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ASSESSMENT OF KNOWLEDGE OF FOOD HYGIENE AMONG FOOD HANDLERS IN BOARDING SECONDARY SCHOOLS IN NORTHWEST ZONE, NIGERIA

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Abstract

The study assessed the knowledge of food hygiene among food handlers in boarding secondary schools in North West Zone, Nigeria. To achieve this purpose, the descriptive survey research design was used and the target population for this study was 1112 and also, the sample size was 470 which were drawn from four states in the North West Zone of Nigeria. The participants were selected using multi-stage sampling techniques. A close-ended structured questionnaire based on the modified four (4) point Likert scale was used to obtain responses from the respondents. A pilot study was carried out to test the reliability of the instrument and statistical analysis Cronbach's Alpha correlation coefficient of 0.88 was obtained. The 470 copies of the questionnaire were distributed to the respondents and retrieved. Descriptive statistics of mean and standard deviation was used to answer the research question. The formulated hypothesis was tested at a 0.05 level of significance using inferential statistics of a one-sample t-test. The results revealed that knowledge of food hygiene among food handlers in boarding secondary schools in Northwest Zone, Nigeria was significant ($p = 0.000 < 0.05$). It was concluded that the food handlers in boarding secondary schools in the North West zone, Nigeria have good knowledge of food hygiene. The study recommended that the federal, state, and local governments should implement comprehensive and mandatory workshops, seminars, or training programs for all food handlers in boarding secondary schools in the Northwest Zone of Nigeria, covering essential topics like proper food handling techniques, personal hygiene practices, sanitation procedures, and foodborne illness prevention, to enhance food safety standards and minimize health risks for students and staff.

Keywords: Knowledge, Food Hygiene, Food Handlers, Boarding Secondary Schools

Introduction

Food is a fundamental necessity of life, playing a critical role in stimulating appetites, providing energy through carbohydrates, fats, and dietary fibre, promoting growth via proteins, and preventing diseases through vitamins and minerals (Samuel, Chidiebere, & Ugochi, 2020). However, the diverse sources of food materials and the numerous processes they undergo before consumption increase the likelihood of food becoming a vector for infections (Kamboj, Gupta, Bandral, Gandotra, & Anjum, 2020). Improper handling of food can lead to contamination, resulting in illnesses, poor health, increased medical expenses, and reduced productivity (Aluh & Aluh, 2017). Food hygiene, which encompasses practices that prevent microbial contamination from farm to table, is essential to ensure food safety (Saad, See, Abdullah & Nor, 2015). This concept is closely related to food safety, which ensures that food is free from all contaminants and hazards, though the terms are often used interchangeably (Mendedo, Berhane, & Haile, 2017).

Food hygiene involves measures to prevent contamination at every stage of food production, including handling, preparation, and storage, to avert foodborne illnesses (Sharif, Obaidat, & Al-Dalalah, 2013). Food handlers play a pivotal role in the transmission of foodborne diseases due to their attitudes and practices, often stemming from poor knowledge of safe food handling (Odeyemi & Bamidele, 2016). Foodborne illnesses, which can be infectious or toxic, are caused by pathogens entering the body through contaminated food. These pathogens, such as *Escherichia coli* and non-typhoidal *Salmonella*, can be shed by food handlers during the infectious or recovery phases of gastrointestinal illnesses (Mendedo et al., 2017). Outbreaks of foodborne diseases are often linked to errors by food workers, bacterial proliferation, and survival factors, highlighting the need for stringent hygiene practices (Sharif et al., 2013).

Improper storage, reheating, and cross-contamination are significant contributors to foodborne illnesses (Odeyemi & Bamidele, 2016). For instance, inadequate hand, body, and clothing hygiene among food handlers can lead to cross-contamination, particularly in boarding secondary schools (Okojie & Isah, 2019). Despite the importance of hygiene, many food handlers neglect proper practices, leading to inconsistent raw material quality and outbreaks of food poisoning (Nkhebenyane & Lues, 2020). Unsafe food handling, coupled with poor water supply and environmental sanitation, has been identified as a major cause of foodborne illness outbreaks among secondary school students (Nkhebenyane & Lues, 2020). Globally, unsafe food remains a significant public health issue, with millions falling ill and many dying annually due to

contaminated food and water (WHO, 2017). In developed countries, up to one-third of the population is affected by foodborne illnesses each year (FAO & WHO, 2016).

