EFFECTIVENESS OF HAZARD ANALYSIS AND CRITICAL CONTROL POINT SYSTEM BASED ON MICROBIAL QUALITY OF POULTRY-BASED FOOD AND FOOD CONTACT SURFACES

By

RAMESH SUBRAMANIAM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2023

FSTM 2023 10

DEDICATION

Dedicated to my family, parents, and friends for their support.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

EFFECTIVENESS OF HAZARD ANALYSIS AND CRITICAL CONTROL POINT SYSTEM BASED ON MICROBIAL QUALITY OF POULTRY-BASED FOOD AND FOOD CONTACT SURFACES

By

RAMESH SUBRAMANIAM

December 2023

Chairman : Nuzul Noorahya Jambari, PhD
Faculty : Food Science and Technology

Increased reliance is placed on the Hazard Analysis and Critical Control Point (HACCP) system to ensure poultry meat's quality and microbiological safety in food service industries. However, epidemiological data revealed that many foodborne infections are attributed to the consumption of poultry meat, challenging the efficacy of the existing food safety system. This pronounced contrast necessitates a critical evaluation of the effectiveness of the HACCP framework in ensuring food safety. The study's objective was to evaluate the effectiveness of HACCP applications through a 30-month assessment of their impact on the microbial quality focused on the presence of total plate count (TPC), coliform, *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* spp. in HACCP establishments. The analysis of 699 ready-to-market poultry meat samples from three companies revealed variable coliform and *E. coli* levels, indicating sporadic fecal contamination and episodic presence of *S. aureus* and *Salmonella* spp., which could be potential breaches in the HACCP system. The statistical analyses, Kruskal-Wallis and Mann-Whitney U tests, further confirmed

these findings, showing significant differences ($P<0.05$) in TPC across companies. The expanded investigation into RTE foods and contact surfaces in 16 upscale dining and six private medical HACCP-certified establishments analyzed 377 RTE food and 825 contact surfaces, demonstrated variability in TPC and coliform levels. Medical establishments exhibited lower TPC and better microbial control than dining facilities, as shown by the Mann-Whitney U test ($P<0.05$). Nonetheless, hygiene issues were identified, with high non-compliance in TPC and coliform levels on contact surfaces and hands. Antibiotic susceptibility testing on isolates from poultry meat processing plants and food serving establishments revealed a concerning level of resistance among 23 *Salmonella* spp. to commonly used antibiotics such as ampicillin (100%), chloramphenicol (87%), and cephalosporins. Similarly, 30 *S. aureus* demonstrated high resistance rates to tetracycline (87.5%), chloramphenicol (81.2%), and penicillin (81.2%). The Multiple Antibiotic Resistance (MAR) index further highlighted the potential high risk of infection that may be difficult to treat with conventional antibiotics. This study reflects that the HACCP system failed to prevent the dissemination of resistant bacteria through the food chain. The study's aim to investigate the adherence of isolated *S. aureus* to different types of surface material commonly used in food preparation environments (glass, GL; stainless steel, SS; and polyethylene, PE), with different surface conditions (with biofilm vs non-biofilm and rough vs smooth) as well as to evaluate the efficacy of chemical sanitizers (Quaternary Ammonium Compounds, QAC, and chlorine) in reducing bacterial adherence on these surfaces. Study shows that *S. aureus*'s adherence was high on rough surfaces and further increased with the presence of biofilm. Compared to PE, QACs demonstrated significantly better sanitization efficacy ($P<0.05$), on GL and SS smooth surfaces without biofilm. Choosing low-adherence surface materials in food facilities and determining optimal sanitization time for food-contact surfaces can be beneficial in ensuring food safety. The study conclusion is critical, highlighting the urgent need to enhance food safety compliance, particularly within HACCP-certified establishments. The current shortcomings of the HACCP system, especially in upscale dining venues, present a notable concern. This emphasizes the essential need for HACCP teams to apply HACCP principles effectively, especially in hazard identification, verification, and implementing corrective actions.

Keywords: HACCP, Hospital, Hygiene, Pathogen, Poultry meat.

SDG: GOAL 1: No poverty, GOAL 2: Zero hunger

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KEBERKESANAN ANALISIS MUDARAT DAN TITIK KAWALAN KRITIKAL BERDASARKAN KUALITI MIKROB MAKANAN BERASASKAN AYAM DAN PERMUKAAN SENTUHAN MAKANAN.

Oleh

RAMESH SUBRAMANIAM

Disember 2023

Pengerusi : Nuzul Noorahya Jambari, PhD
Fakulti : Sains dan Teknologi Makanan

Kebergantungan pada sistem Analisis Mudarat Dan Titik Kawalan Kritikal (HACCP) untuk menjamin kualiti makanan telah dipertingkatkan. Namun demikian, data epidemiologi mendedahkan semakin banyak jangkitan bawaan makanan dikaitkan dengan hidangan daging ayam, mencabar keberkesanan sistem keselamatan makanan sedia ada. Kontras yang ketara ini memerlukan penilaian kritikal terhadap keberkesanan system HACCP dalam kepatuhan keselamatan makanan. Objektif kajian ini adalah untuk menilai keberkesanan aplikasi HACCP melalui penilaian selama 30 bulan terhadap impaknya terhadap kualiti bakteria yang tertumpu kepada kehadiran jumlah kiraan plat (TPC), koliform, *Escherichia coli*, *Staphylococcus aureus*, dan *Salmonella* spp. Analisis 699 sampel daging ayam sedia untuk dipasarkan daripada tiga syarikat mendedahkan paras koliform dan *E. coli* yang tidak sekata, menunjukkan pencemaran najis sporadis dan kehadiran episodik *S. aureus* dan *Salmonella* spp., yang menunjukkan ketidak patuhan sistem HACCP. Analisis statistik, ujian Kruskal-Wallis dan Mann-Whitney U, menunjukkan perbezaan ketara

(P<0.05) dalam kehadiran TPC merentasi tiga syarikat. Kajian diperluaskan ke atas makanan sedia dimakan (RTE) dan permukaan sentuhan di 16 restoran dan enam hospital swasta yang diperakui HACCP dengan menganalisis 377 sampel makanan RTE dan 825 permukaan sentuhan, termasuk tangan pengendali makanan, menunjukkan variasi dalam tahap TPC dan koliform. Hospital swasta mempamerkan TPC yang lebih rendah dan kawalan mikrob yang lebih baik daripada restoran, seperti yang ditunjukkan oleh ujian Mann-Whitney U (P<0.05). Walau bagaimanapun, isu kebersihan telah dikenal pasti, dengan ketidakpatuhan yang tinggi dalam TPC dan tahap koliform pada permukaan sentuhan dan tangan. Ujian kerintangan antibiotik ke atas bacteria daripada kilang pemprosesan daging ayam dan tempat penyajian makanan mendedahkan tahap rintangan yang membimbangkan di kalangan 23 *Salmonella* spp. kepada antibiotik yang biasa digunakan seperti ampicillin (100%), kloramfenikol (87%), dan sefalosporin. Begitu juga, 30 *S. aureus* menunjukkan kadar rintangan yang tinggi terhadap tetrasiklin (87.5%), kloramfenikol (81.2%) dan penisilin (81.2%). Indeks Rintangan Antibiotik Berbilang (MAR) menyerlahkan lagi potensi risiko tinggi jangkitan yang mungkin sukar dirawat dengan antibiotik konvensional. Kajian ini mencerminkan bahawa sistem HACCP gagal menghalang penyebaran bakteria tahan antibiotic dalam rantai makanan. Salah satu faktor yang menyumbang kepada kawalan bakteria yang lemah ialah pembersihan dan sanitasi permukaan sentuhan yang tidak konsisten. Matlamat kajian untuk menyiasat pematuhan *S. aureus* dipencil kepada pelbagai jenis bahan permukaan yang biasa digunakan dalam persekitaran penyediaan makanan (kaca, GL; keluli tahan karat, SS; dan polietilena, PE), dengan keadaan permukaan yang berbeza (dengan biofilm vs tanpa biofilm dan kasar vs licin) serta untuk menilai keberkesanan sanitizer kimia (Sebatian Ammonium Kuaterner, QAC, dan klorin) dalam mengurangkan lekatan

bakteria pada permukaan ini. Kajian menunjukkan bahawa lekatan *S. aureus* adalah tinggi pada permukaan kasar dan terus meningkat dengan kehadiran biofilm. Berbanding dengan PE, QAC menunjukkan keberkesanan sanitasi yang lebih baik (P<0.05), pada permukaan licin GL dan SS tanpa biofilm. Memilih bahan permukaan sesuai dalam indistri makanan dan menentukan masa sanitasi optimum untuk permukaan sentuhan makanan boleh menberi kelebihan dalam keselamatan makanan. Rumusan kajian adalah kritikal, menonjolkan keperluan mendesak untuk meningkatkan pematuhan keselamatan makanan, terutamanya dalam pertubuhan yang diperakui HACCP. Kelemahan semasa sistem HACCP, terutamanya di restaurant, menimbulkan kebimbangan yang ketara. Ini menekankan keperluan penting bagi pasukan HACCP untuk menggunakan prinsip HACCP dengan berkesan, terutamanya dalam pengenalpastian bahaya, pengesahan dan pelaksanaan tindakan pembetulan.

Kata Kunci: HACCP, Hospital, Hygiene, Pathogen, Poultry meat.

SDG: MATLAMAT 1: Tiada kemiskinan, MATLAMAT 2: Tiada kelaparan

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincere gratitude to Dr. Nuzul Noorahya Jambari, the chairperson of my supervisory committee for her professional guidance, support, and patience throughout my study. Thank you very much for all the advice and encouragement that help me complete my studies. My deepest appreciation also goes to my co-supervisors, Associate Prof. Dr. Nor Khaizura Mahmud Ab Rashid, Dr. Kuan Chee Hao, and Dr. Ungku Fatimah Ungku Zainal Abidin for their guidance, advice, and support.

Last but not least, I would like to express my million heartfelt thanks to my wife and children. Thank you so much for your love, support, and encouragement.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AIEC	Adherent-invasive *E. coli*
AOAC	Association of Official Agricultural Chemists
APTVM	Arahan Procedur Tetap Perkhidmatan Veterinar Malaysia
AS	Australian Standard
BAM	Bacteriological Analytical Manual
BGLB	Brilliant Green Bile Lactose Broth
BPW	Buffered Peptone Water
C	Celsius
CDC	Centers for Disease Control and Prevention
CDEC	Cell detaching *E. coli*
CFU	Colony forming unit
COVIT-19	Coronavirus Disease 2019
CLSI	Clinical and Laboratory Standards Institute
DAEC	Diffuse adherent *E. coli*
DNA	Deoxyribonucleic acid
DOSM	Department of Statistic Malaysia
dsLTB	Double Strength Laurly Sulphate Broth
E. coli	*Escherichia coli*
EAEC	enteroaggregative *Escherichia coli*
EDTA	Ethylenediamine tetra acetic acid
EFSA	European Food Safety Authority
EHEC	enterohemorrhagic *E. coli*
EIEC	enter invasive *E. coli*
EPEC	enteropathogenic *E. coli*
ETEC	enterotoxigenic *E. coli*

FAO	Food and Agriculture Organization of the United Nations
FSIS	Food Safety and Inspection Services
g	Gram
GMP	Good Manufacturing Practice
h	Hour
HACCP	Hazard Analysis Critical Control Point
HUS	Haemolytic Uremic Syndrome
ICMSF	The International Commission on Microbiological Specifications for Foods
IFSAC	The Interagency Food Safety Analytics Collaboration
IFT	Institute of Food Technologists
LTB	Lauryl Sulphate Broth
MDR	Multidrug Resistance
MKTTn	Muller-Kauffmann Tetrathionate-Novobiocin
mL	millilitre
mm	millimetre
MPN	Most Probable Number
MRSA	Methicillin-Resistant *Staphylococcus aureus*
NTS	Non-typhoidal *Salmonella*
OECD	Organization for Economic Co-operation and Development
PR/HACCP	Pathogen Reduction, Hazard Analysis, and Critical Control Point (PR/HACCP) System
PRP	Prerequisite program
rRNA	Ribosomal ribonucleic acid
QAC	Quaternary Ammonium Compounds
RTE	Ready-To-Eat
RVS	Rappaport Vasiliadis Soy

S. aureus	*Staphylococcus aureus*
*S.*Enteritidis	*Salmonella* Enteritidis
SE	*Staphylococcus aureus* enterotoxin
SOP	Standard Operating Procedure
SPI	*Salmonella* pathogenicity islands
spp	Species
STEC	Shiga toxin-producing *E. coli*
T3SS	type III secretion system
TPC	Total Plate Count
TSB	Tryptic Soy Broth
USDA	United States Department of Agriculture's
VRSA	Vancomycin-Resistant *Staphylococcus aureus*
WHO	World Health Organization
XLD	Xylose Lysine Deoxycholate Agar

CHAPTER 1

INTRODUCTION

1.1 Introduction

Foodborne illness remains a serious challenge in Malaysia, as this Southeast Asian country has not yet fully implemented an effective national food control system and is thus exposed to substantial health hazards (Salleh et al., 2017). Although the annual foodborne incidence rates in the country fluctuate, they have remained high in the recent decade, with 47.34 (2014), 60.28 (2015), 55.21 (2016), 42.25 (2017), and 45.71 (2018) per 100 000 persons reported by Ministry of Health (MOH, 2019). Yet, despite such high occurrence of food poisoning incidents, in the absence of an outbreak, the food industry does not seem to be compelled to adopt scientifically validated safe food handling practices (Abu Bakar et al., 2021; Saad et al., 2013; Soon et al., 2011).

However, referring foodborne illness to a specific food group can be difficult as most foodborne bacteria can spread easily and contaminate food products through utensils and food preparation services. Identifying an illness to a specific food is rarely possible until respective health authorities investigate a foodborne illness outbreak (O'Bryan et al., 2022). While findings related to such investigations conducted in Malaysia are lacking, according to Painter et al. (2013) and The Interagency Food Safety Analytics Collaboration (IFSAC) (2020), 14.0−17.9% of all foodborne illnesses in the United States are associated with poultry meat consumption. These assertions are supported by several epidemiological studies indicating that poultry meat products are among the most prevalent vehicles for transmitting foodborne pathogens (Abebe et al., 2020; Doulgeraki et al., 2012; Gonçalves-Tenório et al., 2018; Greig & Ravel, 2009). Thus, foodborne illness caused by poultry meat consumption continues to be a significant health risk across the globe (Abebe et al., 2020; Salleh et al., 2017).

This issue has emerged partly due to the decline in the consumption of red meat in the last several decades (González et al., 2020), accompanied by a considerable increase in the demand for poultry meat. According to the Organization for Economic Co-operation and Development-Food and Agriculture Organization for the United Nations (OECD-FAO, 2020), this shift in consumer preferences is mainly attributable to a favorable price–quality ratio, good nutritional value, and ease of preparation for poultry-based ready-to-eat (RTE) food. The benefits from the producer's perspective include a short life-cycle and excellent feed conversion while allowing high nutritional (especially protein) content to be attained at a relatively low cost (Kralik et al., 2018). In Malaysia, these advantages are compounded by the flexibility in developing new products and the lack of cultural or religious limitations (Jayaraman et al., 2013; Shafini et al., 2017). According to the Department of Statistics, Malaysia (DOSM, 2018), in 2017, 52.0 kg of poultry meat was consumed per capita, which is expected to be sustained.

However, as poultry meat and products are easily perishable and highly susceptible to contamination by foodborne pathogens, they pose a considerable risk of foodborne disease transmission, especially gastrointestinal infections (Barroug et al., 2021; Pessoa et al., 2021; Zerabruk et al., 2019). Consumers are primarily exposed to zoonotic pathogens such as *Escherichia coli*, *Bacillus* spp., *Campylobacter* spp., *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Listeria monocytogenes*, *Pseudomonas* spp., and *Salmonella* spp. via consumption of contaminated poultry meat (Bintsis, 2017). These bacterial contaminants can be disseminated during poultry meat processing, storage, and food preparation processes. While most infecting microorganisms merely lead to spoilage and are non-pathogenic to humans, others—such as *Salmonella* spp. and *S. aureus*—can be dangerous (Saharan et al., 2020), requiring stringent control measures.

