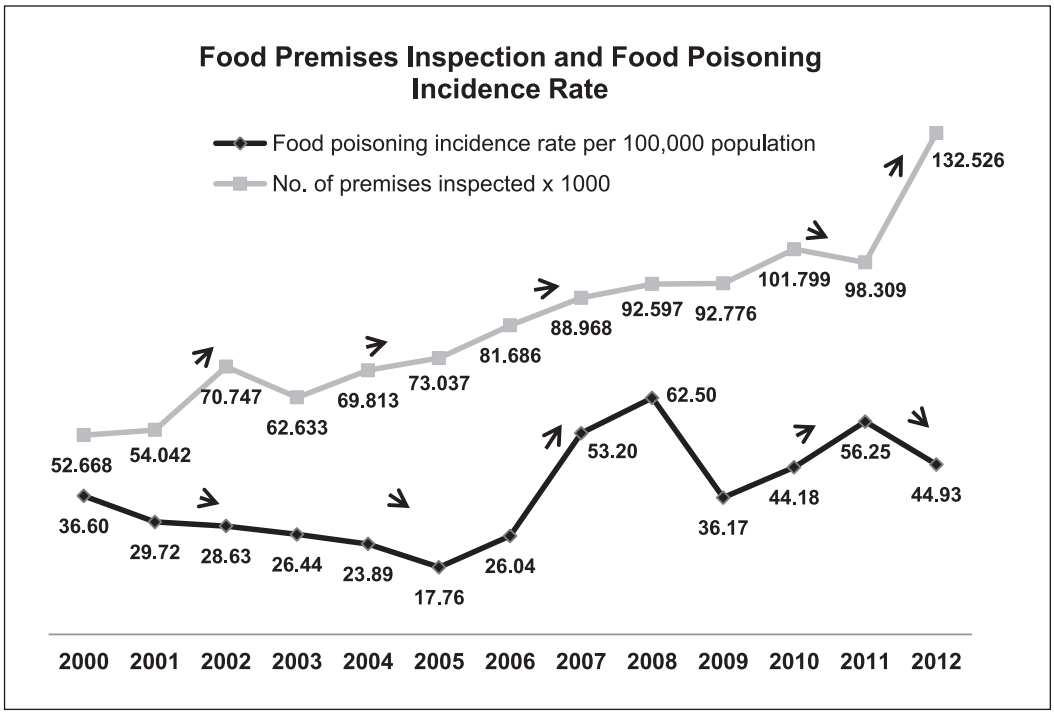

Fig. 1. Food Premises Inspection and Food Poisoning Incidence Rate (A'aishah, 2014).

entrepreneur to earn extra income or as their permanent work (Ali & Abdullah, 2012). These include food that being sold online. More people tend to buy food online as it is easier and the food being delivered right to their doorsteps. These kinds of changes in lifestyles can give impact to the food safety scenario in the future.

Nowadays, people are more focusing on high tech-savvy phone that change very rapidly. Nowadays, people are occupied with smartphone not only for working but also for shopping, cooking, eating and other social activities. Same situation comply with the food consumption. Young generation's behaviour towards eating has totally changed as for some of them having the habit of taking pictures before eating (Walsh, 2015) and then upload it to the social media. This kind of habit might arouse food safety concerns because of the temperature abuse that may occur if the foods are being exposed at ambient temperature for more than 4 hours before consumption.

Globalisation

In 21st centuries, travellers have been increased drastically. International travellers may be infected with foodborne pathogens that unusual in their home region and thus make the diagnosis and treatment more difficult. This can also happen to the non-travellers as the travellers may be the carrier of the pathogen back to their home (Finelli *et al.*, 1992). As example, 75 illness were reported, ten persons were hospitalised and one died in a cholera outbreak that involved international airline passengers in 1992 (Eberhart-Phillips *et al.*, 1996). International trade has increased in the diversification and variation of food distributed globally. Food safety can be an issue if any process involved during harvesting, preparing, transport and delivery being contaminated with foodborne pathogen.