In Nigeria, the situation is particularly dire, with many cases of foodborne diseases going unreported, making it difficult to gauge the true extent of the problem (WHO, 2017). For example, in 1994, a group of medical students at the University of Lagos fell ill after consuming salad contaminated with *Salmonella* (Otu, 2014). Poor knowledge of food safety, inadequate personal hygiene, and improper storage practices among food handlers in boarding schools are significant concerns (Akorede & Toyin, 2020; Gbolabo et al., 2020). Food hygiene practices, which ensure the cleanliness and safety of food from bacterial contamination, are critical in preventing such outbreaks (Adebowale & Kassim, 2017). Microorganisms, which are ubiquitous in the environment, can contaminate food through various means, including unwashed hands, insects, and improper storage (Isara & Isah, 2016).

The World Health Organization (WHO) emphasizes the importance of understanding the knowledge, attitudes, and practices of food handlers to minimize foodborne diseases (WHO, 2017). Effective food safety practices among food handlers are crucial in ensuring the safe production of food, particularly in large-scale operations like school cafeterias (Aluh et al., 2017). Studies have highlighted the need for training and education of food handlers in hygiene measures, as many lack knowledge of microbiological hazards, proper refrigeration temperatures, and cross-contamination prevention (Oludare et al., 2016). The risk of food contamination is largely dependent on the health status, personal hygiene, and knowledge of food handlers (Akorede & Toyin, 2020; Mortlock et al., 2015).

Training and education are essential in improving food hygiene practices among food handlers. However, studies have shown that while training can increase knowledge, it does not always translate into positive changes in food-handling attitudes (Young et al., 2019). Hofforon et al. (2015) supported this finding, indicating that knowledge alone is insufficient to promote safe behaviours. Therefore, alternative educational strategies, such as motivational health education models, are necessary to foster positive attitudes and practices among food handlers (Tolulope et al., 2015). Identifying the knowledge of food handlers is crucial in ensuring food hygiene and preventing foodborne illnesses in boarding secondary schools (Bas et al., 2016).

Food, being rich in nutrients, is highly susceptible to microbial contamination from various sources, including water, air, dust, equipment, and human handlers (Onyeaka et al., 2021). Changes in food production, handling, and consumption habits have further increased the risk of foodborne illnesses (Coleman & Roberts, 2015). In Nigeria, the lack of proper hygiene practices among food handlers in boarding schools poses a significant public health risk, particularly in the Northwest Zone, where poor sanitation and inadequate water supply are prevalent (Teffo & Tabit, 2020).

The researcher's observations as a former secondary school teacher in Zamfara State revealed that many food handlers in boarding schools have poor hygiene practices, such as unkempt hair, dirty footwear, and the use of contaminated water for washing utensils. These conditions often result in food contamination, leading to infections and diseases among students. Given the critical role of food handlers in ensuring food safety, there is an urgent need to assess their knowledge of food hygiene to identify gaps and implement targeted interventions. This study seeks to evaluate the knowledge of food hygiene among food handlers in boarding secondary schools in the Northwest Zone of Nigeria, to improve food safety practices and reduce the incidence of foodborne illnesses.

Research Question

What is the knowledge of food hygiene among food handlers in boarding secondary schools in the Northwest Zone of Nigeria?

Hypotheses

Knowledge of food hygiene among food handlers in boarding secondary schools in Northwest Zone, Nigeria is not significant.

Methodology

The research design employed in this study was a survey research design, which was deemed appropriate for the study's objectives. According to Anikweze (2013), survey research involves a detailed and critical examination of a topic or situation to ascertain the current state of affairs. The population of the study comprised all food handlers in boarding secondary schools across the North West Zone, which includes states such as Sokoto, Kebbi, Katsina, Zamfara, Kaduna, Jigawa, and Kano. The total number of state boarding secondary schools in this zone is 226, with 1,943 food handlers employed across these schools. The data on the number of schools and food handlers were obtained from the State Ministry of Education (2022).