Yet, these strategies are difficult to implement due to the high prevalence of conventional poultry farms where animals are kept in confined spaces in large numbers (Cobanoglu et al., 2014). Under these conditions, antibiotics are routinely used for preventive and therapeutic purposes to mitigate risks of disease outbreaks and reduce operational costs (Van Boeckel et al., 2015; Van Cuong et al., 2021). However, intensified antibiotic use has resulted in antibiotic resistance or multi-drug-resistant development among foodborne pathogens (Adzitey, 2020; Golden et al., 2021; Manyi-Loh et al., 2018; Mehdi et al., 2018; B. M. Marshall & Levy, 2011) that can easily enter the food chain, thus jeopardizing the treatment effectiveness in both humans and animals (Mendelson & Matsoso, 2015).

While this is not a new issue, it was brought into focus by recent foodborne illness outbreaks involving *Salmonella* spp., *Listeria monocytogenes*, *Campylobacter*, and potential COVID-19 transmission through the food chain interaction have refocused attention on the role of the environment, food animals, and food handlers in disease transmission (Ceniti et al., 2021; Ehuwa et al., 2021; Olaimat et al., 2020; Sanlier et al., 2020). Most countries have specific acts, legislation, guidelines, and regulations on food safety and quality management systems to govern safe practices in poultry meat better. Hazard Analysis Critical Control Point (HACCP), a risk-based food safety method used in the food supply chain, is one of the Codex Committee's well-recognized preventive measures (Faour-Klingbeil & Todd, 2020). Food Safety and Inspection Service (FSIS) and the United States Department of Agriculture (USDA) published the "Pathogen Reduction, Hazard Analysis, and Critical Control Point (PR/HACCP) System." A set of regulations to restrict and prevent the occurrence of foodborne pathogens in poultry meat products subsequently minimizes foodborne illness (FSIS, 1996). In Europe, according to Regulation (EC) No 852/2004 and of the Council of 29th April 2004, chapter 1, Article 4 on the hygiene of food states that food business operators shall adopt specific hygiene measures to eliminate, control, and prevent food safety hazards (Wallace et al., 2018). In the United Kingdom, food hygiene is mandated by Article 5 of the Food Hygiene Regulation (2006), stating that the operators of food businesses must establish, implement, and maintain a permanent HACCP-based procedure (Egan et al., 2007).

In April 2001, Malaysia established the HACCP certification scheme, followed by the Food Hygiene Regulation (Section 34 of the Food Act 1983) in 2009 to protect the public from foodborne diseases and ensure access to safe and quality food. Other measures, such as the Good Manufacturing Practice (GMP) food safety program, are also in place to ensure that food producers, owners, and occupants of food facilities, food handlers, and caterers adhere to stringent hygiene measures (Saad et al., 2013). In Malaysia, adopting HACCP has significantly enhanced food safety standards, particularly in the food production and export sectors. Through various regulatory bodies, the government has implemented HACCP as a mandatory requirement for certain food business operators. In Malaysia, both HACCP and GMP certifications are typically issued by certification bodies that are accredited by national or international accreditation organizations. As a part of this endeavor, the HACCP system is adopted when conducting risk assessments of biological, chemical, and physical hazards related to food processing and preparation. The HACCP plan also defines the allowed limits, provides management tools for processors, and defines ways risks can be contained within the specified safety thresholds.

In many countries, including Malaysia, the HACCP system is adopted in abattoirs, including those responsible for poultry processing, to improve microorganism control by developing a resource-targeting strategy that maximizes the control options. For this purpose, various indicator microorganisms are used to determine the nature of the foodborne hazard, some of which may generate toxins, while others are pathogens. However, microbial indicator parameters are most widely adopted, as this is the fastest way to assess hygiene and food safety. For example, total coliform count indicates environmental contamination, whereas the presence of *S. aureus* indicates poor handling, cleanliness, and storage conditions. In some cases, specific tests are developed for non-typhoidal *Salmonella* (NTS), particularly *Salmonella* enteritidis, as this is a common disease-causing bacterium associated with poultry and poultry products that serve as natural hosts for many NTS serovars (Althaus et al., 2017; Maharjan et al., 2019). Other measures focus on equipment cleanliness, environmental contamination, and food handling processes, as unsanitary conditions in any stage of food preparation can lead to microbial cross-contamination (Abu Bakar et al., 2021; Al-Ghazali et al., 2020; Alrasheed et al., 2021).

Although food safety throughout the food chain is vital, it must also be ensured at the point of consumption. According to the Centers for Disease Control and Prevention

(CDC), more than half of all foodborne illness outbreaks in 2015 occurred in restaurants (Kearney, 2018). Nonetheless, any outlet that serves a substantial number of consumers, such as restaurants, hospitals, and catering services, can have a substantial effect on food safety and public health (Hughes et al., 2007; Osei Tutu & Anfu, 2019; Rebouças et al., 2017). The risk increases when serving RTE meals, as indicated by the findings reported by the European Food Safety Authority EFSA (2018) and the CDC (2017), suggesting that their consumption is responsible for over 60% of foodborne diseases.

These findings are particularly disconcerting, given that immunocompromised individuals, very young children, and institutionalized elderly individuals are at a heightened risk of gastroenteritis (Scallan et al., 2011), as well as compromised digestion and nutrient absorption due to food poisoning (Barrie, 1996; Hayes et al., 2003; Uçar et al., 2016). Hospitalized patients are also a vulnerable group, as they need a balanced, healthy, and safe diet to heal quickly, and any pathogens that could cause foodborne nosocomial infections can hinder their recovery (Lahou et al., 2015; Touimi et al., 2019). These claims are supported by Meakins et al. (2003) findings, which show that the mortality risk in nosocomial epidemics of infectious intestinal disease is much higher than in community outbreaks.

In this study, several hypothesis have been set up, respecting the current situation of poultry meat processing plants, poultry meat-based food serving establishments, and the cleanliness of food contact and non-food contact surfaces and food handlers'hands. The microbiological quality of processed poultry meat, meat products, and food served in food service establishments can cause food poisoning. Besides, food handlers and food and non-food contact surfaces can cross-contaminate final products. Sanitization can reduce the microbial population, including those highly resistant to antibiotics in food contact surfaces, and subsequently reduce the risk of foodborne illness. Still, biofilm on type of contact surfaces in production and food servicing facilities poses a significant challenge, as it can protect microbial populations from sanitization procedures and contribute to the persistence and potential transfer of spoilage and pathogenic bacteria.

1.2 Statement of the Problem

The ultimate goal of HACCP is to ensure food safety by controlling hazards throughout food production and distribution. Even though the food industry widely adopts preventative measures based on the HACCP principles, the effectiveness of these food safety management systems for poultry meat products in Malaysia has never been examined (Nidaullah et al., 2017; Shafini et al., 2017). While there is substantial research on the effectiveness of HACCP systems in enhancing food safety in poultry meat processing, a significant gap exists in understanding the direct impact of these systems on the microbiological quality of the end products. Most existing studies have concentrated on the prevalence of pathogens in the processing environment or at various stages of production. Conversely, there is limited comprehensive analysis focused on the final product, especially regarding how well HACCP-certified plants control microbiological hazards in the end products that reach consumers. This gap highlights a need for detailed investigations into the microbiological safety and quality of poultry meat and meat products at the point of sale, considering the final step in the food safety management system where HACCP's effectiveness is ultimately tested.

Despite the rigorous controls during the processing phase, there remains an underexplored area concerning the final step in the food chain: the microbiological safety and compliance of poultry meat based RTE food when served. Existing literature and studies have primarily concentrated on the processing stages, knowledge, attitudes, and practices (KAP), focusing less on how these safety measures translate into the actual serving environment. This oversight is critical, considering the CDC and EFSA report highlighting the significant role of food service establishments in foodborne illness outbreaks. The gap, therefore, lies in the empirical examination of microbiological quality and HACCP compliance at the point of serving within HACCP-certified dining and medical facilities. At this juncture, the risk of cross-contamination and poor hand and surface hygiene could undermine earlier safety efforts.

Beyond the issue of foodborne pathogens, the poultry industry is also compromised by the unethical use of antibiotics for growth promotion. This has facilitated the development and spread of antibiotic-resistant bacteria through both vertical and horizontal gene transfer, significantly endangering public health. (Haulisah et al., 2021; Scott et al., 2018). As a result, poultry meat-based products are among the primary causes of foodborne illnesses, and this issue is particularly pronounced in establishments serving poultry-based RTE meals. Therefore, it becomes evident that while the implementation of HACCP systems in Malaysia has been explored, there remains a significant gap in understanding their real-world effectiveness, particularly in poultry meat processing plants, dining outlets serving food to general populations, hospital settings with vulnerable populations, and the cleanliness of food handlers'hand in food preparation kitchens. Studies that have already been conducted have mostly concentrated on the theoretical underpinnings of HACCP and its compliance aspects; even so, their practical effectiveness in lowering the levels of foodborne pathogens, bacteria resistant to antibiotics, and surface and food handler cleanliness to a compliance level have not been fully explored. This gap in knowledge is critical, as it impedes the development of more effective strategies and policies to ensure food safety. This study aims to bridge this gap by providing an empirical evaluation of HACCP-certified facilities, thereby contributing valuable insights into the effectiveness of these systems in controlling foodborne pathogens in the Malaysian context.

While numerous studies have highlighted the efficacy of common sanitizers such as chlorine and quaternary ammonia compounds (QAC) in reducing microbial loads on poultry products and in hospitality settings, there appears to be a scarcity of research focusing specifically on their effectiveness in the presence of biofilms. Biofilms pose a significant challenge due to their protective matrix made of polyanionic polymer, which can shield microorganisms from the effects of sanitizers. At the same time, organic matter within polyanionic polymer (Cloete, 2003) can neutralize sanitizer, potentially leading to persistent contamination and reduced sanitizer efficacy. This gap is critical, considering the prevalent use of these sanitizers in Malaysian poultry meat processing and hospitality establishments with HACCP certification.

1.3 Objectives

To this end, several specific objectives were defined, as outlined below:

1. This study aims to assess the microbiological safety of poultry meat and products from HACCP-certified plants at the point of distribution, focusing on

indicator bacteria against Malaysia's Veterinary Department standards. The goal is to evaluate HACCP's effectiveness in producing safe final products for consumers, thereby guiding future improvements in food safety practices.

2. To comprehensively assess the microbiological quality of poultry-based RTE foods, cleanliness of food handlers'hand, and contact surfaces in HACCP-certified dining and medical facilities and verify compliance with microbiological reference limits. This objective aims to explore the interconnectedness of HACCP certifications at the raw material processing and RTE food preparation stages, determining their collective impact on reducing microbiological contamination and enhancing food safety for consumers.

3. To determine the prevalence and antibiotic resistance patterns of *Salmonella* spp. and *S. aureus* isolated from HACCP-certified establishments.

4. To evaluate the effectiveness of chlorine and QAC sanitizer against biofilm formed on different type and surface conditions by *S. aureus* bacteria isolated from poultry meat processing plants and dining establishments.

1.4 Hypothesis

1. Hypothesis 1 (H1): HACCP-certified poultry meat processing plants will uniformly comply with the microbiological reference limits set by the Veterinary Department of Malaysia for indicator microbes, indicating not only the effectiveness of HACCP systems in maintaining food safety standards but also the consistency in their implementation across these establishments.

2. Hypothesis 2 (H2): HACCP certification across two food-serving establishments (Medical and Dining) significantly influences the prevalence and compliance of indicator bacteria at the point of serving RTE food, on kitchen surfaces, and on food handlers'hands at both establishments.

REFERENCES

Abdelhamid, A. G., & El-Dougdoug, N. K. (2020). Controlling Foodborne Pathogens with Natural Antimicrobials by Biological Control and Antivirulence Strategies. *Heliyon*, *6*(9). https://doi.org/10.1016/j.heliyon.2020.e05020

Abdul Mutalib, N. A., Amin Nordin, S., Sakai, K., & Shirai, Y. (2015). An Overview of Foodborne Illness and Food Safety in Malaysia. *International Food Research Journal*, *22*(3), 896–901. https://www.researchgate.net/publication/277138700

Abdullah, N. B. A., & Ismail, A. F. (2021). Food Poisoning Outbreaks Among Schoolchildren in Terengganu and Their Associated Factors. *Sains Malaysiana*, *50*(4), 1027–1036. https://doi.org/10.17576/jsm-2021-5004-13

Abdul-Mutalib, N. A., Abdul-Rashid, M. F., Mustafa, S., Amin-Nordin, S., Hamat, R. A., & Osman, M. (2012). Knowledge, Attitude and Practices Regarding Food Hygiene and Sanitation of Food Handlers in Kuala Pilah, Malaysia. *Food Control*, *27*(2), 289–293. https://doi.org/10.1016/j.foodcont.2012.04.001

Abdul-Mutalib, N. A., Nordin, S. A., Osman, M., Roslan, A. M., Ishida, N., Sakai, K., Tashiro, Y., Tashiro, K., Maeda, T., & Shirai, Y. (2016). The Prevalence of Foodborne Pathogenic Bacteria on Cutting Boards and Their Ecological Correlation with Background Biota. *AIMS Microbiology*, *2*(2), 138–151. https://doi.org/10.3934/MICROBIOL.2016.2.138

Abdul-Rashid, S., Fatimah, U. Z. A. U., Abdul-Mutalib, N. A., Omar, S., Jinap, S., & Sanny, M. (2022). Relating Food Handlers' Knowledge, Attitude, and Self-Reported Practices on Food Safety and Hygiene to the Performance of Food Safety Assurance System: A Multiple Case Study in Government Hospital Kitchens. *Pertanika Journal of Tropical Agricultural Science*, *45*(3), 731–745. https://doi.org/10.47836/pjtas.45.3.12

Abebe, E., Gugsa, G., & Ahmed, M. (2020). Review on Major Food-Borne Zoonotic Bacterial Pathogens. *Journal of Tropical Medicine*, *2020*. https://doi.org/10.1155/2020/4674235

Abu Bakar, N. A. N., Abdullah, N., Mohd Yusof, N. M. Y., & Ishak, N. (2021). Assessing Food Hygiene Knowledge and Practice of On-Campus Food Handler During Pandemic COVID-19. *International Journal of Academic Research in Business and Social Sciences*, *10*(12), 1305–1316. https://doi.org/10.6007/ijarbss/v10-i12/8617

Abulreesh, H. H. (2012). *Salmonellae* In the Environment. In *IntechOpen* (pp. 20–37). https://doi.org/doi: 10.5772/28201

Aduah, M., Adzitey, F., Amoako, D. G., Abia, A. L. K., Ekli, R., Teye, G. A., Shariff, A. H. M., & Huda, N. (2021). Not All Street Food Is Bad: Low Prevalence of Antibiotic-Resistant Salmonella Enterica in Ready-To-Eat (RTE) Meats in

Ghana Is Associated with Good Vendors'Knowledge of Meat Safety. *Foods*, *10*(5). https://doi.org/10.3390/foods10051011

Adzitey, F. (2020). Incidence and Antimicrobial Susceptibility of *Escherichia coli* Isolated from Beef (Meat Muscle, Liver and Kidney) Samples in Wa Abattoir, Ghana. *Cogent Food and Agriculture*, *6*(1). https://doi.org/10.1080/23311932.2020.1718269

Adzitey, F., Rusul, G., & Huda, N. (2012). Prevalence And Antibiotic Resistance of *Salmonella* Serovars in Ducks, Duck Rearing and Processing Environments In Penang, Malaysia. *Food Research International*, *45*(2), 947–952. https://doi.org/10.1016/j.foodres.2011.02.051

Agada, G. (2014). Prevalence And Antibiotic Resistance Profile of *Salmonella* Isolates from Commercial Poultry and Poultry Farm-Handlers in Jos, Plateau State, Nigeria. *British Microbiology Research Journal*, *4*(4), 462–479. https://doi.org/10.9734/BMRJ/2014/5872