The numbers of immigrant workers have also increased due to globalisation process. Since 30 years ago, Malaysia has depended on immigrant workers to support the infrastructure and physical development (Kanapathy, 2006). Therefore, the numbers of registered immigrant workers has increased drastically from 532,000 in 1993 to 1.6 million in 2012 (Ministry of Finance, 2013). They are generally being employed in the manufacturing, construction, plantation and agriculture sectors. But because of the food and beverages market disproportions, these immigrant workers have been employed to minimise the cost of food company business (Yee & Yuen, 2014). As the diversity of immigrant workers have increased and more numbers of ethnic restaurants have newly operated, the correct food handling practices must be practiced to ensure the food consumed are safe (Rajagopal, 2013).

Antimicrobial resistance bacteria

The antimicrobial resistance to pathogenic bacteria has existed and presently rising in the South East Asia with it resistance varied by country, hospital and patient types (Lestari *et al.,* 2003). For the antimicrobial resistance in Southeast Asia, a few trends have been observed; (i) High prevalence of resistance of penicillin was shown among *Streptococcus pneumonia* and *Neisseria gonorrhoeae*, (ii) Diarrheal diseases' pathogen are usually resistant to cheaper and older antibiotics, (iii) Resis-tance to almost all antibiotic classes were found among *Enterobacteriaceae* and non-fermenting Gram-negative bacteria, but whether the multidrug resistant Gram-negative bacteria have emerged as a major problem is still uncertain and (iv) In certain countries, the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) is not clear (Lestari *et al.,* 2003). Significant risk can occur for the antimicrobial resistance being transferred to human because of the raw food products been consumed without further treatment or processing that eventually caused the resistant bacteria to persist in the food. Furthermore, occurrence of antimicrobial genes transfer between bacteria might happen after the consumption (Verraes *et al.*, 2013). World Health Organization has confirmed antimicrobial resistance is a growing public health threat and emerging public health problem because pathogen bacteria withstand therapy that cause main problem in disease control. Therefore, biosafety issue regarding antibiotic resistance are really important. Antimicrobial resistant of pathogenic bacteria strains occurrence, propagation, accumulation and maintenance have become a public health issues worldwide (Levy & Marshall, 2004).

Climate changes

The rise and fall of the foodborne disease incidence rate may be influenced by the weather and temperature of certain region in the country. Factors such as weather and temperature play an important role that affect the incidence of foodborne disease. In the 21st century, the most extreme environmental crisis is the climate changes (Hassan *et al.,* 2014). Surface temperature in Malaysia, has been estimated to increase between 2.7°C to 4.0°C per century in the last 400 years. This change may have bad impacts on human health and can affect the distribution and occurrence of food borne disease in Malaysia (Hassan *et al.*, 2014). Appropriate temperature and condition for the growth of most bacteria can contribute to the high incidence of foodborne disease in Malaysia (Soon *et al.*, 2011; Abdul-Mutalib *et al.,* 2015). According to a study done by Han *et al.* (2016), temperature increase between 25°C to 37°C can produce stronger biofilm

formation for *Vibrio parahaemolyticus.* This is in agreement with another study by Li *et al.* (2013) that concluded temperatures increases and precipitation have significant impacts on survivals of food pathogen such as *E. coli* O157:H7 and *Salmonella* spp. in the food chain. More attention should be given to this climate changes in food safety management and research.

FOODBORNE DISEASES INTERVENSIONS AND CONTROL

Surveillance systems in different countries are varied due to the economic factor, human resources, laboratory amenities and skilled workers (Sharifa-Ezat *et al.,* 2013). International Network of Food Safety Authorities (INFOSAN) has been established in 2013 by WHO and Food Agriculture Organization (FAO) to provide appropriate information when food safety emergency incidences occur and to assist in strong structuring systems as prevention strategy to reduce food poisoning episodes. Besides the INFOSAN (2013), other initiatives done by WHO is the Global Infection Network that promotes integration of laboratory-based surveillance and advance multi-sector cooperation (Fukuda, 2015). With regards to the intervention strategies for food safety in Malaysia, National Food Safety and Nutrition Council has been established and approved on the 21st March 2001. It provides the advices related to food safety and nutrition in the country. Food Safety and Quality Division (FSQD) has been established to plan, implement, monitor and evaluate all the food safety and quality programme at all level that includes national, state, districts, entry points and local authorities. For the surveillance purpose, the analysis of the related food samples are done by the Food Laboratory Section, a programme under Food Safety and Quality Division, Ministry of Health, Malaysia (MOH). Besides the Food Laboratory Section, the division also have the International Food Safety and Training Centre (IFSTC) that developed protocols, harmonised quality systems for all MOH food laboratories and provide trainings to improve competency levels in performing food analysis in laboratories (FSQD 2016).