The sample size for the study was determined to be 470 food handlers, drawn from a population of 1,112. A multistage sampling technique was employed to select the sample, which included simple random sampling, stratified sampling, and proportionate sampling. In the first stage, four states (Katsina, Jigawa, Kebbi, and Sokoto) were randomly selected from the seven states in the North West Zone using a hat-drawn method. In the second stage, the sample size of 470 was determined using the Research Advisor table for determining sample size, which recommended this number based on a population of 1,112, a 0.035% margin of error, and a 95% confidence interval. The third stage involved stratifying each selected state into

three senatorial zones (Northern, Southern, and Central), and in the fourth stage, two senatorial zones were randomly selected from each state. Finally, a proportionate sampling technique was used to select 470 food handlers from the four states, ensuring that the sample was representative of the population. Convenience sampling was then used to distribute the questionnaires to the selected food handlers, as they were sparsely distributed across the schools.

The data collection instrument was a close-ended questionnaire which assessed the knowledge of food hygiene among the food handlers using a 4-point Likert scale. The validity of the instrument was established through vetting by experts in the Department of Human Kinetics and Health Education at Ahmadu Bello University, Zaria. A pilot study was conducted with 50 participants to test the reliability of the instrument, and the data collected were analyzed using Cronbach's alpha, which yielded a reliability index of 0.88, indicating high internal consistency. The data collection involved the researchers administering 470 questionnaires across the selected senatorial zones. Mean and standard deviation was used to answer the research question. The null hypothesis was tested using a one-sample t-test at a 0.05 level of significance.

Results

Research Question: What is the knowledge of food hygiene among food handlers in boarding secondary schools in the Northwest Zone of Nigeria?

Table 1: Respondent Knowledge of Food Hygiene among Food Handlers

S/N	Statement	Mean	SD
1	Food handlers must take their bath first thing in the morning before handling food.	3.50	1.291
2	Food handlers must sanitize the cooking and serving food environment before handling food.	3.52	1.235
3	Food handlers must cover food from flies and other insects to prevent disease transmission.	3.37	1.684
4	Insect and rodent control is an effective way of ensuring food safety.	3.43	1.339
5	Uncooked foods are stored in a dry environment.	3.73	1.292
6	Bacteria are transmitted to food through poorly cleaned equipment such as pots, knives and other cooking utensils.	3.44	1.575
7	Washing vegetables and animal-originated foods such as meat and fish properly under running water before cooking is very important.	2.07	1.197
8	Food poisoning is transmitted through unwashed hands.	3.57	1.579
9	The use of a cap, face mask, protective gloves and adequate protective clothing reduces the risk of food contamination.	3.31	1.493
10	Kitchen workers must go through health checks every 6 months.	2.48	1.262
	Average	**3.242**	

Decision/Criterion mean = 2.50

From Table 1, knowledge of food hygiene among food handlers in boarding secondary schools in the Northwest Zone of Nigeria is relatively high, this is because their average mean response of 3.242 is above 2.500 which is the criterion mean. A deeper examination of this table shows that their mean responses in each of the 8 items were higher than the decision mean. Specifically, the majority of the respondents understand that uncooked foods are stored in a dry environment, as this response attracted the highest mean response of 3.73. Furthermore, knowledge of food poisoning transmission through unwashed hands is important as this response had the second-highest mean of 3.57. Similarly, other items such as food handlers must sanitize the cooking and serving food environment before handling food and must take their bath first thing in the morning before handling food have a mean rating of 3.52 and 3.50 respectively. Similarly, the majority of the respondents agreed that bacteria are transmitted to food through poorly cleaned types of equipment such as pots, knives and other cooking utensils with a mean score of 3.44 and that insect and rodent control is an effective way of ensuring food safety with a mean rating of 3.43. This implies that the kitchen environment and cooking utensils should be kept clean and safe away from insects and rodents. In the same vein, the majority of the respondents agreed that the use of a cap, face mask, protective gloves and adequate protective clothing reduces the risk of food contamination with a mean score of 3.31

However, the majority of the respondents disagreed that washing vegetables and animal-originated foods such as meat and fish properly under running water before cooking is very important and kitchen workers must go through health checks every 6 months with a mean score of 2.07 and 2.48 respectively. In summary, the majority of all the participants are knowledgeable about food hygiene especially as related to storage of uncooked foods, causes and transmission of food poisoning, sanitization of cooking and serving environment, personal hygiene for the food handlers, transmission of bacteria and, food safety through rodents and insects control mechanism. Therefore, it can be concluded that food handlers in boarding secondary schools in the Northwest Zone of Nigeria have adequate knowledge about food hygiene.

Hypothesis: Knowledge of food hygiene among food handlers in boarding secondary schools in Northwest Zone, Nigeria is not significant.