Agyare, C., Etsiapa Boamah, V., Ngofi Zumbi, C., & Boateng Osei, F. (2019). Antibiotic Use in Poultry Production and Its Effects on Bacterial Resistance. *Antimicrobial Resistance - A Global Threat*. https://doi.org/10.5772/intechopen.79371

Aik, J., Turner, R. M., Kirk, M. D., Heywood, A. E., & Newall, A. T. (2020). Evaluating Food Safety Management Systems in Singapore: A Controlled Interrupted Time-Series Analysis of Foodborne Disease Outbreak Reports. *Food Control*, *117*. https://doi.org/10.1016/j.foodcont.2020.107324

Akbar, A., & Anal, A. K. (2013). Prevalence And Antibiogram Study of *Salmonella* and *Staphylococcus aureus* In Poultry Meat. *Asian Pacific Journal of Tropical Biomedicine*, *3*(2), 163–168. https://doi.org/10.1016/S2221-1691(13)60043-X

Al-Ghazali, M., Al-Bulushi, I., Al-Subhi, L., Rahman, M. S., & Al-Rawahi, A. (2020). Food Safety Knowledge and Hygienic Practices among Different Groups of Restaurants in Muscat, Oman. *International Journal of Food Science*, *2020*. https://doi.org/10.1155/2020/8872981

Aliyu, A. B., Saleha, A. A., Jalila, A., & Zunita, Z. (2016). Risk factors and spatial distribution of extended spectrum β-lactamase-producing- *Escherichia coli* at retail poultry meat markets in Malaysia: A cross-sectional study. *BMC Public Health*, *16*(1). https://doi.org/10.1186/s12889-016-3377-2

Almeida, A. P. M., Rosa, G. R. da, Blumberg, T. G., Marques, L. O., Bordini, F. W., Rosolen, M. D., Oliveira, J. T., & Pieniz, S. (2022). Evaluation of Microbiological Cloth and Sponge Disinfection Methods in a Hospital's Food and Nutrition Unit. *Brazilian Archives of Biology and Technology*, *65*. https://doi.org/10.1590/1678-4324-2022210551

Alonso, V. P. P., Furtado, M. M., Iwase, C. H. T., Brondi-Mendes, J. Z., & Nascimento, M. da S. (2024). Microbial Resistance to Sanitizers in The Food

Industry: Review. *Critical Reviews in Food Science and Nutrition*, *64*(3), 654–669. https://doi.org/10.1080/10408398.2022.2107996

Alrasheed, A., Connerton, P., Alshammari, G., & Connerton, I. (2021). Cohort Study on The Food Safety Knowledge Among Food Services Employees in Saudi Arabia State Hospitals. *Journal of King Saud University - Science*, *33*(6). https://doi.org/10.1016/j.jksus.2021.101500

Althaus, D., Zweifel, C., & Stephan, R. (2017). Analysis of a Poultry Slaughter Process: Influence of Process Stages on The Microbiological Contamination of Broiler Carcasses. *Italian Journal of Food Safety*, *6*(7097), 190–194. https://doi.org/10.4081/ijfs.2017.7097

Alves, A., Viveiros, C., Lopes, J., Nogueira, A., Pires, B., Afonso, A. F., & Teixeira, C. (2021). Microbiological Contamination in Different Food Service Units Associated with Food Handling. *Applied Sciences (Switzerland)*, *11*(16). https://doi.org/10.3390/app11167241

Amadi-Ikpa, C. N., & Achinike, O. A. (2023). Biofilm Formation Capacity of Bacterial Isolates from Kitchen Sponges. *Article in International Journal of Advanced Research in Social Sciences Environmental Studies & Technology*. https://doi.org/10.59890/ijatss.v1i2.546

Amoako, D. G., Somboro, A. M., Abia, A. L. K., Molechan, C., Perrett, K., Bester, L. A., & Essack, S. Y. (2020). Antibiotic Resistance in *Staphylococcus aureus* From Poultry and Poultry Products in Umgungundlovu District, South Africa, Using The “Farm to Fork” Approach. *Microbial Drug Resistance*, *26*(4), 402–411. https://doi.org/10.1089/mdr.2019.0201

Andino, A., & Hanning, I. (2015). *Salmonella enterica*: Survival, Colonization, And Virulence Differences Among Serovars. In *Scientific World Journal* (Vol. 2015). Hindawi Publishing Corporation. https://doi.org/10.1155/2015/520179

Angelo, K. M., Nisler, A. L., Hall, A. J., Brown, L. G., & Gould, L. H. (2017). Epidemiology of Restaurant-Associated Foodborne Disease Outbreaks, United States, 1998-2013. In *Epidemiology and Infection* (Vol. 145, Issue 3, pp. 523–534). Cambridge University Press. https://doi.org/10.1017/S0950268816002314

Argudín, M. Á., Mendoza, M. C., & Rodicio, M. R. (2010). Food Poisoning and *Staphylococcus aureus* Enterotoxins. In *Toxins* (Vol. 2, Issue 7, pp. 1751–1773). https://doi.org/10.3390/toxins2071751

Arjyal, C., Kc, J., & Neupane, S. (2020). Prevalence of Methicillin-Resistant *Staphylococcus aureus* In Shrines. *International Journal of Microbiology*, *2020*. https://doi.org/10.1155/2020/7981648

Aryal, M., & Muriana, P. M. (2019). Efficacy of Commercial Sanitizers Used in Food Processing Facilities for Inactivation of *Listeria monocytogenes*, *E. coli* O157:H7, And *Salmonella* Biofilms. *Foods*, *8*(12). https://doi.org/10.3390/foods8120639

Asfaw Ali, D., Tadesse, B., & Ebabu, A. (2020). Prevalence And Antibiotic Resistance Pattern of *Salmonella* Isolated from Caecal Contents of Exotic Chicken in Debre Zeit and Modjo, Ethiopia. *International Journal of Microbiology*, *2020*. https://doi.org/10.1155/2020/1910630

Auad, L. I., Ginani, V. C., Stedefeldt, E., Nakano, E. Y., Nunes, A. C. S., & Zandonadi, R. P. (2019). Food Safety Knowledge, Attitudes, and Practices of Brazilian Food Truck Food Handlers. *Nutrients*, *11*(8). https://doi.org/10.3390/nu11081784

Auzureen, A., Aklilu, E., Khan, M. A., Hayati, R., Sultan, A., & Soon, J. M. (2017). Microbiological Quality of Cooked Meat Products Sold in Kelantan, Malaysia During Ramadhan Month. In *International Food Research Journal* (Vol. 24, Issue 1).

Ayçiçek, H., Sarimehmetoğlu, B., & Çakiroğlu, S. (2004). Assessment of the Microbiological Quality of Meals Sampled at The Meal Serving Units of a Military Hospital in Ankara, Turkey. *Food Control*, *15*(5), 379–384. https://doi.org/10.1016/S0956-7135(03)00101-4

Azmi, M., Hassali, A., Rhu, H., Ashutosh, Y., Verma, K., Hussain, R., & Sivaraman, S. (2018). *Antibiotic Use in Food Animals: Malaysia Overview*. School of Pharmaceutical Sciences, Universiti Sains Malaysia. www.reactgroup.org

Balzaretti, C. M., & Marzano, M. A. (2013). Prevention Of Travel-Related Foodborne Diseases: Microbiological Risk Assessment of Food Handlers and Ready-To-Eat Foods in Northern Italy Airport Restaurants. *Food Control*, *29*(1), 202–207. https://doi.org/10.1016/j.foodcont.2012.05.077

Bantawa, K., Rai, K., Subba Limbu, D., & Khanal, H. (2018). Food-Borne Bacterial Pathogens in Marketed Raw Meat of Dharan, Eastern Nepal. *BMC Research Notes*, *11*(1). https://doi.org/10.1186/s13104-018-3722-x

Bantawa, K., Sah, S. N., Subba Limbu, D., Subba, P., & Ghimire, A. (2019). Antibiotic Resistance Patterns of *Staphylococcus aureus, Escherichia coli*, *Salmonella, Shigella* and *Vibrio* Isolated from Chicken, Pork, Buffalo and Goat Meat in Eastern Nepal. *BMC Research Notes*, *12*(1). https://doi.org/10.1186/s13104-019-4798-7

Barrie, D. (1996). The Provision of Food and Catering Services in Hospital. *Journal of Hospital Infection*, *33*, 13–33.

Barroug, S., Chaple, S., & Bourke, P. (2021). Combination of Natural Compounds with Novel Non-Thermal Technologies for Poultry Products: A Review. *Frontiers in Nutrition*, *8*. https://doi.org/10.3389/fnut.2021.628723

Bartkiene, E., Ruzauskas, M., Bartkevics, V., Pugajeva, I., Zavistanaviciute, P., Starkute, V., Zokaityte, E., Lele, V., Dauksiene, A., Grashorn, M., Hoelzle, L. E., Mendybayeva, A., Ryshyanova, R., & Gruzauskas, R. (2020). Study Of the Antibiotic Residues in Poultry Meat in Some of The EU Countries and Selection of The Best Compositions of Lactic Acid Bacteria and Essential Oils

Against *Salmonella enterica*. *Poultry Science*, *99*(8), 4065–4076. https://doi.org/10.1016/j.psj.2020.05.002

Belhu, T., Fissehatsion, K., Tesfaye, A., Woldekidan, D. Y., & Desta, K. (2020). Prevalence of Intestinal Parasites and Gastrointestinal Carriage of Pathogenic Gram-Negative Enteric Bacteria among Apparently Healthy Food Handlers of Public Hospitals, Addis Ababa, Ethiopia. *International Journal of Microbiology*, *2020*. https://doi.org/10.1155/2020/8867033

Benrabia, I., Hamdi, T. M., Shehata, A. A., Neubauer, H., & Wareth, G. (2020). Methicillin-Resistant *Staphylococcus aureus* (MRSA) in Poultry Species in Algeria: Long-Term Study on Prevalence and Antimicrobial Resistance. *Veterinary Sciences*, *7*(54). https://doi.org/10.3390/vetsci7020054

Benson, A. K., David, J. R. D., Gilbreth, S. E., Smith, G., Nietfeldt, J., Legge, R., Kim, J., Sinha, R., Duncan, C. E., Ma, J., & Singh, I. (2014). Microbial successions are associated with changes in chemical profiles of a model refrigerated fresh pork sausage during an 80-day shelf-life study. *Applied and Environmental Microbiology*, *80*(17), 5178–5194. https://doi.org/10.1128/AEM.00774-14

Bernama. (2023, July 31). Health Minister confirms food poisoning incident in SK Cyberjaya. *Malaymail*. https://www.malaymail.com/news/malaysia/2023/07/31/health-ministry-confirms-food-poisoning-incident-in-sk-cyberjaya/82831

Bintsis, T. (2017). Foodborne pathogens. *AIMS Microbiology*, *3*(3), 529–563. https://doi.org/10.3934/microbiol.2017.3.529

Biswas, S., Li, Y., Elbediwi, M., & Yue, M. (2019). Emergence and dissemination of mcr-carrying clinically relevant *Salmonella typhimurium* monophasic clone st34. *Microorganisms*, *7*(9). https://doi.org/10.3390/microorganisms7090298

Blair, J. M. A., Webber, M. A., Baylay, A. J., Ogbolu, D. O., & Piddock, L. J. V. (2015). Molecular Mechanisms of Antibiotic Resistance. *Nature Reviews Microbiology*, *13*(1), 42–51. https://doi.org/10.1038/nrmicro3380

Bou-Mitri, C., Mahmoud, D., El Gerges, N., & Jaoude, M. A. (2018). Food Safety Knowledge, Attitudes and Practices of Food Handlers in Lebanese Hospitals: A Cross-Sectional Study. *Food Control*, *94*, 78–84. https://doi.org/10.1016/j.foodcont.2018.06.032

Brown, L. G., Hoover, E. R., Selman, C. A., Coleman, E. W., & Schurz Roger, H. (2017). Outbreak Characteristics Associated with Identification of Contributing Factors to Foodborne Illness Outbreaks. *Epidemiology and Infection*, *145*(11), 2254–2262. https://doi.org/10.1017/S0950268817001406

Buchanan, R. L., & Oni, R. (2012). Use of Microbiological Indicators for Assessing Hygiene Controls for The Manufacture of Powdered Infant Formula. *Journal of Food Protection*, *75*(5), 989–997. https://doi.org/10.4315/0362-028X.JFP-11-532

Buchanan, R. L., Smith, J. L., & Long, W. (2000). Microbial Risk Assessment: Dose-Response Relations and Risk Characterization. In *International Journal of Food Microbiology* (Vol. 58). www.elsevier.nl/locate/ijfoodmicro

Buffet-Bataillon, S., Tattevin, P., Maillard, J. Y., Bonnaure-Mallet, M., & Jolivet-Gougeon, A. (2016). Efflux Pump Induction by Quaternary Ammonium Compounds and Fluoroquinolone Resistance in Bacteria. *Future Microbiology*, *11*(1), 81–92. https://doi.org/10.2217/fmb.15.131

Butaye, P., Argudín, M. A., & Smith, T. C. (2016). Livestock-Associated MRSA and Its Current Evolution. In *Current Clinical Microbiology Reports* (Vol. 3, Issue 1, pp. 19–31). Springer. https://doi.org/10.1007/s40588-016-0031-9

Campana, R., Ciandrini, E., & Baffone, W. (2018). Experimental Approach for A Possible Integrated Protocol to Determine Sanitizer Activity Against Both Planktonic Bacteria and Related Biofilms. *Food Research International*, *111*, 472–479. https://doi.org/10.1016/j.foodres.2018.05.067

Campos, A. C., Albiero, J., Ecker, A. B., Kuroda, C. M., Meirelles, L. E. F., Polato, A., Tognim, M. C. B., Wingeter, M. A., & Teixeira, J. J. V. (2016). Outbreak of *Klebsiella Pneumoniae* Carbapenemase–Producing *K Pneumoniae*: A Systematic Review. *American Journal of Infection Control*, *44*(11), 1374–1380. https://doi.org/10.1016/j.ajic.2016.03.022

Castro, V. S., Mutz, Y. da S., Rosario, D. K. A., Cunha-Neto, A., Figueiredo, E. E. de S., & Conte-Junior, C. A. (2020). Inactivation Of Multi-Drug Resistant Non-Typhoidal *Salmonella* and Wild-Type *Escherichia coli* STEC Using Organic Acids: A Potential Alternative to The Food Industry. *Pathogens*, *9*(10), 1–13. https://doi.org/10.3390/pathogens9100849

Castro-Vargas, R. E., Herrera-Sánchez, M. P., Rodríguez-Hernández, R., & Rondón-Barragán, I. S. (2020). Antibiotic Resistance in *Salmonella* Spp. Isolated from Poultry: A Global Overview. *Veterinary World*, *13*(10), 2070–2084. https://doi.org/10.14202/vetworld.2020.2070-2084

CDC. (2017). *Surveillance for Foodborne Disease Outbreaks United States, 2015: Annual Report*. http://www.cdc.gov/foodsafety/fdoss/

CDC. (2019). *Infographic Preventing Foodborne Illness Outbreaks 2019.* https://www.Cdc.Gov/Nceh/Ehs/Publications/Ehs-Infographics.Html. . https://www.cdc.gov/nceh/ehs/publications/ehs-infographics.html.