Other activities that strengthen the surveillance system are Food Safety Information System of Malaysia (FOSIM) that was launched in 2003. The objective of FOSIM is to manage food safety surveillance that ensures imported foods can be eaten safely. Malaysia Foodborne Disease Network (MyFoodNet) was also established to cater the needs of effective surveillance systems of foodborne disease. Besides that, two other information systems was developed in 2012, Food Analyst Registration Information System (FARIS) and the Interactive Club for Food Safety and Quality (MohKLIK). The purpose of FARIS is to ensure all the food analysts are registered and comply with the Food Analyst Act 2011 that have been enforced. Whereas, MohKLIK has been launched to develop food safety awareness, among public especially children (FSQD, 2016).

Ministry of Health, Malaysia (MOH) has also established the Food Handlers' Training Programme since 1996 as to increase the knowledge on food hygiene. This knowledge is very useful to ensure the handling, preparation and sales of food have been done in appropriate way (Jinap *et al.,* 2003). Thus, to ensure the training is effective and had the long term effect and impact, continuous improvement is needed. There are many reasons for the lack of impact of training initiatives and the implementation of safe food handling practices within the food service industry. The possible factors such as; the staff high revenue, the staff small wages, the staff position, more part-time staff working, the low language level and/or educational level of the staff, less awareness on quality assurance, lot of complicated meals served, fulfilling high demands and short period of serving/preparing most of the foods at mealtimes, culinary requirements for the current trend, the high quantity of vulnerable consumers been provisioned, less knowledge on food safety, inappropriate placement of equipment and the rotation of staff (Capunzo *et al.,* 2005).

The positive impact from the training can be enhanced by monitoring the food handlers that involved in their contributions in decreasing the foodborne outbreaks incidence rate (Soon *et al.,* 2011). Various language usage of the trainers can be used in the food safety programme to improve the food safety handlers practising the skills learned (Rudder, 2006). Management of food services that being supportive is really important to influence the food handlers in practising their food hygiene training knowledge (Philip & Anita, 2010).

CONCLUSION

National food safety systems that complement the food producers and suppliers are critical to be implemented. This system can ensure customer to be aware about the latest food safety updates is very useful. Main concern should be given on development of laboratory-based surveillance programmes in the enhancement process. Monitoring and surveillance can be done more intensively in lowering the consequences of the foodborne diseases. Various agencies in MOH such as Communicable Disease Section, Disease Control Division and Food Safety and Quality Division can

play their roles more effectively by continuous collaboration with government agencies and private sectors that enhances the intervention strategy. These intervention strategies must be considered to manage the foodborne disease, so it will not become an economic problem to the government. Therefore, the synergy and collaborations from government and private sectors are paramount for a sustainable and impactful strategies to assure the food safety in Malaysia.

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REFERENCES

A'aishah, S. 2014. Keracunan Makanan- Peranan PBT. In: Prosiding Persidangan Kesihatan Persekitaran Pihak Berkuasa Tempatan. Putrajaya: Ministry of Urban Wellbeing, Housing and Local Government.

Abdul Mutalib, N.A., Syafinaz, A.N., Sakai, K. & Shirai, Y. 2015. An overview of foodborne illness and food safety in Malaysia. *International Food Research Journal*, **22(3)**: 896-901.

Ali, N. & Abdullah, M.A. 2012. The food consumption and eating behaviour of Malaysian urbanites: Issues and Concerns. *Malaysia Journal of Society and Space,* **8(6)**: 157-165.

Campos, A.K.C., Cardonha Â.M.S., Pinheiro, L.B.G., Ferreira, N.R., Azevedo, P.R.M. de & Stamford, T.L.M. 2009. Assessment of personal hygiene and practices of food handlers in municipal public schools of Natal, Brazil. *Food Control*, **20(9)**: 807-810.

Capunzo, M., Cavallo, P., Boccia, G., Brunetti, L., Buonomo, R. & Mazza, G. 2005. Food hygiene on merchant ships: the importance of food handlers' training. *Food Control*, **16**: 183-188.