Table 2: One sample t-test statistical analysis results on the significance of Knowledge of food hygiene among food handlers in boarding secondary schools in Northwest Zone, Nigeria.

	N	Mean	SD.	SD. Error Mean	df	t_{Cal}	t_{Cri}	p-value
Knowledge	470	34.623	5.870	.271	469	-19.86	1.965	0.000
Decision Mean	420	2.50						

$t_{Cal.} > t_{Cri}$ at df 469, calculated p-value (0.000) < 0.05, t = |19.86|

The hypothesis posited that knowledge of food hygiene among food handlers in boarding secondary schools in the Northwest Zone of Nigeria is not significant. The results of the one-sample t-test, as presented in Table 4.8, strongly reject this hypothesis. The mean knowledge score is 34.623, and the standard deviation is 5.870. The standard error of the mean is 0.271, calculated based on a sample size of 470 and degrees of freedom (df) of 469. The calculated t-value (t_{Cal}) is -19.86, while the critical t-value (t_{Cri}) at df 469 and a significance level of 0.05 is 1.965. The absolute value of t_{Cal} (|19.86|) is significantly greater than t_{Cri}, indicating a highly significant difference. The p-value, calculated as 0.000, is less than 0.05, providing strong evidence against the null hypothesis.

Therefore, based on the results of the one-sample t-test, it can be concluded that the knowledge of food hygiene among food handlers in the boarding secondary schools in Northwest Zone, Nigeria is indeed significant. The negative t-value indicates that the mean knowledge score is significantly lower than a hypothetical mean, further emphasizing the need for targeted interventions to enhance knowledge levels and, consequently, improve food hygiene practices among the food handlers in the boarding secondary schools in the Northwest Zone of Nigeria.

Discussion of Findings

The findings from this study showed that the knowledge of food hygiene among food handlers in boarding secondary schools in Northwest Zone, Nigeria is significant. Firstly, it is imperative to acknowledge that food hygiene plays a fundamental role in preventing food-borne illnesses and ensuring the safety of consumers, particularly in settings like boarding secondary schools where large numbers of individuals are served meals regularly. The findings of this research shed light on the current state of food hygiene awareness among food handlers within the Northwest Zone, Nigeria providing valuable insights into potential areas of improvement. This finding emphasizes the importance of educational interventions and training programmes aimed at enhancing the knowledge and practices of food handlers regarding food hygiene. By identifying areas of deficiency in food hygiene knowledge, such interventions can be tailored to address specific gaps and equip food handlers with the necessary skills to uphold proper hygiene standards in food preparation and handling processes. These results concur with various studies done on knowledge which entails the ability to acquire, retain and utilize information hence education and training are prerequisites of knowledge (Addo-Tham *et al.,* 2020). According to a study conducted in Ghana, on knowledge of food safety and food-handling practices of street food vendors in primary, it revealed that the level of knowledge on food hygiene and safety practices was satisfactory after intervention treatment (Annor, 2011).

Moreover, the findings underscore the need for stringent regulatory measures and enforcement mechanisms to ensure compliance with food safety standards in boarding secondary schools. This may involve the implementation of regular inspections, monitoring systems, and the establishment of clear guidelines and protocols for food handling practices. By holding food handlers accountable for maintaining high standards of hygiene, such measures can contribute to safeguarding the health of students and reducing the risk of foodborne diseases. Similarly, the findings and observations of this study are similar to some other studies done in Nigeria (Afolaranmi *et al.,* 2015, Bamidele *et al.,* 2015; Zain & Naing, 2002). On the contrary, studies from Ethiopia, Malaysia, Iran, Korea and Thailand observed that a majority of the food vendors had poor level of food hygiene knowledge (Tessema *et al.,* 2014; Rahman *et al.,* 2012; Cuprasittrut *et al.,* 2011; Pirsaheb *et al.,* 2010; Park *et al.,* 2010). It is tempting to say that the level of good knowledge among the majority of food vendors in the present study could be related to the fact that a majority of the respondents had a level of education or training which could have formed the basis for increased comprehension of food hygiene information and therefore improved knowledge.

The potential justification for this finding might be that education might help food handlers get better information regarding food safety as compared to non-educated. Besides, educated food handlers' will also be able to read additional written messages on food safety from different sources of information such as leaflets, posters, or fliers which in turn could positively affect food handlers' knowledge of food safety (Addo-Tham *et al.,* 2020). Therefore, it can be concluded that training could help them to acquire a better knowledge of food safety and hygiene.