Ceniti, C., Tilocca, B., Britti, D., Santoro, A., & Costanzo, N. (2021). Food Safety Concerns in "COVID-19 Era." *Microbiology Research*, *12*(1), 53–68. https://doi.org/10.3390/microbiolres12010006

Chai, S. J., Cole, D., Nisler, A., & Mahon, B. E. (2017). Poultry: The Most Common Food in Outbreaks with Known Pathogens, United States, 1998-2012. *Epidemiology and Infection*, *145*(2), 316–325. https://doi.org/10.1017/S0950268816002375

Che Hamzah, A. M., Yeo, C. C., Puah, S. M., Chua, K. H., & Chew, C. H. (2019). *Staphylococcus aureus* infections in Malaysia: A review of antimicrobial resistance and characteristics of the clinical isolates, 1990–2017. *Antibiotics*, *8*(3). https://doi.org/10.3390/antibiotics8030128

Cheng, R. A., Eade, C. R., & Wiedmann, M. (2019). Embracing Diversity: Differences In Virulence Mechanisms, Disease Severity, and Host Adaptations Contribute to The Success of Nontyphoidal *Salmonella* as A Foodborne Pathogen. *Frontiers in Microbiology*, *10*(JUN). https://doi.org/10.3389/fmicb.2019.01368

Choe, D. W., Hassan, L., & Loh, T. C. (2011). The Prevalence of Antimicrobial Resistant *Salmonella* spp. and the Risk Factors Associated with Their Occurrence in Finisher Pigs in Seberang Perai, Malaysia. *Pertanika J. Trop. Agric. Sci.*, *34*(2), 303–310.

Christensen, H., Nordentoft, S., & Olsen, J. E. (1998). Phylogenetic Relationships of *Salmonella* Based on Rrna Sequences. *International Journal of Systematic Bacteriology*, *48*(2), 605–610. https://doi.org/10.1099/00207713-48-2-605

Christison, C. A., Lindsay, D., & von Holy, A. (2008). Microbiological Survey of Ready-To-Eat Foods and Associated Preparation Surfaces in Retail Delicatessens, Johannesburg, South Africa. *Food Control*, *19*(7), 727–733. https://doi.org/10.1016/j.foodcont.2007.07.004

Clarke, A. K., & Ajlouni, S. (2021). Recommended Practices to Eliminate *Campylobacter* from Live Birds and Chicken Meat in Japan. *Food Safety*, *9*(3), 57–74. https://doi.org/10.14252/foodsafetyfscj.d-20-00021

Cloete, T. E. (2003). Resistance Mechanisms of Bacteria to Antimicrobial Compounds. *International Biodeterioration and Biodegradation*, *51*(4), 277–282. https://doi.org/10.1016/S0964-8305(03)00042-8

CLSI. (2017). Performance Standards for Antimicrobial Susceptibility Testing. *Wayne, PA: Clinical and Laboratory Standards Institute*.

Cobanoglu, P., Kucukyilmaz, K., Cinar, M., Bozkurt, M., Catli, A., & Bintas, E. (2014). Comparing the Profitability of Organic and Conventional Broiler Production. *Brazilian Journal of Poultry Science*, *16*(1), 89–96.

Compaore, M. K. A., Kpoda, S. D., Bazie, R. B. S., Ouedraogo, M., Valian, M., Gampene, M.-L., Yakoro, A., Nikiema, F., Belemlougri, A., Meda, N.-S.-B. R., Meda, N.-I. S. D., Sanon, S., Bande, M., Hien, H., Barro, N., & Kabre, E. (2022). Microbiological Quality Assessment of Five Common Foods Sold at Different Points of Sale in Burkina-Faso. *PLOS ONE*, *17*(4), e0258435. https://doi.org/10.1371/journal.pone.0258435

Corbellini, L. G., Costa, E. de F., Cardoso, M., & Nauta, M. (2017). Quantitative Microbial Risk Assessment of *Salmonella* in Dry Fermented Sausage (Salami) In Southern Brazil. *Microbial Risk Analysis*, *6*, 31–43. https://doi.org/10.1016/j.mran.2017.02.001

Cordier, J.-L. (2013). Microbiological Criteria and Indicator Microorganisms. In M. Doyle & R. L. Buchanan (Eds.), *Food Microbiology: Fundamentals and Frontiers* (4th Edition, pp. 81–90). American Society for Microbiology.

Courtenay, M., Ramirez, L., Cox, B., Han, I., Jiang, X., & Dawson, P. (2005). Effects of various hand hygiene regimes on removal and/or destruction of Escherichia coli on hands. *Food Service Technology*, *5*, 77–84.

Cruz, C. D., & Fletcher, G. C. (2012). Assessing manufacturers'recommended concentrations of commercial sanitizers on inactivation of Listeria monocytogenes. *Food Control*, *26*(1), 194–199. https://doi.org/10.1016/j.foodcont.2012.01.041

Cruz Campos, T. C., & Barreto, M. F. (2018). Effectiveness Of Good Manufacturing Practice Training for Food Manipulators. *Journal of Nutrition & Food Sciences*, *08*(06). https://doi.org/10.4172/2155-9600.1000740

Curutiu, C., Iordache, F., Gurban, P., Lazar, V., & Chifiriuc, M. C. (2019). Main Microbiological Pollutants of Bottled Waters and Beverages. In Bottled and Packaged Water (pp. 403–422). Elsevier. https://doi.org/10.1016/b978-0-12-815272-0.00014-3

Da Silva, M. V. (2013). *Poultry development review*. Food and Agriculture Organization of the United Nations (FAO).

Dalton, C. B., Gregory, J., Kirk, M. D., Stafford, R. J., Givney, R., Kraa, E., & Gould, D. (2004). Foodborne disease outbreaks in Australia, 1995 to 2000. *Communicable Diseases Intelligence Quarterly Report*, *28*(2), 211–224.

Dantas, S. T. A., Rossi, B. F., Bonsaglia, E. C. R., Castilho, I. G., Hernandes, R. T., Fernandes, A., & Rall, V. L. M. (2018). Cross-Contamination and Biofilm Formation by *Salmonella enterica* Serovar Enteritidis on Various Cutting Boards. *Foodborne Pathogens and Disease*, *15*(2), 81–85. https://doi.org/10.1089/fpd.2017.2341

Dehkordi, F. S., Gandomi, H., Basti, A. A., Misaghi, A., & Rahimi, E. (2017). Phenotypic and genotypic characterization of antibiotic resistance of methicillin-resistant *Staphylococcus aureus* isolated from hospital food. *Antimicrobial Resistance and Infection Control*, *6*(1). https://doi.org/10.1186/s13756-017-0257-1

DOSM. (2018). Supply and Utilization Accounts Selected Agricultural Commodities, Malaysia 2013-2017, Malaysia. *Department of Statistics, Malaysia*.

DOSM. (2020). *Pocket Stats Q1 2020*. www.dosm.gov.my

Doulgeraki, A. I., Ercolini, D., Villani, F., & Nychas, G. J. E. (2012). Spoilage Microbiota Associated to The Storage of Raw Meat in Different Conditions. *International Journal of Food Microbiology*, *157*(2), 130–141. https://doi.org/10.1016/j.ijfoodmicro.2012.05.020

EFSA. (2018). The European Union Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-Borne Outbreaks in 2017. *EFSA Journal*, *16*(12). https://doi.org/10.2903/j.efsa.2018.5500

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. https://doi.org/10.1016/j.foodcont.2006.08.001

Eguale, T. (2018). Non-typhoidal *Salmonella* serovars in poultry farms in central Ethiopia: Prevalence and antimicrobial resistance. *BMC Veterinary Research*, *14*(1). https://doi.org/10.1186/s12917-018-1539-4

Ehuwa, O., Jaiswal, A. K., & Jaiswal, S. (2021). *Salmonella*, food safety and food handling practices. *Foods*, *10*(5). https://doi.org/10.3390/foods10050907

Ekici, G., & Dümen, E. (2019). *Escherichia coli* and Food Safety. *IntechOpen*. https://doi.org/DOI: http://dx.doi.org/10.5772/intechopen.82375

Elisha Onyango, A., Wandayi Okoth, M., Nkirote Kunyanga, C., & Ochieng, B. (2018). Microbiological Quality and Contamination Level of Water Sources in Isiolo County in Kenya. *Journal of Environmental and Public Health*. https://doi.org/10.1155/2018/2139867

El-Zamkan, M. A., & Mohamed, H. M. A. (2018). Molecular detection of *Enterobacter* spp. and other related species in powdered milk infant formula and milk powder. *Journal of Food Safety*, *38*(6). https://doi.org/10.1111/jfs.12538

Eng, S. K., Pusparajah, P., Ab Mutalib, N. S., Ser, H. L., Chan, K. G., & Lee, L. H. (2015). Salmonella: A review on pathogenesis, epidemiology and antibiotic resistance. *Frontiers in Life Science*, *8*(3), 284–293. https://doi.org/10.1080/21553769.2015.1051243

European Committee on Antimicrobial Susceptibility Testing (EUCAST). (2017). *Breakpoint tables for interpretation of MICs and zone diameters, version 7.0.* http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Breakpoint_tables/v_7.0_Breakpoint_Tables.pdf

Eyi, A., & Arslan, S. (2012). Prevalence of *Escherichia coli* in retail poultry meat, ground beef and beef. *Medycyna Weterynaryjna*, *68*(4). https://www.researchgate.net/publication/236897351

Fagerlund, A., Møretrø, T., Heir, E., Briandet, R., Langsrud Nofima, S., & Christopher Elkins, E. A. (2017). Cleaning and Disinfection of Biofilms Composed of *Listeria monocytogenes* and Background Microbiota from Meat Processing Surfaces. *Applied and Environmental Microbiology*, *83*, 1046–1063. https://journals.asm.org/journal/aem

FAO. (2021). The FAO Action Plan on Antimicrobial Resistance 2021–2025. In *The FAO Action Plan on Antimicrobial Resistance 2021–2025*. FAO. https://doi.org/10.4060/cb5545en

Faour-Klingbeil, D., & Todd, E. C. D. (2020). Prevention And Control of Foodborne Diseases in Middle East North African Countries: Review Of National Control Systems. *International Journal of Environmental Research and Public Health*, *17*(1). https://doi.org/10.3390/ijerph17010070

Feng, P., Weagant, S. D., Grant, M. A., & Burkhardt, W. (2020). Bacteriological Analytical Manual Chapter 4 Enumeration of *Escherichia coli* and the Coliform Bacteria. USFDA. https://www.fda.gov/food/laboratory-methods-food/bam-chapter-4-enumeration-escherichia-coli-and-coliform-bacteria

Feßler, A. T., Kadlec, K., Hassel, M., Hauschild, T., Eidam, C., Ehricht, R., Monecke, S., & Schwarz, S. (2011). Characterization of Methicillin-Resistant *Staphylococcus aureus* Isolates from Food and Food Products of Poultry Origin in Germany. *Applied and Environmental Microbiology*, *77*(20), 7151–7157. https://doi.org/10.1128/AEM.00561-11

Fetsch, A., & Johler, S. (2018). *Staphylococcus aureus* as a Foodborne Pathogen. *Current Clinical Microbiology Reports*, *5*(2), 88–96. https://doi.org/10.1007/s40588-018-0094-x

Fielding, L. M., Ellis, L., Beveridge, C., & Peters, A. C. (2005). An Evaluation of HACCP Implementation Status in UK Small and Medium Enterprises in Food Manufacturing. *International Journal of Environmental Health Research*, *15*(2), 117–126. https://doi.org/10.1080/09603120500061583

Fisher, E. L., Otto, M., & Cheung, G. Y. C. (2018). Basis Of Virulence in Enterotoxin-Mediated Staphylococcal Food Poisoning. *Frontiers in Microbiology*, *9*(MAR). https://doi.org/10.3389/fmicb.2018.00436

Fortin, N. D., Carr, C. C., & Scheffler, J. D. (2021). HACCP And Other Regulatory Approaches to Prevention of Foodborne Diseases. In *Foodborne Infections and Intoxications* (pp. 545–561). Elsevier. https://doi.org/10.1016/B978-0-12-819519-2.00006-2

França, A., Gaio, V., Lopes, N., & Melo, L. D. R. (2021). Virulence Factors in Coagulase-Negative *Staphylococci*. *Pathogens*, *10*(2), 1–46. https://doi.org/10.3390/pathogens10020170

Fri, J., Njom, H. A., Ateba, C. N., & Ndip, R. N. (2020). Antibiotic Resistance and Virulence Gene Characteristics of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Isolated from Healthy Edible Marine Fish. *International Journal of Microbiology, 2020*. https://doi.org/10.1155/2020/9803903

FSIS. (1996). Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems. *Federal Register*, *61*(144). www.access.gpo.gov/sudocs/aces/

Fung, F., Wang, H. S., & Menon, S. (2018). Food safety in the 21st century. In *Biomedical Journal* (Vol. 41, Issue 2, pp. 88–95). Elsevier B.V. https://doi.org/10.1016/j.bj.2018.03.003

Gashe, B. A., & Mpuchane, S. (2000). Prevalence of *Salmonellae* on Beef Products at Butcheries and their Antibiotic Resistance Profiles. *JOURNAL OF FOOD SCIENCE*, *65*(5), 880–883.

Gast, R. K., & Porter, R. E. (2020). Section III Bacterial Diseases. In *Diseases of Poultry* (Fourteenth Edition). John Wiley & Sons, Inc.

Geidam, Y. A., Zakaria, Z., Aziz, S. A., Bejo, S. K., Abu, J., & Omar, S. (2012). High Prevalence of Multi-Drug Resistant Bacteria in Selected Poultry Farms in Selangor, Malaysia. *Asian Journal of Animal and Veterinary Advances*, *7*(9), 891–897. https://doi.org/10.3923/ajava.2012.891.897

Gikas, A., Kritsotakis, E. I., Maraki, S., Roumbelaki, M., Babalis, D., Scoulica, E., Panoulis, C., Saloustros, E., Kontopodis, E., Samonis, G., & Tselentis, Y. (2007). A Nosocomial, Foodborne Outbreak of *Salmonella enterica* Serovar Enteritidis in A University Hospital in Greece: The Importance of Establishing HACCP Systems In Hospital Catering. *Journal of Hospital Infection*, *66*(2), 194–196. https://doi.org/10.1016/j.jhin.2007.03.001

Giwa, A. S., Memon, A. G., Ahmed Shaikh, A., Korai, R., Maitlo, G. U., Maitlo, I., Ali, S., & Ahmad, J. (2021). Microbiological Survey of Ready-To-Eat Foods and Associated Preparation Surfaces in Cafeterias of Public Sector Universities. *Environmental Pollutants and Bioavailability*, *33*(1), 11–18. https://doi.org/10.1080/26395940.2021.1880973

Gizaw, Z. (2019). Public Health Risks Related to Food Safety Issues in The Food Market: A Systematic Literature Review. In *Environmental Health and Preventive Medicine* (Vol. 24, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12199-019-0825-5

Golden, C. E., Rothrock, M. J., & Mishra, A. (2021). Mapping Foodborne Pathogen Contamination Throughout the Conventional and Alternative Poultry Supply Chains. *Poultry Science*, *100*(7). https://doi.org/10.1016/j.psj.2021.101157

Gonçalves-Tenório, A., Nunes Silva, B., Rodrigues, V., Cadavez, V., & Gonzales-Barron, U. (2018). Prevalence Of Pathogens in Poultry Meat: A Meta-Analysis of European Published Surveys. *Foods*, *7*(5). https://doi.org/10.3390/foods7050069

González, N., Marquès, M., Nadal, M., & Domingo, J. L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010–2020) Evidences. In *Food Research International* (Vol. 137). Elsevier Ltd. https://doi.org/10.1016/j.foodres.2020.109341

Gosbell, I. B., & van Hal, S. J. (2013). *Staphylococcus aureus* Colonisation: Some Questions Answered. In *The Lancet Infectious Diseases* (Vol. 13, Issue 5, pp. 380–381). https://doi.org/10.1016/S1473-3099(13)70048-3

Govender, V., Madoroba, E., Magwedere, K., Fosgate, G., & Kuonza, L. (2019). Prevalence And Risk Factors Contributing to Antibiotic-Resistant *Staphylococcus aureus* Isolates from Poultry Meat Products in South Africa, 2015–2016. *Journal of the South African Veterinary Association*, *90*(2019). https://doi.org/10.4102/jsava.v90i0.1738

Greig, J. D., & Ravel, A. (2009). Analysis Of Foodborne Outbreak Data Reported Internationally for Source Attribution. *International Journal of Food Microbiology*, *130*(2), 77–87. https://doi.org/10.1016/j.ijfoodmicro.2008.12.031