Dewaal, C.S., Robert, N., Witmer, J. & Tian, X.A. 2010. A comparison of the burden of foodborne and waterborne diseases in Three World Regions, 2008. *Food Protection Trends*, **30(8)**: 483-90.

Eberhart-Phillips, J., Bessser, R.E., Tormey, M.P., Feikin, D., Araneta, M.R., Wells, J., Kilman, L., Rutherford, G.W., Griffin, P.M., Baron, R. & Mascola, L. 1996. An outbreak of cholera from food served on an international aircraft. *Epidemiology and Infection*, **116(1)**: 9-13.

EFSA Panel on Biological Hazards. 2014. Scientific opinion on the risk posed by pathogens in food of non-animal origin. Part 2 (*Salmonella* and Norovirus in Leafy Greens Eaten Raw as Salad). *European Food Safety Authority*, **12(3)**: 1-118. doi:10.2903/j.efsa.2014.3600.

Egan, M.B., Raats, M.M, Grubb, S.M., Eves, A., Lumbers, M.L., Dean, M.S. & Adams, M.R. 2007. A review of food safety and food hygiene training studies in the commercial sector. *Food Control*, **18(10)**: 1180-1190.

Ehiri, J.E., Morris, G.P. & McEwen, J. 1997. Evaluation of a food hygiene training course in Scotland. *Food Control,* **8(3)**: 137-147.

Finelli, L., Swerdlow, D., Mertz, K., Ragazzoni, H., & Spitalny, K. 1992. Outbreak of cholera associated with crab brought from an area with epidemic disease. *The Journal of Infectious Diseases*, **166(6)**:1433-1435.

Food Safety and Quality Division (FSQD). Retrieved on 20 July, 2016 from FSQD website: http://fsq.moh.gov.my/v5/ms/

Fukuda, K. 2015. Food safety in a globalized world. *Bulletin World Health Organisation*, **93**: 212.

Haagsma, J.A., Polinder, S., Stein, C.E. & Havelaar, A.H. 2013. Systematic review of foodborne burden of disease studies: Quality assessment of data and methodology. *International Journal of Food Microbiology*, **166(1)**: 34-47.

Han, N., Mizan, M.F.R., Jahid, I.K. & Ha, S-D. 2016. Biofilm formation by *Vibrio parahaemolyticus* on food and food contact surfaces increases with rise in temperature. *Food Control*, **70**: 161-166.

Hassan, N.A., Hashim, J.H., Johar, Z. & Faisal, M.S. 2014. The implications of climatic changes on food and water-borne diseases in Malaysia: A Case Study of Kelantan, Terengganu, Johor and Melaka. *BioMed Central Public Health*, **14** (Suppl 1): P22.

International Network of Food Safety Authorities (INFOSAN). 2013. Enhancing INFOSAN in Asia and implementation of regional food safety strategies: *Meeting report*, Seoul, Republic of Korea, 27-30 November 2012.

Jinap, S., Mad Nasir, S. & Mohd Salim, D. 2003. Pacific food system outlook 2002–2003 – Malaysia. In: *Pacific food system outlook 2002-2003*, 30-34 pp.

Kanapathy, V. 2006. Migrant Workers in Malaysia: An Overview. Report of the workshop on an East Asian cooperation framework for migrant labour, Kuala Lumpur, 6-7 December 2006.

Lestari, E.S., Severin, J.A. & Verbrugh, H.A. 2003. Review antimicrobial resistance among pathogenic bacteria in Southeast Asia. *Southeast Asian Journal Tropical Medicine and Public Health*, **43(2)**: 385-422.

Levy, S.B. & Marshall, B. 2004. Antibacterial resistance worldwide: Causes, challenges and responses. *Nature Medicine*, **10**: 1078-1089.

Li, H., Wang, H., D'Aoust, J.Y. & Maurer, J. 2013. *Salmonella* species, In: Doyle, M.P., Buchanan, R.L. (Eds.), *Food Microbiology: Fundamentals and Frontiers*, 4th Ed. ASM Press, Washington. DC, pp. 225-262.

Meftahuddin, T. 2002. Review of the trends and causes of food borne outbreaks in Malaysia from 1988 to 1997. *The Medical Journal of Malaysia*, **57(1)**: 70-79.