Conclusion

The food handlers in boarding secondary schools in Northwest Zone, Nigeria know about some food hygiene.

Recommendations

Since food hygiene knowledge among food handlers in boarding secondary schools in the Northwest Zone of Nigeria is important, federal, state and local governments should implement comprehensive and mandatory workshops, seminars or training programmes for all food handlers. These programmes should cover essential topics such as proper food handling techniques, personal hygiene practices, sanitation procedures, and food-borne illness prevention. By equipping food handlers with the necessary knowledge and skills, schools can significantly enhance food safety standards and minimize the risk of foodborne illnesses among students and staff.

References

Addo-Tham, R., Appiah-Brempong, E., Vampere, H., Acquah-Gyan, E., & Gyimah, A. A. (2020). Knowledge of food safety and food-handling practices of street food vendors in Ejisu-Juaben Municipality of Ghana. *Adv Public Health,* 4579573.

Adebowale, O. & Kassim, I. (2017). Food safety and health: A survey of rural-urban household consumer practices, knowledge of food safety and food.

Afolaranmi, T.O., Hassan, Z.I., Bello, D.A. & Misari, Z. (2015). Knowledge and Practice of Food Safety and Hygiene among Food Vendors in Primary Schools in Jos, Plateau State, North Central Nigeria. *Journal of Medical Research*, *4*, 16-22.

Akorede, S. N., & Toyin, A. (2020) Knowledge of Personal Hygiene among Undergraduates. *Journal of Health Education (JHE), 5*(2), 66-71

Aluh, F. O., & Aluh, D. O. (2017). Knowledge, attitudes and practices of food hygiene among mobile food vendors in a Nigerian rural settlement. International *Journal of Community Medicine and Public Health, 4*(11), 4025-4030.

Annor, E. B. (2011). Evaluation of food hygiene knowledge attitudes and practices of food handlers in food businesses in Accra, Ghana. *Food Nutr Sci., 2*(8), 830

Bamidele, J. O., Adebimpe, W. O., Oladele, E. A. and Adeoye, O.A. (2015) Hygiene Practices among Workers in Local Eateries of Orolu Community in South Western Nigeria. *Annals of Medical and Health Sciences Research, 5*, 235-240.

Bas, M., Azmi, S. E., & Gokhan, K. (2016), The evaluation of food hygiene knowledge, attitudes, and practices of food handlers in food businesses in Turkey", *Food Control*, *17*(2016). 317-322.

Coleman, P. & Roberts, A. (2015). Food hygiene training in the UK: A time for change. *Journal of Food Service Technology, 5*, 17-22.

Cuprasittrut, T., Srisorrachatr, S. & Malai, D. (2011). Food Safety Knowledge, Attitude and Practice of Food Handlers and Microbiological and Chemical Food Quality Assessment of the Food for Making Merit for Monks in Ratchathewi District, Bangkok. *Asia Journal of Public Health, 2*, 27-34.

FAO/WHO (2016). *Guidance to Governments on the application of HACCP in small and /or less developed businesses*. FAO London.

Gbolabo, J. K., Adebola, A. A., & Abdul-Hakeem, O. A. (2020). Assessment of Knowledge, Attitude, and Practice of Meat Hygiene among Meat Handlers in Lagos State, Nigeria. *Nigerian Journal of General Practice, 18*, 27-36

Hofforon, P. R., Bradley, C. R., & Ayliffe, G. (2013). *Disinfection in health care.(3rd Ed.).*Oxford: Blackwell Publishing

Isara, A. & Isah, I. (2016). Knowledge and practice of food hygiene and hygiene among food handlers in fast food restaurants in Benin City, Edo State, Nigeria. *Postgraduate Medical Journal*, September, *16*(3), 207-12.

Kamboj, S., Gupta, N., Bandral, J. D., Gandotra, G. & Anjum, N. (2020). Food safety and hygiene: A review. *International Journal of Chemical Studies, 8*(2), 358-365

Mendedo, E. K., Berhane, Y., Haile, B. T. (2017). Factors associated with sanitary conditions of food and drinking establishments in Addis Ababa, Ethiopia: cross-sectional study. *Pan Afr Med J*., *28*(1), 237

Mortlock, M. P., Peters, A. C., & Griffith, C. (2015). Food hygiene and HACCP in the UK food industry, practices, perceptions and attitudes. *Journal of Food Protection, 62*, 786-792.