Griffith, C. (2016). Surface Sampling and The Detection of Contamination. In Handbook of Hygiene Control in The Food Industry*:* Second Edition (pp. 673–696). Elsevier Inc. https://doi.org/10.1016/B978-0-08-100155-4.00044-3

Guo, Y., Song, G., Sun, M., Wang, J., & Wang, Y. (2020). Prevalence and Therapies of Antibiotic-Resistance in *Staphylococcus aureus*. *Frontiers in Cellular and Infection Microbiology*, *10*. https://doi.org/10.3389/fcimb.2020.00107

Haaber, J., Penadés, J. R., & Ingmer, H. (2017). Transfer of Antibiotic Resistance in *Staphylococcus aureus*. *Trends in Microbiology*, *25*(11), 893–905. https://doi.org/10.1016/j.tim.2017.05.011

Hafez, H. M., & Attia, Y. A. (2020). Challenges to the Poultry Industry: Current Perspectives and Strategic Future After the COVID-19 Outbreak. *Frontiers in Veterinary Science*, *7*. https://doi.org/10.3389/fvets.2020.00516

Hafez, H. M., & El-Adawy, H. (2019). Foodborne Diseases of Poultry and Related Problems. *Journal of Food Nutrition and Metabolism*. https://doi.org/http://dx.doi.org/10.31487/j.JFNM.2018.01.005

Hamed, E. A., Abdelaty, M. F., Sorour, H. K., Roshdy, H., Abdelrahman, M. A. A., Magdy, O., Ibrahim, W. A., Sayed, A., Mohamed, H., Youssef, M. I., Hassan, W. M., & Badr, H. (2021). Monitoring of Antimicrobial Susceptibility of Bacteria Isolated from Poultry Farms from 2014 to 2018. *Veterinary Medicine International*, *2021*. https://doi.org/10.1155/2021/6739220

Hammad, A. M., Eltahan, A., Hassan, H. A., Abbas, N. H., Hussien, H., & Shimamoto, T. (2022). Loads Of Coliforms and Fecal Coliforms and Characterization of Thermotolerant *Escherichia coli* In Fresh Raw Milk Cheese. *Foods*, *11*(3). https://doi.org/10.3390/foods11030332

Handley, J. A., Shi, Z., Park, S. H., Dawoud, T. M., Kwon, Y. M., & Ricke, S. C. (2015). *Salmonella* And the Potential Role for Methods to Develop Microbial Process Indicators on Chicken Carcasses. In *Food Safety* (pp. 81–104). Elsevier. https://doi.org/10.1016/b978-0-12-800245-2.00006-x

Harris, J. K., Wong, R., Matthew, M. G., & Mansour, R. (2018). Availability Of Foodborne Illness Reporting Mechanisms for The Public on Local Health Department Web Sites. *Journal of Public Health Management and Practice*, *24*(3), 241–247. https://doi.org/10.1097/PHH.0000000000000564

Haulisah, N. A., Hassan, L., Bejo, S. K., Jajere, S. M., & Ahmad, N. I. (2021). High Levels of Antibiotic Resistance in Isolates from Diseased Livestock. *Frontiers in Veterinary Science*, *8*. https://doi.org/10.3389/fvets.2021.652351

Havelaar, A. H., Kirk, M. D., Torgerson, P. R., Gibb, H. J., Hald, T., Lake, R. J., Praet, N., Bellinger, D. C., de Silva, N. R., Gargouri, N., Speybroeck, N., Cawthorne, A., Mathers, C., Stein, C., Angulo, F. J., Devleesschauwer, B., Adegoke, G. O., Afshari, R., Alasfoor, D., … Zeilmaker, M. (2015). World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. In *PLoS Medicine* (Vol. 12, Issue 12). Public Library of Science. https://doi.org/10.1371/journal.pmed.1001923

Hayes, J. R., English, L. L., Carter, P. J., Proescholdt, T., Lee, K. Y., Wagner, D. D., & White, D. G. (2003). Prevalence and Antimicrobial Resistance of Enterococcus Species Isolated from Retail Meats. *Applied and Environmental Microbiology*, *69*(12), 7153–7160. https://doi.org/10.1128/AEM.69.12.7153-7160.2003

Heißenhuber, A., Hautmann, W., Arenz, S., Kugler, R., Kleih, W., Ludwig, S., & Wildner, M. (2005). Accumulated occurrence of illnesses with *Salmonella Enteritidis* in hospitals and nursing homes in the District Oberallgaeu, Bavaria, in July 2004. *Gesundheitswesen*, *67*(12), 845–852. https://doi.org/10.1055/s-2005-858898

Hennekinne, J. A., De Buyser, M. L., & Dragacci, S. (2012). *Staphylococcus aureus* and its food poisoning toxins: Characterization and outbreak investigation. In *FEMS Microbiology Reviews* (Vol. 36, Issue 4, pp. 815–836). https://doi.org/10.1111/j.1574-6976.2011.00311.x

Henroid, D., & Sneed, J. (2004). Readiness To Implement Hazard Analysis and Critical Control Point (HACCP) Systems in Iowa Schools. *Journal of the American Dietetic Association*, *104*(2), 180–185. https://doi.org/10.1016/j.jada.2003.11.009

Heredia, N., & García, S. (2018). Animals As Sources of Food-Borne Pathogens: A Review. In *Animal Nutrition* (Vol. 4, Issue 3, pp. 250–255). KeAi Communications Co. https://doi.org/10.1016/j.aninu.2018.04.006

Hertanto, B. S., Nurmalasari, C. D. A., Nuhriawangsa, A. M. P., Cahyadi, M., & Kartikasari, L. R. (2018). The Physical and Microbiological Quality of Chicken Meat in The Different Type of Enterprise Poultry Slaughterhouse: A Case Study in Karanganyar District. *IOP Conference Series: Earth and Environmental Science*, *102*(1). https://doi.org/10.1088/1755-1315/102/1/012051

Herzog, K. A. T., Schneditz, G., Leitner, E., Feierl, G., Hoffmann, K. M., Zollner-Schwetz, I., Krause, R., Gorkiewicz, G., Zechner, E. L., & Högenauer, C. (2014). Genotypes of *Klebsiella oxytoca* Isolates from Patients with Nosocomial Pneumonia Are Distinct from Those of Isolates from Patients with Antibiotic-Associated Hemorrhagic Colitis. *Journal of Clinical Microbiology*, *52*(5), 1607–1616. https://doi.org/10.1128/JCM.03373-13

Holt, K. E., Wertheim, H., Zadoks, R. N., Baker, S., Whitehouse, C. A., Dance, D., Jenney, A., Connor, T. R., Hsu, L. Y., Severin, J., Brisse, S., Cao, H., Wilksch, J., Gorrie, C., Schultz, M. B., Edwards, D. J., Nguyen, K. Van, Nguyen, T. V., Dao, T. T., … Thomson, N. R. (2015). Genomic Analysis of Diversity, Population Structure, Virulence, And Antimicrobial Resistance in *Klebsiella Pneumoniae* , An Urgent Threat To Public Health. *Proceedings of the National Academy of Sciences*, *112*(27). https://doi.org/10.1073/pnas.1501049112

Hughes, C., Gillespie, I. A., & O'Brien, S. J. (2007). Foodborne transmission of infectious intestinal disease in England and Wales, 1992-2003. *Food Control*, *18*(7), 766–772. https://doi.org/10.1016/j.foodcont.2006.01.009

Huvenne, W., Hellings, P. W., & Bachert, C. (2013). Role Of Staphylococcal Superantigens in Airway Disease. *International Archives of Allergy and Immunology*, *161*(4), 304–314. https://doi.org/10.1159/000350329

Hwang, C. C., Kung, H. F., Lin, C. Saint, Hwang, D. F., & Tsai, Y. H. (2011). Bacteriological Quality and Histamine-Forming Bacteria Associated with Fish Meats and Environments in HACCP And Non-HACCP Fish Processing Factories. *Food Control*, *22*(10), 1657–1662. https://doi.org/10.1016/j.foodcont.2011.03.025

Ibrahim, S., Wei Hoong, L., Lai Siong, Y., Mustapha, Z., C. W. Zalati, C. W. S., Aklilu, E., Mohamad, M., & Kamaruzzaman, N. F. (2021). Prevalence Of Antimicrobial Resistance (AMR) *Salmonella* spp. And *Escherichia coli* Isolated from Broilers in The East Coast of Peninsular Malaysia. *Antibiotics*, *10*(5). https://doi.org/10.3390/antibiotics10050579

Imai, K., Ishibashi, N., Kodana, M., Tarumoto, N., Sakai, J., Kawamura, T., Takeuchi, S., Taji, Y., Ebihara, Y., Ikebuchi, K., Murakami, T., Maeda, T., Mitsutake, K., & Maesaki, S. (2019). Clinical Characteristics in Blood Stream Infections Caused by *Klebsiella pneumoniae*, *Klebsiella variicola*, And *Klebsiella quasipneumoniae*: A Comparative Study, Japan, 2014–2017. *BMC Infectious Diseases*, *19*(1), 946. https://doi.org/10.1186/s12879-019-4498-x

Iñiguez-Moreno, M., Gutiérrez-Lomelí, M., & Avila-Novoa, M. G. (2021). Removal Of Mixed-Species Biofilms Developed on Food Contact Surfaces with A Mixture of Enzymes and Chemical Agents. *Antibiotics*, *10*(8). https://doi.org/10.3390/antibiotics10080931

Ismail, F. H., Chik, C. T., Muhammad, R., & Yusoff, N. M. (2016). Food Safety Knowledge and Personal Hygiene Practices amongst Mobile Food Handlers in Shah Alam, Selangor. *Procedia - Social and Behavioral Sciences*, *222*, 290–298. https://doi.org/10.1016/j.sbspro.2016.05.162

Jain, V. M., Karibasappa, G. N., Suresh Dodamani, A., Prashanth, V. K., & Mali, G. V. (2016). Comparative Assessment of Antimicrobial Efficacy of Different Hand Sanitizers: An In Vitro Study. In *Dental Research Journal* (Vol. 424). www.ncbi.nlm.nih.gov/pmc/journals/1480

Jayaraman, K., Munira, H., Chowdhury, D., & Iranmanesh, M. (2013). The Preference and Consumption of Chicken Lovers with Race as A Moderator-An Empirical Study in Malaysia. In *International Food Research Journal* (Vol. 20, Issue 1).

Jiménez, S. M., Tiburzi, M. C., Salsi, M. S., Moguilevsky, M. A., & Pirovani, M. E. (2009). Survival Of *Salmonella* on Refrigerated Chicken Carcasses and Subsequent Transfer to Cutting Board. *Letters in Applied Microbiology*, *48*(6), 687–691. https://doi.org/10.1111/j.1472-765X.2009.02596.x

Jubayer, M. F., Kayshar, M. S., Hossain, M. S., Uddin, M. N., Al-Emran, M., & Akter, S. S. (2020). Evaluation Of Food Safety Knowledge, Attitude, And Self-Reported Practices of Trained and Newly Recruited Untrained Workers of Two Baking Industries In Dhaka, Bangladesh. *Heliyon*, *6*(9). https://doi.org/10.1016/j.heliyon.2020.e05021

Jubeh, B., Breijyeh, Z., & Karaman, R. (2020). Resistance of Gram-Positive Bacteria to Current Antibacterial Agents and Overcoming Approaches. *Molecules*, *25*(2888), 1–22. https://doi.org/10.3390/molecules25122888

Kadariya, J., Smith, T. C., & Thapaliya, D. (2014). *Staphylococcus aureus* and Staphylococcal Food-Borne Disease: An Ongoing Challenge in Public Health. *BioMed Research International*, *2014*. https://doi.org/10.1155/2014/827965

Karmakar, A., Dua, P., & Ghosh, C. (2016). Biochemical and Molecular Analysis of *Staphylococcus aureus* Clinical Isolates from Hospitalized Patients. *Canadian Journal of Infectious Diseases and Medical Microbiology*, *2016*. https://doi.org/10.1155/2016/9041636

Kearney, G. D. (2018). Introduction to Foodborne Illness Outbreak Investigations. In Environmental Public Health: The Practitioner's Guide. American Public Health Association. https://doi.org/10.2105/9780875532943ch13

Keerthirathne, T. P., Ross, K., Fallowfield, H., & Whiley, H. (2017). Reducing Risk of Salmonellosis Through Egg Decontamination Processes. In *International Journal of Environmental Research and Public Health* (Vol. 14, Issue 3). MDPI. https://doi.org/10.3390/ijerph14030335

Khalid, T., Hdaifeh, A., Federighi, M., Cummins, E., Boué, G., Guillou, S., & Tesson, V. (2020). Review of Quantitative Microbial Risk Assessment in Poultry Meat: The Central Position of Consumer Behavior. In *Foods* (Vol. 9, Issue 11). MDPI AG. https://doi.org/10.3390/FOODS9111661

Khater, D. F., Lela, R. A., El-Diasty, M., Moustafa, S. A., & Wareth, G. (2021). Detection of Harmful Foodborne Pathogens in Food Samples at The Points of Sale by MALDT-TOF MS in Egypt. *BMC Research Notes*, *14*(1). https://doi.org/10.1186/s13104-021-05533-8

Kim, C. Y., Ryu, G. J., Park, H. Y., & Ryu, K. (2017). Resistance Of *Staphylococcus aureus* on Food Contact Surfaces with Different Surface Characteristics To Chemical Sanitizers. *Journal of Food Safety*, *37*(4). https://doi.org/10.1111/jfs.12354

Kim, H., Moon, M. J., Kim, C. Y., & Ryu, K. (2019). Efficacy of Chemical Sanitizers Against *Bacillus cereus* on Food Contact Surfaces with Scratch and Biofilm. *Food Science and Biotechnology, 28*(2), 581–590. https://doi.org/10.1007/s10068-018-0482-2

Kim, J. H., Hur, S. J., & Yim, D. G. (2018). Monitoring of Microbial Contaminants of Beef, Pork, And Chicken in HACCP Implemented Meat Processing Plants of Korea. *Korean Journal for Food Science of Animal Resources*, *38*(2), 282–290. https://doi.org/10.5851/kosfa.2018.38.2.282

Kim, J. H., & Yim, D. G. (2016). Assessment of the Microbial Level for Livestock Products in Retail Meat Shops Implementing HACCP System. *Korean Journal for Food Science of Animal Resources*, *36*(5), 594–600. https://doi.org/10.5851/kosfa.2016.36.5.594

Klaharn, K., Pichpol, D., Meeyam, T., Harintharanon, T., Lohaanukul, P., & Punyapornwithaya, V. (2022). Bacterial Contamination of Chicken Meat in Slaughterhouses and The Associated Risk Factors: A Nationwide Study In Thailand. *PLOS ONE*, *17*(6), e0269416. https://doi.org/10.1371/journal.pone.0269416

Kode, D., Nannapaneni, R., Bansal, M., Chang, S., Cheng, W. H., Sharma, C. S., & Kiess, A. (2021). Low-Level Tolerance to Fluoroquinolone Antibiotic Ciprofloxacin In QAC-Adapted Subpopulations of Listeria monocytogenes. *Microorganisms*, *9*(5). https://doi.org/10.3390/microorganisms9051052

Koningstein, M., Simonsen, J., Helms, M., & Mølbak, K. (2010). The Interaction Between Prior Antimicrobial Drug Exposure and Resistance in Human *Salmonella* Infections. *Journal of Antimicrobial Chemotherapy*, *65*(8), 1819–1825. https://doi.org/10.1093/jac/dkq176

Kralik, G., Kralik, Z., Grčević, M., & Hanžek, D. (2018). Quality of Chicken Meat. InTech. https://doi.org/10.5772/intechopen.72865

Krishnamoorthy, G., Leus, I. V, Weeks, J. W., Wolloscheck, D., Rybenkov, V. V, & Zgurskaya, H. I. (2017). Synergy between Active Efflux and Outer Membrane Diffusion Defines Rules of Antibiotic Permeation into Gram-negative bacteria.mBio https://doi.org/10.1128/mBio.01172-17