Ministry of Finance, Malaysia. Economic Report 2012/2013. http://www.tresury.gov.my/pdf/ekonomi/le/1213/chap3.pdf

Ministry of Health (MOH). 2016. Kejadian keracunan makanan di sekolah seluruh Malaysia. (April 2016). Retrieved on 30 April 2016 from MOH Website: http://www.moh.gov.my/

Nieto-Montenegro, S., Brown, J.L. & La Borde, L.F. 2008. Development and assessment of pilot food safety educational materials and training strategies for Hispanic workers in the mushroom industry using the health action model. *Food Control*, **19(6)**: 616-633.

Nik Rosmawati, N.H., Wan Manan, W.M., Noor Izani, N.J. & Nik Nurain, N.H. 2014. Evaluation of environmental hygiene and microbiological status of selected primary school canteens. *Health and the Environment Journal*, **5(3)**: 110-127.

Palma, M.A., Ribera, L.A., Bessler, D., Paggi, M. & Knutson, R.D. 2010. Potential impacts of foodborne illness incidences on market movements and prices of fresh produce in the U.S. *Journal of Agricultural and Applied Economics*, **42(4)**: 731-741.

Phillip, S. & Anita, E. 2010. Efficacy of the theory of planned behaviour model in predicting safe food handling practices. *Food Control*, **21**: 983-987.

Pires, S.M., Fischer-Walker, C.L., Lanata, C.F., Devleesschauwer, B., Hall, A.J., Kirk, M.D., Duarte, A.S.R., Black, R.E. & Angulo, F.J. 2015. Aetiology-specific estimates of the global and regional incidence and mortality of diarrhoeal diseases commonly transmitted through Food. *PloS One*, **10(12)**: 1-17.

Rajagopal, L. 2013. Educating immigrant Hispanic foodservice workers about food safety using visual-based training. *Journal of Extension*, **51(2)**: Article #2FEA8.

Rudder, A. 2006. Food safety and the risk assessment of ethnic minority food retail businesses. *Food Control*, **17(3)**: 189e196.

Sharifa-Ezat, W.P., Netty, D. & Sangaran, G. 2013. Paper review of factors, surveillance and burden of food borne disease outbreak in Malaysia. *Malaysian Journal of Public Health Medicine*, **13(2)**: 98-105.

Soon, J.M., Singh, H. & Baines, R. 2011. Foodborne diseases in Malaysia: A review. *Food Control*, **22(6)**: 823-830.

Soon, J.M., Seaman, P. & Baines, R.N. 2013. *Escherichia coli* O104:H4 outbreak from sprouted seeds. *International Journal of Hygiene and Environmental Health*, **216(3)**: 346-354.

Teisl, M.F. & Roe, B.E. 2010. Consumer willingness-to-pay to reduce the probability of retail foodborne pathogen contamination. *Food Policy*, **35(6)**: 521-530.

Todd, E.C.D., Greig, J.D., Bartleson, C.A. & Michaels, B.S. 2007. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 3. Factors contributing to outbreaks and description of outbreak categories. *Journal of Food Protection*, **70**: 2199-2217.

Verraes, C., Boxstael, S.V., Meervenne, E.V., Coillie, E.V., Butaye, P., Catry, B., de Schaetzen, M., Huffel, X.V., Imberechts, H., Dierick, K., Daube, G., Saegerman, C., Block, J.D., Dewulf, J. & Herman, L. 2013. Antimicrobial Resistance in the Food Chain: A Review. *International Journal of Environmental Research and Public Health*, **10(7)**: 2643-2669.

Walsh, M. International Food Technology (IFT). Food Producers Must Embrace Innovation to Succeed with next generation. (July 2015). Retrieved on 30 May 2016 from IFT Website: http://www.ift.org/newsroom/news-releases/2015/july/14/futurist-mike-walsh.aspx

World Health Organization (WHO) 2003. Diet, nutrition, and the prevention of chronic diseases. Report of a Joint WHO/Food and Agriculture Organization Expert Consultation, Technical Report Series No. 916. WHO Publisher, Geneva, Switzerland.

World Health Organization (WHO) 2015. WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015.

Yee, Y.S. & Yuen, J.L.F. 2014. The recruitment of migrant workers in the food service industry in Malaysia: A study of Old Town White Coffee and Pappa Rich Kopitiam. *International Journal of Business, Economics and Management*, **1(10)**: 291-304.