Nkhebenyane, J. S., & Lues, R. (2020). The knowledge, attitude, and practices of food handlers in central South African hospices. *Food Sci*.

Odeyemi, A., & Bamidele, T. (2016). Harnessing the potentials and predictive microbiology in microbe food safety and quality research in Nigeria. *Future Science, 2*(1) 91-93.

Okojie, P. W., & Isah, E. C. (2019). Food hygiene knowledge and practices of street food vendors in Benin City, Nigeria, *International Journal of Consumer Studies, 43*(6), 528-535.

Oludare, A.O., Ogundipe, A., Odunjo, A., Komolafe, J. & Olatunji, I. (2016). Knowledge and food handling practices of nurses in a tertiary health care hospital in Nigeria, *Journal of Environmental Health, 76*(8), 32-39

Onyeaka, H., Osmond, C. E., Ukpai, A. E., Queeneth, I. O., Job, A., Ogueri, N., & Joy, O. C., (2021) Improving Food Safety Culture in Nigeria: A Review of Practical Issues. *Foods 10*(8), 1878.

Otu, S. S. (2014). *Food Hygiene Practices among Food Handlers in Ahmadu Bello University, Zaria*. MPH Thesis Department of Community Medicine, Ahmadu Bello University, Zaria.

Park, S., Kwak, T. and &, H. (2010). Evaluation of the Food Safety Training for Food Handlers in the Restaurant Operation. *Nutrition Research and Practice*, *4*, 58-68.

Pirsaheb, M., Almasi, A. & Rezaee, M. (2010) The Special Education Course Effects on Knowledge, Attitude and Practice of Preparation, Distribution and Sale Centres Food Staff in Kermanshah. *Iranian Journal of Health and Environment*, *3*, 299-308.

Rahman, M. M., Arif, M. T., Bakar, K. & Tambi, Z. (2012). Food Safety Knowledge, Attitude and Hygiene Practices among the Street Food Vendors in Northern Kuching City, Sarawak. *Borneo Science, 31*, 94-103.

Saad, M., See, T. P., Abdullah, M. F. F., &Nor, N. M. (2015). Use of Rapid Microbial Kits for Regular Monitoring of Food-contact Surfaces Towards Hygiene Practices. *Procedia - Social and Behavioral Sciences, 105*, 273–283.

Samuel, E. O, Chidiebere, F. U, & Ugochi, R. E. (2020). Foodborne Diseases and Intoxication in Nigeria: Prevalence of Escherichia coli 0157:H7

Sharif, L., Obaidat, M. M., & Al-Dalalah, M. R. (2013). Food hygiene knowledge, attitudes and practices of the food handlers in the military hospitals. *Food Nut. Sci., 4*(3), 245–251

Teffo, L. A., & Tabit, F. T. (2020). An assessment of the food safety knowledge and attitudes of food handlers in hospitals. *BMC Public Health, 20*, 1–12.

Tessema, A. G., Gelaye, K. A. & Chercos, D. H. (2014). Factors Affecting Food Handling Practices among Food Handlers of Dangila Town Food and Drink Establishments, North West Ethiopia. BMC Public Health, 14, 571

Tolulope, O.A., Zuwaira, I.H., Danjuma, A.B., Yetunde, O.T., Chundung, A.M., &Ayuba, I.Z. (2013). Training: a vital tool for improving the knowledge and practice of food hygiene and hygiene among food handlers in boarding schools in Plateau state. *J Med Trop* 16(2):87–92.

World Health Organization (2017). Food hygiene [Retrieved 29 September 2017]. Available from: http://www.who.int/foodsafety/areas_work/food-hygiene/en/ (accessed on 29 June 2018).

Young, I., Greig, J., Wilhelm, B. J., & Waddell, L. A. (2019). Effectiveness of food handler training and education interventions: A systematic review and meta-analysis. *Journal of Food Protection, 82*(10), 1714–1728

Zain, M. M. & Naing, N. N. (2002). Socio-demographic Characteristics of Food Handlers and Their Knowledge, Attitude and Practice towards Food Sanitation: A Preliminary Report. Southeast *Asian Journal of Tropical Medicine and Public Health*, 33, 410-417.