Krumperman, P. H. (1983). Multiple Antibiotic Resistance Indexing of Escherichia coli to Identify High-Risk Sources of Fecal Contamination of Food. Applied And Environmental Microbiology, *46*(1), 165–170. https://journals.asm.org/journal/aem

Kumar, H., Bhardwaj, K., Kaur, T., Nepovimova, E., Kuča, K., Kumar, V., Bhatia, S. K., Dhanjal, D. S., Chopra, C., Singh, R., Guleria, S., Bhalla, T. C., Verma, R., & Kumar, D. (2020). Review Detection of Bacterial Pathogens and Antibiotic Residues in Chicken Meat: A Review. *Foods*, *9*(10). https://doi.org/10.3390/foods9101504

Kvenberg, J. E., & Schwalm, D. J. (2000). Use of Microbial Data for Hazard Analysis and Critical Control Point Verification-Food and Drug Administration Perspective. *Journal of Food Protection*, *63*(6), 810–814. http://meridian.allenpress.com/jfp/article-pdf/63/6/810/1673832/0362-028x-63_6_810.pdf

Lahou, E., Jacxsens, L., Verbunt, E., & Uyttendaele, M. (2015). Evaluation Of the Food Safety Management System in A Hospital Food Service operation toward *Listeria monocytogenes*. *Food Control*, *49*, 75–84. https://doi.org/10.1016/j.foodcont.2013.10.020

Lam, B. C. C., Lee, J., & Lau, Y. L. (2004). Hand hygiene practices in a neonatal intensive care unit: A multimodal intervention and impact on nosocomial infection. *Pediatrics*, *114*(5). https://doi.org/10.1542/peds.2004-1107

Lambrechts, A. A., Human, I. S., Doughari, J. H., & Lues, J. F. R. (2014). Bacterial Contamination of The Hands of Food Handlers as Indicator of Hand Washing Efficacy in Some Convenient Food Industries. *Pakistan Journal of Medical Sciences*, *30*(4). https://doi.org/10.12669/pjms.304.4400

Langøyli Giske, L. A., Lindstad, L. H., Løvdal, T., & Mork, O. J. (2020). Design of Fish Processing Equipment: Exploring Cleaning Brush Performance and Material Properties to Minimize Biofilm Deposits. *Procedia CIRP*, *91*, 140–145. https://doi.org/10.1016/j.procir.2020.02.159

Langsrud, S., Sidhu, M. S., Heir, E., & Holck, A. L. (2003). Bacterial disinfectant resistance - A challenge for the food industry. *International Biodeterioration and Biodegradation*, *51*(4), 283–290. https://doi.org/10.1016/S0964-8305(03)00039-8

Laxminarayan, R., Duse, A., Wattal, C., Zaidi, A. K. M., Wertheim, H. F. L., Sumpradit, N., Vlieghe, E., Hara, G. L., Gould, I. M., Goossens, H., Greko, C., So, A. D., Bigdeli, M., Tomson, G., Woodhouse, W., Ombaka, E., Peralta, A. Q., Qamar, F. N., Mir, F., … Cars, O. (2013). Antibiotic resistance-the need for global solutions. *The Lancet Infectious Diseases*, *13*(12), 1057–1098. https://doi.org/10.1016/S1473-3099(13)70318-9

Le Chevallier, M. W., Cameron, S. C., & Mcfeters, G. A. (1983). Comparison of Verification Procedures for the Membrane Filter Total Coliform Technique Downloaded from. *Applied And Environmental Microbiology*, *45*(3), 1126–1128. http://aem.asm.org/

Le, H. H. T., Dalsgaard, A., Andersen, P. S., Nguyen, H. M., Ta, Y. T., & Nguyen, T. T. (2021). Large-Scale *Staphylococcus aureus* Foodborne Disease Poisoning Outbreak among Primary School Children. *Microbiology Research*, *12*(1), 43–52. https://doi.org/10.3390/microbiolres12010005

Leclerc, H., Mossel, D. A. A., Edberg, S. C., & Struijk, C. B. (2001). Advances In the Bacteriology of The Coliform Group: Their Suitability as Markers of Microbial Water Safety. www.annualreviews.org

Lee, H. K., Abdul Halim, H., Thong, K. L., & Chai, L. C. (2017). Assessment of Food Safety Knowledge, Attitude, Self-Reported Practices, and Microbiological Hand Hygiene of Food Handlers. *International Journal of Environmental Research and Public Health*, *14*(1). https://doi.org/10.3390/ijerph14010055

Lee, J. C., Daraba, A., Voidarou, C., Rozos, G., El Enshasy, H. A., & Varzakas, T. (2021). Implementation of Food Safety Management Systems Along with Other Management Tools (Hazop, Fmea, Ishikawa, Pareto). The Case Study of *Listeria monocytogenes* and Correlation with Microbiological Criteria. *Foods*, *10*(9). https://doi.org/10.3390/foods10092169

Li, Y., Li, X., Hao, Y., Liu, Y., Dong, Z. L., & Li, K. (2021). Biological And Physiochemical Methods of Biofilm Adhesion Resistance Control of Medical-Context Surface. *International Journal of Biological Sciences*, *17*(7), 1769–1781. https://doi.org/10.7150/ijbs.59025

Li, Y., Pei, X., Zhang, X., Wu, L., Liu, Y., Zhou, H., Ma, G., Chen, Q., Liang, H., & Yang, D. (2019). A Surveillance of Microbiological Contamination on Raw Poultry Meat at Retail Markets in China. *Food Control*, *104*, 99–104. https://doi.org/10.1016/j.foodcont.2019.04.037

Lika, E., Puvača, N., Jeremić, D., Stanojević, S., Kika, T. S., Cocoli, S., & Frutos, R. D. L. (2021). Antibiotic Susceptibility of *Staphylococcus* Species Isolated in Raw Chicken Meat from Retail Stores. *Antibiotics*, *10*(8). https://doi.org/10.3390/antibiotics10080904

Loir, Y. Le, Baron, F., & Gautier, M. (2003). *Staphylococcus aureus* and Food Poisoning. *Genetics and Molecular Research*, *2*(1), 63–76. www.funpecrp.com.br

Losito, P., Visciano, P., Genualdo, M., Satalino, R., Migailo, M., Ostuni, A., Luisi, A., & Cardone, G. (2017). Evaluation of Hygienic Conditions of Food Contact Surfaces in Retail Outlets: Six Years of Monitoring. *LWT - Food Science and Technology*, *77*, 67–71. https://doi.org/10.1016/j.lwt.2016.11.029

Luber, P. (2009). Cross-Contamination Versus Undercooking of Poultry Meat or Eggs - Which Risks Need to Be Managed First? In *International Journal of Food Microbiology* (Vol. 134, Issues 1–2, pp. 21–28). https://doi.org/10.1016/j.ijfoodmicro.2009.02.012

Luis Lugo, J., Rafael Lugo, E., & De La Puente, M. (2021). A Systematic Review of Microorganisms as Indicators of Recreational Water Quality in Natural and Drinking Water Systems. *Journal of Water and Health*, *19*(1), 20–28. https://doi.org/10.2166/WH.2020.179

Magistrali, C., Dionisi, A. M., De Curtis, P., Cucco, L., Vischi, O., Scuota, S., Zicavo, A., & Pezzotti, G. (2008). Contamination of *Salmonella* spp. in a pig finishing herd, from the arrival of the animals to the slaughterhouse. *Research in Veterinary Science*, *85*(2), 204–207.https://doi.org/10.1016/j.rvsc.2007.12.002

Maharjan, S., Rayamajhee, B., Chhetri, V. S., Sherchan, S. P., Panta, O. P., & Karki, T. B. (2019). Microbial quality of poultry meat in an ISO 22000:2005 certified poultry processing plant of Kathmandu valley. *International Journal of Food Contamination*, *6*(1). https://doi.org/10.1186/s40550-019-0078-5

Mandal, A. K., Talukder, S., Hasan, M. M., Tasmim, S. T., Parvin, M. S., Ali, M. Y., & Islam, M. T. (2022). Epidemiology and antimicrobial resistance of Escherichia coli in broiler chickens, farmworkers, and farm sewage in Bangladesh. *Veterinary Medicine and Science*, *8*(1), 187–199. https://doi.org/10.1002/vms3.664

Manyi-Loh, C., Mamphweli, S., Meyer, E., & Okoh, A. (2018). Antibiotic use in agriculture and its consequential resistance in environmental sources: Potential public health implications. *Molecules*, *23*(4). https://doi.org/10.3390/molecules23040795

Marshall, B. J., Ohye, D. F., & Christian, J. H. B. (1971). Tolerance of Bacteria to High Concentrations of NaCl and Glycerol in the Growth Medium. *Applied Microbiology*, *363*(2), 363–364. https://journals.asm.org/journal/am

Marshall, B., & Levy, S. B. (2011). Food animals and antimicrobials: Impacts on human health. *Clinical Microbiology Reviews*, *24*(4), 718–733. https://doi.org/10.1128/CMR.00002-11

Marshall, B. M., & Levy, S. B. (2011). Food animals and antimicrobials: Impacts on human health. *Clinical Microbiology Reviews*, *24*(4), 718–733. https://doi.org/10.1128/CMR.00002-11

Martin, N. H., Trmcic, A., Hsieh, T. H., Boor, K. J., & Wiedmann, M. (2016). The evolving role of coliforms as indicators of unhygienic processing conditions in dairy foods. *Frontiers in Microbiology*, *7*(SEP). https://doi.org/10.3389/fmicb.2016.01549

Martínez-Lage, J. F., Martínez-Lage Azorín, L., Almagro, M. J., Bastida, M. E., Reyes, S., & Tellez, C. (2010). Citrobacter koseri meningitis: A neurosurgical condition? *European Journal of Paediatric Neurology*, *14*(4), 360–363. https://doi.org/10.1016/j.ejpn.2009.08.002

Marzano, M. A., & Balzaretti, C. M. (2011). Cook-Serve Method in Mass Catering Establishments: Is It Still Appropriate to Ensure a High Level of Microbiological Quality and Safety? *Food Control*, *22*(12), 1844–1850. https://doi.org/10.1016/j.foodcont.2011.04.024

Marzano, M. A., & Balzaretti, C. M. (2013). Protecting Child Health by Preventing School-Related Foodborne Illnesses: Microbiological Risk Assessment of Hygiene Practices, Drinking Water and Ready-To-Eat Foods in Italian Kindergartens and Schools. *Food Control*, *34*(2), 560–567. https://doi.org/10.1016/j.foodcont.2013.05.031

Mat Arif, Z. (2023, April 5). 60 MRSM Gerik students suffered food poisoning after consuming spoilt food. *News Straits Time*. https://www.nst.com.my/news/

nation/2023/04/896465/60-mrsm-gerik-students-suffered-food-poisoning-after-consuming-spoilt

Mead, G. (2004). Microbiological quality of poultry meat: a review*. *Brazillian Journal of Poultry Science*, *6*(3), 135–142.

Meakins, S. M., Adak, G. K., Lopman, B. A., & O'Brien, S. J. (2003). General outbreaks of infectious intestinal disease (IID) in hospitals, England and Wales, 1992-2000. *Journal of Hospital Infection*, *53*(1), 1–5. https://doi.org/10.1053/jhin.2002.1326

Mehdi, Y., Létourneau-Montminy, M. P., Gaucher, M. Lou, Chorfi, Y., Suresh, G., Rouissi, T., Brar, S. K., Côté, C., Ramirez, A. A., & Godbout, S. (2018). Use Of Antibiotics in Broiler Production: Global Impacts and Alternatives. In *Animal Nutrition* (Vol. 4, Issue 2, pp. 170–178). KeAi Communications Co. https://doi.org/10.1016/j.aninu.2018.03.002

Mellor, K. C., Petrovska, L., Thomson, N. R., Harris, K., Reid, S. W. J., & Mather, A. E. (2019). Antimicrobial resistance diversity suggestive of distinct *Salmonella typhimurium* sources or selective pressures in food-production animals. *Frontiers in Microbiology*, *10* (Apr). https://doi.org/10.3389/fmicb.2019.00708

Mendelson, M., & Matsoso, M. (2015). The World Health Organization Global Action Plan for antimicrobial resistance. *South Africa Medical Journal*, *105*(5).

Michaelis, C., & Grohmann, E. (2023). Horizontal Gene Transfer of Antibiotic Resistance Genes in Biofilms. In *Antibiotics* (Vol. 12, Issue 2). https://doi.org/10.3390/antibiotics12020328

Michaels, B., Keller, C., Blevins, M., Paoli, G., Ruthman, T., Todd, E., & Griffith, C. J. (2004). Prevention Of Food Worker Transmission of Foodborne Pathogens: Risk Assessment and Evaluation of Effective Hygiene Intervention. In *Food Service Technology* (Vol.4, pp. 31-49).

Mishra, M., Arukha, A. P., Patel, A. K., Behera, N., Mohanta, T. K., & Yadav, D. (2018). Multi-Drug Resistant Coliform: Water Sanitary Standards and Health Hazards. *Frontiers in Pharmacology*, *9* (Jun). https://doi.org/10.3389/fphar.2018.00311

Mkize, N., Zishiri, O. T., & Mukaratirwa, S. (2017). Genetic Characterisation of Antimicrobial Resistance and Virulence Genes in *Staphylococcus aureus* Isolated from Commercial Broiler Chickens in The Durban Metropolitan Area, South Africa. *Journal of the South African Veterinary Association*, *88*(1). https://doi.org/10.4102/jsava.v88i0.1416

MOH. (2019). Health Facts 2019. In *Ministry of Health Malaysia*. Ministry Of Health Malaysia. https://www.moh.gov.my/moh/resources/Penerbitan/Penerbitan%20Utama/HEALTH%20FACTS/Health%20Facts%202019_Booklet.pdf

Mohammad Murshed, H., Lutful Kabir, S. M., Rahman, S., Oh, D.-H., Murshed, H., Al-Amin, M., Kabir, S., Deog-Hwan Oh, and, & Syed Md Ehsanur Rahman, P. (2016). Quality and safety of meat and meat products available in Mymensingh, Bangladesh. *Journal of Meat Science and Technology*, *4*, 61–70. www.jakraya.com/journal/jmst

Monecke, S., Coombs, G., Shore, A. C., Coleman, D. C., Akpaka, P., Borg, M., Chow, H., Ip, M., Jatzwauk, L., Jonas, D., Kadlec, K., Kearns, A., Laurent, F., O'Brien, F. G., Pearson, J., Ruppelt, A., Schwarz, S., Scicluna, E., Slickers, P., … Ehricht, R. (2011). A Field Guide to Pandemic, Epidemic and Sporadic Clones of Methicillin-Resistant *Staphylococcus aureus*. *PLoS ONE*, *6*(4). https://doi.org/10.1371/journal.pone.0017936

Moorman, M., Nettleton, W., Ryser, E., Linz, J., & Pestka, J. (2005). Altered Sensitivity to a Quaternary Ammonium Sanitizer in Stressed *Listeria innocua*. *Journal of Food Protection*, *68*(8), 1659–1663.

Møretrø, T., & Langsrud, S. (2017). Residential Bacteria on Surfaces in the Food Industry and Their Implications for Food Safety and Quality. *Comprehensive Reviews in Food Science and Food Safety*, *16*(5), 1022–1041. https://doi.org/10.1111/1541-4337.12283

Mourabit, N., Arakrak, A., Bakkali, M., Zian, Z., Bakkach, J., & Laglaoui, A. (2021). Antimicrobial Resistance Trends in *Staphylococcus aureus* Strains Carried by Poultry in North of Morocco: A Preliminary Analysis. *Journal of Food Quality*, *2021*, 1–5. https://doi.org/10.1155/2021/8856004

Mpundu, P., Mbewe, A. R., Muma, J. B., Zgambo, J., & Munyeme, M. (2019). Evaluation of Bacterial Contamination in Dressed Chickens in Lusaka Abattoirs. *Frontiers in Public Health*, *7*(FEB). https://doi.org/10.3389/fpubh.2019.00019

Mrema, N., Mpuchane, S., & Gashe, B. A. (2006). Prevalence Of *Salmonella* in Raw Minced Meat, Raw Fresh Sausages and Raw Burger Patties from Retail Outlets in Gaborone, Botswana. *Food Control*, *17*(3), 207–212. https://doi.org/10.1016/j.foodcont.2004.09.019

Mukerji, S., O'Dea, M., Barton, M., Kirkwood, R., Lee, T., & Abraham, S. (2017). Development And Transmission of Antimicrobial Resistance Among Gram-Negative Bacteria in Animals and Their Public Health Impact. *Essays in Biochemistry*, *61*(1), 23–35. https://doi.org/10.1042/EBC20160055

Nacer, S., El Ftouhy, F. Z., Derqaoui, S., Khayli, M., Nassik, S., & Lkhider, M. (2022). Prevalence and Antibiotic Resistance of *Salmonella* spp. and *Staphylococcus aureus* Isolated from Broiler Chicken Meat in Modern and Traditional Slaughterhouses of Morocco. *World's Veterinary Journal*, 430–439. https://doi.org/10.54203/scil.2022.wvj53

Ncube, F., Kanda, A., Chijokwe, M., Mabaya, G., & Nyamugure, T. (2020). Food Safety Knowledge, Attitudes and Practices of Restaurant Food Handlers in A

Lower-Middle-Income Country. *Food Science and Nutrition*, *8*(3), 1677–1687. https://doi.org/10.1002/fsn3.1454

New, C. Y., Ubong, A., Premarathne, J. M. K. J. K., Thung, T. Y., Lee, E., Chang, W. S., Loo, Y. Y., Kwan, S. Y., Tan, C. W., Kuan, C. H., & Son, R. (2017). Microbiological Food Safety in Malaysia from The Academician's Perspective. In *Food Research* (Vol. 1, Issue 6, pp. 183–202). Rynnye Lyan Resources. https://doi.org/10.26656/fr.2017.6.013

Newsdesk. (2020, January 5). Food Poisoning outbreak in Kuala Lumpur. *Outbreak News Today*. https://outbreaknewstoday.com/food-poisoning-outbreak-in-kuala-lumpur-14308/

Nidaullah, H., Abirami, N., Shamila-Syuhada, A. K., Chuah, L. O., Huda, N., Tan, T. P., Zainal Abidin, F. W., & Rusul, G. (2017). Prevalence of *Salmonella* in poultry processing environments in wet markets in Penang and Perlis, Malaysia. *Veterinary World*, *10*(3), 286–292. https://doi.org/10.14202/vetworld.2017.286-292

Nkhebenyane, J. S., & Lues, R. (2020). The Knowledge, Attitude, And Practices of Food Handlers in Central South African Hospices. *Food Science and Nutrition*, *8*(6), 2598–2607. https://doi.org/10.1002/fsn3.1499

Norhaslinda, R., Norhayati, H., & Mohd Adzim Khalil, R. (2016). Knowledge, Attitudes and Practices (KAP) On Good Manufacturing Practices (GMP) Among Food Handlers in Terengganu Hospitals. *International Journal of Pharmacy and Pharmaceutical Sciences*, *8*(11), 53–59. https://doi.org/10.22159/ijpps.2016v8i11.13000

Obe, T., Nannapaneni, R., Schilling, W., Zhang, L., McDaniel, C., & Kiess, A. (2020). Prevalence Of *Salmonella enterica* On Poultry Processing Equipment After Completion of Sanitization Procedures. *Poultry Science*, *99*(9), 4539–4548. https://doi.org/10.1016/j.psj.2020.05.043

O'Bryan, C. A., Ricke, S. C., & Marcy, J. A. (2022). Public Health Impact of *Salmonella* spp. on Raw Poultry: Current Concepts and Future Prospects in The United States. *Food Control*, *132*, 108539. https://doi.org/10.1016/j.foodcont.2021.108539

Odwar, J. A., Kikuvi, G., Kariuki, J. N., & Kariuki, S. (2014). A Cross-Sectional Study on The Microbiological Quality and Safety of Raw Chicken Meats Sold in Nairobi, Kenya. *BMC Research Notes*, *7*(1). https://doi.org/10.1186/1756-0500-7-627

OECD-FAO. (2020). *OECD-FAO Agricultural Outlook 2020-2029*. https://doi.org/10.1787/1112c23b-en

Olaimat, A. N., Shahbaz, H. M., Fatima, N., Munir, S., & Holley, R. A. (2020). Food Safety During and After the Era of COVID-19 Pandemic. *Frontiers in Microbiology*, *11*. https://doi.org/10.3389/fmicb.2020.01854

Oliveira, R. S., Rodrigues, M. J., & Henriques, A. R. (2021). Specific Hygiene Procedures and Practices Assessment: A Cross-Sectional Study in Fresh Fishery Product Retailers of Lisbon's Traditional Food Markets. *Foods*, *10*(8). https://doi.org/10.3390/foods10081805

Osei Tutu, B., & Anfu, P. O. (2019). Evaluation Of the Food Safety and Quality Management Systems of The Cottage Food Manufacturing Industry in Ghana. *Food Control*, *101*, 24–28. https://doi.org/10.1016/j.foodcont.2019.02.028

Osimani, A., Aquilanti, L., & Clementi, F. (2016). Salmonellosis Associated with Mass Catering: A Survey of European Union Cases Over A 15-Year Period. *Epidemiology and Infection*, *144*(14), 3000–3012. https://doi.org/10.1017/S0950268816001540

Painter, J. A., Hoekstra, R. M., Ayers, T., Tauxe, R. V., Braden, C. R., Angulo, F. J., & Griffin, P. M. (2013). Attribution Of Foodborne Illnesses, Hospitalizations, And Deaths to Food Commodities by Using Outbreak Data, United States, 1998-2008. *Emerging Infectious Diseases*, *19*(3), 407–415. https://doi.org/10.3201/eid1903.111866

Panisello, P. J., Quantick, P. C., & Knowles, M. J. (1999). Towards The Implementation Of HACCP: Results of A UK Regional Survey. *Food Control*, *10*, 87–98.

Paruch, A. M., & Mæhlum, T. (2012). Specific Features of *Escherichia coli* that Distinguish It from Coliform and Thermotolerant Coliform Bacteria and Define It as The Most Accurate Indicator of Faecal Contamination in The Environment. *Ecological Indicators*, *23*, 140–142. https://doi.org/10.1016/j.ecolind.2012.03.026

Pepe, O., Blaiotta, G., Bucci, F., Anastasio, M., Aponte, M., & Villani, F. (2006). *Staphylococcus aureus* and Staphylococcal enterotoxin A in Breaded Chicken Products: Detection and Behavior During the Cooking Process. *Applied and Environmental Microbiology*, *72*(11), 7057–7062. https://doi.org/10.1128/AEM.00198-06

Perez-Arnedo, I., & Gonzalez-Fandos, E. (2020). Prevalence of *Campylobacter* spp. In Poultry in Three Spanish Farms, A Slaughterhouse and A Further Processing Plant. *Foods*, *8*(3). https://doi.org/10.3390/foods8030111

Pessoa, J., Rodrigues da Costa, M., Nesbakken, T., & Meemken, D. (2021). Assessment of the Effectiveness of Pre-harvest Meat Safety Interventions to Control Foodborne Pathogens in Broilers: A Systematic Review. *Current Clinical Microbiology Reports*, *8*(2), 21–30. https://doi.org/10.1007/s40588-021-00161-z

Petruzzelli, A., Foglini, M., Paolini, F., Framboas, M., Serena Altissimi, M., Naceur Haouet, M., Mangili, P., Osimani, A., Clementi, F., Cenci, T., & Tonucci, F. (2014). Evaluation Of the Quality of Foods for Special Diets Produced in A School Catering Facility Within A HACCP-Based Approach: A Case Study.

International Journal of Environmental Health Research, *24*(1), 73–81. https://doi.org/10.1080/09603123.2013.782605

Petruzzelli, A., Osimani, A., Tavoletti, S., Clementi, F., Vetrano, V., Di Lullo, S., Paolini, F., Foglini, M., Micci, E., Orazietti, N., Luchetti, T., & Tonucci, F. (2018). Microbiological quality assessment of meals and work surfaces in a school-deferred catering system. *International Journal of Hospitality Management*, *68*, 105–114. https://doi.org/10.1016/j.ijhm.2017.10.003

Projahn, M., Pacholewicz, E., Becker, E., Correia-Carreira, G., Bandick, N., & Kaesbohrer, A. (2018). Reviewing Interventions against Enterobacteriaceae in Broiler Processing: Using Old Techniques for Meeting the New Challenges of ESBL *E. coli*. In *BioMed Research International* (Vol. 2018). Hindawi Limited. https://doi.org/10.1155/2018/7309346

Puah, S. M., Heng Chua, K., Mary, J. A., & Tan, A. (2017). Prevalence Of *Staphylococcus aureus* And *Salmonella enterica* In Ready-To-Eat Sushi And Sashimi. *Tropical Biomedicine*, *34*(1), 45–51.

Qin, X., Yang, M., Cai, H., Liu, Y., Gorris, L., Aslam, M. Z., Jia, K., Sun, T., Wang, X., & Dong, Q. (2022). Antibiotic Resistance of *Salmonella Typhimurium* Monophasic Variant 1,4,[5],12:i:-in China: A Systematic Review and Meta-Analysis. In *Antibiotics* (Vol. 11, Issue 4). MDPI. https://doi.org/10.3390/antibiotics11040532

Raffaella, C., Casettari, L., Fagioli, L., Cespi, M., Bonacucina, G., & Baffone, W. (2017). Activity of Essential Oil-Based Microemulsions Against *Staphylococcus aureus* Biofilms Developed On Stainless Steel Surface In Different Culture Media And Growth Conditions. *International Journal of Food Microbiology*, *241*, 132–140. https://doi.org/10.1016/j.ijfoodmicro.2016.10.021

Raineri, E. J. M., Altulea, D., & Van Dijl, J. M. (2022). Staphylococcal trafficking and infection - From “nose to gut” and back. *FEMS Microbiology Reviews*, *46*(1). https://doi.org/10.1093/femsre/fuab041

Rampal, L., Jegathesan, M., & Lim, Y. S. (1984). An Outbreak of *Bacillus cereus* Food Poisoning in a School Hostel, Klang. *Med. J. Malaysia*, *39*(2). https://www.researchgate.net/publication/16756290

Rebouças, L. T., Santiago, L. B., Martins, L. S., Rios Menezes, A. C., Araújo, M. da P. N., & Almeida, R. C. de C. (2017). Food Safety Knowledge and Practices of Food Handlers, Head Chefs and Managers in Hotels’Restaurants of Salvador, Brazil. *Food Control*, *73*, 372–381. https://doi.org/10.1016/j.foodcont.2016.08.026

Rodriguez, M., Valero, A., Carrasco, E., Pérez-Rodríguez, F., Posada, G. D., & Zurera, G. (2011). Hygienic Conditions and Microbiological Status of Chilled Ready-To-Eat Products Served in Southern Spanish Hospitals. *Food Control*, *22*(6), 874–882. https://doi.org/10.1016/j.foodcont.2010.11.015

Rortana, C., Nguyen-Viet, H., Tum, S., Unger, F., Boqvist, S., Dang-Xuan, S., Koam, S., Grace, D., Osbjer, K., Heng, T., Sarim, S., Phirum, O., Sophia, R., & Lindahl, J. F. (2021). Prevalence of *Salmonella* spp. and *Staphylococcus aureus* In Chicken Meat and Pork from Cambodian Markets. *Pathogens*, *10*(5). https://doi.org/10.3390/pathogens10050556

Rose, B. E., Hill, W. E., Umholtz, R., Ransom, G. M., & James, W. O. (2002). Testing for *Salmonella* in Raw Meat and Poultry Products Collected at Federally Inspected Establishments in the United States, 1998 through 2000 †. *Journal of Food Protection*, *65*(6), 937–947.

Roth, N., Käsbohrer, A., Mayrhofer, S., Zitz, U., Hofacre, C., & Domig, K. J. (2019). The Application of Antibiotics in Broiler Production and The Resulting Antibiotic Resistance in *Escherichia coli*: A global overview. *Poultry Science*, *98*(4), 1791–1804. https://doi.org/10.3382/ps/pey539

Rouger, A., Tresse, O., & Zagorec, M. (2017). Bacterial Contaminants of Poultry Meat: Sources, Species, and Dynamics. *Microorganisms*, *5*(3). https://doi.org/10.3390/microorganisms5030050

Ruby, J. R., Zhu, J., & Ingham, S. C. (2007). Using Indicator Bacteria and *Salmonella* Test Results from Three Large-Scale Beef Abattoirs over an 18-Month Period to Evaluate Intervention System Efficacy and Plan Carcass Testing for *Salmonella*. *Journal of Food Protection*, *70*(12), 2732–2740.

Ryan, M. P., O'Dwyer, J., & Adley, C. C. (2017). Evaluation of the Complex Nomenclature of the Clinically and Veterinary Significant Pathogen *Salmonella*. *BioMed Research International*, *2017*. https://doi.org/10.1155/2017/3782182

Saad, M., See, T. P., Abdullah, M. F. F., & Nor, N. Md. (2013). Use of Rapid Microbial Kits for Regular Monitoring of Food-contact Surfaces towards Hygiene Practices. *Procedia - Social and Behavioral Sciences*, *105*, 273–283. https://doi.org/10.1016/j.sbspro.2013.11.029

Saharan, V. V., Verma, P., & Singh, A. P. (2020). *Escherichia coli*, *Salmonella* spp., and *Staphylococcus aureus* Susceptibility to Antimicrobials of Human and Veterinary Importance in Poultry Sector of India. *Journal of Food Safety*, *40*(1). https://doi.org/10.1111/jfs.12742

Saide-Albornoz, J. J., Knipe, C. L., Murano, E. A., & Beran1, G. W. (1995). Contamination of Pork Carcasses during Slaughter, Fabrication, and Chilled Storage. *Journal of Food Protection*, *58*(9), 993–997. http://meridian.allenpress.com/jfp/article-pdf/58/9/993/1665954/0362-028x-58_9_993.pdf

Sales, W. B., Tunala, J. F., Vasco, J. F. de M., Ravazzani, E. D. do A., & Caveião, C. (2015). Occurrence of Total and Thermotolerant Coliforms in fried pastries sold in bars in downtown Curitiba-PR, Brazil. *DEMETRA: Alimentação, Nutrição & Saúde*, *10*(1). https://doi.org/10.12957/demetra.2015.14142

Salleh, W., Lani, M. N., Wan Zin, W. Z., & Wan Abdullah, W. Z. (2017). A review on incidences of foodborne diseases and interventions for a better national food safety system in Malaysia. *Malaysia Applied Biology*, *46*(3), 1–7. https://www.researchgate.net/publication/320383138

Sanderson, M. W., Sargeant, J. M., Renter, D. G., Griffin, D. D., & Smith, R. A. (2005). Factors associated with the presence of coliforms in the feed and water of feedlot cattle. *Applied and Environmental Microbiology*, *71*(10), 6026–6032. https://doi.org/10.1128/AEM.71.10.6026-6032.2005

Sanlier, N., Sormaz, Ü., & Güneş, E. (2020). The Effect of Food Safety Education on Food Safety Knowledge, Attitudes, Behaviors of Individuals Who Work In Food And Beverage Departments In Turkey. *International Journal of Gastronomy and Food Science*, *22*. https://doi.org/10.1016/j.ijgfs.2020.100259

Scaletsky, I. (2019). Enteropathogenic *Escherichia coli*. *IntechOpen*. https://doi.org/10.5772/intechopen.82861

Scallan, E., Griffin, P. M., Angulo, F. J., Tauxe, R. V., & Hoekstra, R. M. (2011). Foodborne illness acquired in the United States-Unspecified agents. *Emerging Infectious Diseases*, *17*(1), 16–22. https://doi.org/10.3201/eid1701.P21101

Scallan, E., Hoekstra, R. M., Mahon, B. E., Jones, T. F., & Griffin, P. M. (2015). An Assessment of The Human Health Impact of Seven Leading Foodborne Pathogens in The United States Using Disability Adjusted Life Years. *Epidemiology and Infection*, *143*(13), 2795–2804. https://doi.org/10.1017/S0950268814003185

Schultz, M. (2008). Theobald Smith. *Emerging Infectious Disease*, *14*(12). https://doi.org/10.3201/eid1412.081188

Scott, A. M., Beller, E., Glasziou, P., Clark, J., Ranakusuma, R. W., Byambasuren, O., Bakhit, M., Page, S. W., Trott, D., & Mar, C. Del. (2018). Is Antimicrobial Administration to Food Animals a Direct Threat to Human Health? A Rapid Systematic Review. *International Journal of Antimicrobial Agents*, *52*(3), 316–323. https://doi.org/10.1016/j.ijantimicag.2018.04.005

Sekoai, P. T., Feng, S., Zhou, W., Ngan, W. Y., Pu, Y., Yao, Y., Pan, J., & Habimana, O. (2020). Insights Into the Microbiological Safety of Wooden Cutting Boards Used for Meat Processing in Hong Kong's Wet Markets: A Focus on Food-Contact Surfaces, Cross-Contamination and The Efficacy of Traditional Hygiene Practices. *Microorganisms*, *8*(4). https://doi.org/10.3390/microorganisms8040579

Seow, W. L., Mahyudin, N. A., Amin-Nordin, S., Radu, S., & Abdul-Mutalib, N. A. (2021). Antimicrobial Resistance of *Staphylococcus aureus* Among Cooked Food and Food Handlers Associated with their Occupational Information in Klang Valley, Malaysia. *Food Control*, *124*. https://doi.org/10.1016/j.foodcont. 2021.107872

Sezer, Ç., Özgür, Ç., Aksem, A., & Leyla, V. (2015). Food Handlers: A Bridge in The Journey of Enterotoxigenic MRSA in Food. *Journal Fur Verbraucherschutz Und Lebensmittelsicherheit*, *10*(2), 123–129. https://doi.org/10.1007/s00003-015-0939-7

Shafini, A. B., Son, R., Mahyudin, N. A., Rukayadi, Y., & Zainazor, T. (2017). Prevalence of *Salmonella* spp. in chicken and beef from retail outlets in Malaysia. *International Food Research Journal*, *24*(1), 437–449.

Shaltout, F. A., Salem, A. M., Khater, D. F., & Lela, R. A. (2016). Studies on bacteriological Profile of some meat products. *Behna Veterinary Medical Journal*, *31*(1), 43–49. http://www.bvmj.bu.edu.eg

Shang, Y., Kumar, S., Oakley, B., & Kim, W. K. (2018). Chicken Gut Microbiota: Importance and Detection Technology. *Frontiers in Veterinary Science*, *5*(OCT). https://doi.org/10.3389/fvets.2018.00254

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.

Shehata, A. A., Basiouni, S., Elrazek, A., Sultan, H., Tarabees, R., Elraheam Elsayed, M. S. A., Talat, S., Moharam, I., Said, A., Mohsen, W. A., & Kruger, M. (2019). Characterization of *Salmonella enterica* Isolated from Poultry Hatcheries and Commercial Broiler Chickens. *Pakistan Veterinary Journal*, *39*(4), 515–520. https://doi.org/10.29261/pakvetj/2018.xxx

Sikora, A., & Zahra, F. (2022). *Nosocomial Infections*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK559312/

Singh, Y., Saxena, A., Kumar, R., & Saxena, M. K. (2018). Virulence System of *Salmonella* with Special Reference to *Salmonella enterica*. In *IntechOpen*. InTech. https://doi.org/10.5772/intechopen.77210

Sneed, J., Strohbehn, C., Gilmore, S. A., & Mendonca, A. (2004). Microbiological evaluation of foodservice contact surfaces in Iowa assisted-living facilities. *Journal of the American Dietetic Association*, *104*(11), 1722–1724. https://doi.org/10.1016/j.jada.2004.08.026

Somers, E. B., & Wong, A. C. L. (2004). Efficacy of Two Cleaning and Sanitizing Combinations on *Listeria monocytogenes* Biofilms Formed at Low Temperature on a Variety of Materials in the Presence of Ready-to-Eat Meat Residue. *Journal of Food Protection*, *67*(10), 2218–2229.

Soon, J. M., Brazier, A. K. M., & Wallace, C. A. (2020). Determining Common Contributory Factors in Food Safety Incidents – A Review of Global Outbreaks and Recalls 2008–2018. *Trends in Food Science and Technology*, *97*, 76–87. https://doi.org/10.1016/j.tifs.2019.12.030

Soon, J. M., Singh, H., & Baines, R. (2011). Foodborne diseases in Malaysia: A review. *Food Control*, *22*(6), 823–830. https://doi.org/10.1016/j.foodcont.2010.12.011

Su, L.-H., & Chiu, C.-H. (2007). *Salmonella*: Clinical Importance and Evolution of Nomenclature. *Chang Gung Medical Journal*, *30*(3).

Suhaila, A. R., Ariffin, H. F., Sanny, M., Ungku Zainal Abidin, U. F., & Hasni Falina, M. I. (2020). Knowledge, Attitude, And Practice on Food Safety Culture Among Kitchen Employees of Malaysian Government Hospitals. ESTEEM Journal of Social Sciences and Humanities, 4, 180–195. https://ir.uitm.edu.my/id/eprint/29282

Syed, M. A., Ullah, H., Tabassum, S., Fatima, B., Woodley, T. A., Ramadan, H., & Jackson, C. R. (2020). Staphylococci In Poultry Intestines: A Comparison Between Farmed and Household Chickens. *Poultry Science*, *99*(9), 4549–4557. https://doi.org/10.1016/j.psj.2020.05.051

Tallent, S., Hait, J., Bennett, R., & Lancette, G. (2019). *BAM Chapter 12: Staphylococcus aureus*. Bacteriological Analytical Manual (BAM) .

Tan, S. L., Lee, H. Y., Bakar, A., Karim, A., Rukayadi, Y., & Mahyudin, N. A. (2013). Microbiological Quality on Food Handlers'Hands at Primary Schools in Hulu Langat District, Malaysia. In *International Food Research Journal* (Vol. 20, Issue 5).

Tang, J., Zhou, R., Shi, X., Kang, M., Wang, H., & Chen, H. (2008). Two Thermostable Nucleases Coexisted in *Staphylococcus aureus*: Evidence from Mutagenesis And In Vitro Expression. *FEMS Microbiology Letters*, *284*(2), 176–183. https://doi.org/10.1111/j.1574-6968.2008.01194.x

Tavechio, A. T., Ngela, A. ˆ, Ghilardi, C. R., Peresi, J. T. M., Fuzihara, T. O., Yonamine, E. K., Jakabi, M., & Fernandes, S. A. (2002). *Salmonella* Serotypes Isolated from Nonhuman Sources in São Paulo, Brazil, from 1996 through 2000. *Journal of Food Protection*, *65*(6), 1041–1044.

Thames, H. T., & Sukumaran, A. T. (2020). A Review of *Salmonella* and *Campylobacter* in Broiler Meat: Emerging Challenges and Food Safety Measures. *Foods*, *9*(6). https://doi.org/10.3390/foods9060776

Thanner, S., Drissner, D., & Walsh, F. (2016). Antimicrobial resistance in agriculture. *MBio*, *7*(2). https://doi.org/10.1128/MBIO.02227-15

The Interagency Food Safety Analytics Collaboration (IFSAC). (2020). Foodborne illness source attribution estimates for 2017 for *Salmonella*, *Escherichia coli* O157, *Listeria monocytogenes*, and *Campylobacter* using multi-year outbreak surveillance data, United States. https://www.cdc.gov/foodsafety/ifsac/projects/index.html.

Thwala, T., Madoroba, E., Basson, A., & Butaye, P. (2021). Prevalence and Characteristics of *Staphylococcus aureus* Associated with Meat and Meat

Products In African Countries: A Review. In *Antibiotics* (Vol. 10, Issue 9). MDPI. https://doi.org/10.3390/antibiotics10091108

Todd, E. C. D., Michaels, B. S., Greig, J. D., Smith, D., & Bartleson, C. A. (2010). Outbreaks Where Food Workers Have Been Implicated in The Spread of Foodborne Disease. Part 8. Gloves As Barriers to Prevent Contamination of Food by Workers. In *Journal of Food Protection* (Vol. 73, Issue 9, pp. 1762–1773). International Association for Food Protection. https://doi.org/10.4315/0362-028X-73.9.1762

Tominaga, T. (2020). Rapid quantification of coliforms in ready-to-eat foods using lateral-flow immunochromatographic assay. *Journal of Food Safety*, *40*(5). https://doi.org/10.1111/jfs.12835

Touimi, G. B., Bennani, L., Berrada, S., Benboubker, M., & Bennani, B. (2019). Evaluation of hygienic conditions of food contact surfaces in a hospital kitchen in Morocco. *Iranian Journal of Microbiology*, *11*(6), 527–534. http://ijm.tums.ac.ir

Trafialek, J., & Kolanowski, W. (2017). Implementation and functioning of HACCP principles in certified and non-certified food businesses: A preliminary study. *British Food Journal*, *119*(4), 710–728. https://doi.org/10.1108/BFJ-07-2016-0313

Trmčić, A., Chauhan, K., Kent, D. J., Ralyea, R. D., Martin, N. H., Boor, K. J., & Wiedmann, M. (2016). Coliform Detection in Cheese Is Associated with Specific Cheese Characteristics, But No Association Was Found with Pathogen Detection. *Journal of Dairy Science*, *99*(8), 6105–6120. https://doi.org/10.3168/jds.2016-11112

Trüper, H. G. (2005). The Type Species of The Genus *Salmonella lignieres* 1900 Is *Salmonella enterica* (Ex Kauffmann and Edwards 1952) Le Minor and Popoff 1987, With the Type Strain LT2T, And Conservation of The Epithet Enterica In *Salmonella enterica* Over All Earlier Epithets That May Be Applied To This Species. Opinion 80. In *International Journal of Systematic and Evolutionary Microbiology* (Vol. 55, Issue 1, pp. 519–520). https://doi.org/10.1099/ijs.0.63579-0

Uçar, A., Yilmaz, M. V., & Çakiroglu, F. P. (2016). Food Safety – Problems and Solutions. In Significance, Prevention and Control of Food Related Diseases. InTech. https://doi.org/10.5772/63176

Uddin, J., Hossain, K., Hossain, S., Saha, K., Jubyda, F. T., Haque, R., Billah, B., Talukder, A. A., Parvez, A. K., & Dey, S. K. (2019). Bacteriological Assessments of Foodborne Pathogens in Poultry Meat At Different Super Shops In Dhaka, Bangladesh. *Italian Journal of Food Safety*, *8*(1), 15–20. https://doi.org/10.4081/ijfs.2019.6720

USFDA. (2015). FDA Food Code 2009: Chapter 2- Management & Personnel. Section 2-301-16. Hands and Arms. Hand Antiseptics. U.S. Food and Drug Administration. https://wayback.archive-it.org/7993/20170406184612/https://

www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm181242.htm

USFDA. (2023, October 17). *Code of Federal Regulations Title 21 - FDA*. Code of Federal Regulations. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=178.1010

Valero, A., Rodríguez, M.-Y., Posada-Izquierdo, G. D., Pérez-Rodríguez, F., Carrasco, E., & García-Gimeno, R. M. (2016). Risk Factors Influencing Microbial Contamination in Food Service Centers. In *Significance, Prevention and Control of Food Related Diseases*. InTech. https://doi.org/10.5772/63029

Van Boeckel, T. P., Brower, C., Gilbert, M., Grenfell, B. T., Levin, S. A., Robinson, T. P., Teillant, A., & Laxminarayan, R. (2015). Global trends in antimicrobial use in food animals. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(18), 5649–5654. https://doi.org/10.1073/pnas.1503141112

Van Boeckel, T. P., Gandra, S., Ashok, A., Caudron, Q., Grenfell, B. T., Levin, S. A., & Laxminarayan, R. (2014). Global Antibiotic Consumption 2000 To 2010: An Analysis of National Pharmaceutical Sales Data. *The Lancet Infectious Diseases*, *14*(8), 742–750. https://doi.org/10.1016/S1473-3099(14)70780-7

van Cuong, N., Kiet, B. T., Phu, D. H., Van, N. T. B., Hien, V. B., Thwaites, G., Carrique-Mas, J., & Choisy, M. (2021). Effects Of Prophylactic and Therapeutic Antimicrobial Uses in Small-Scale Chicken Flocks. *Zoonoses and Public Health*, *68*(5), 483–492. https://doi.org/10.1111/zph.12839

Vargas, D. A., Rodríguez, K. M., Betancourt-Barszcz, G. K., Ajcet-Reyes, M. I., Dogan, O. B., Randazzo, E., Sánchez-Plata, M. X., Brashears, M. M., & Miller, M. F. (2022). Bio-Mapping of Microbial Indicators to Establish Statistical Process Control Parameters in a Commercial Beef Processing Facility. *Foods*, *11*(8), 1133. https://doi.org/10.3390/foods11081133

Viator, C., Blitstein, J., Brophy, J. E., & Fraser, A. (2015). Preventing And Controlling Foodborne Disease in Commercial and Institutional Food Service Settings: A Systematic Review of Published Intervention Studies. *Journal of Food Protection*, *78*(2), 446–456. https://doi.org/10.4315/0362-028X.JFP-14-266

Viçosa, G. N., Botta, C., Ferrocino, I., Bertolino, M., Ventura, M., Nero, L. A., & Cocolin, L. (2018). *Staphylococcus aureus* undergoes major transcriptional reorganization during growth with *Enterococcus faecalis* in milk. *Food Microbiology*, *73*, 17–28. https://doi.org/10.1016/j.fm.2018.01.007

Wallace, C. A. (2014). HACCP-based food safety management systems: great in theory but can we really make them work in practice? *Perspectives in Public Health*, *134*(4). www.who.int/foodsafety/fs_management/

Wallace, C. A., Holyoak, L., Powell, S. C., & Dykes, F. C. (2014). HACCP - The difficulty with Hazard Analysis. *Food Control*, *35*(1), 233–240. https://doi.org/10.1016/j.foodcont.2013.07.012

Wallace, C. A., Sperber, W. H., & Mortimore, S. E. (2018). Food Safety for the 21st Century: Managing HACCP and Food Safety Throughout the Global Supply Chain (Second Edition). John Wiley & Sons Ltd.

Wang, R., Zhou, Y., Kalchayanand, N., Harhay, D. M., & Wheeler, T. L. (2020). Effectiveness and Functional Mechanism of a Multicomponent Sanitizer against Biofilms Formed by *Escherichia coli* O157:H7 and Five *Salmonella* Serotypes Prevalent in the Meat Industry. *Journal of Food Protection*, *83*(4), 568–575. https://doi.org/10.4315/0362-028X.JFP-19-393

Wang, W., Baloch, Z., Jiang, T., Zhang, C., Peng, Z., Li, F., & Fanning, S. (2017). Enterotoxigenicity and Antimicrobial Resistance of *Staphylococcus aureus* Isolated from Retail Food in China. *Frontiers in Microbiology | www.Frontiersin.Org*, *8*, 2256. https://doi.org/10.3389/fmicb.2017.02256

Wen, X., Chen, F., Lin, Y., Zhu, H., Yuan, F., Kuang, D., Jia, Z., & Yuan, Z. (2020). Microbial indicators and their use for monitoring drinkingwater quality-A review. *Sustainability (Switzerland)*, *12*(6). https://doi.org/10.3390/su12062249

Wessels, K., Rip, D., & Gouws, P. (2021). *Salmonella* in chicken meat: Consumption, outbreaks, characteristics, current control methods and the potential of bacteriophage use. In *Foods* (Vol. 10, Issue 8). MDPI AG. https://doi.org/10.3390/foods10081742

WHO. (2015). WHO estimates of the global burden of foodborne diseases: Foodborne disease burden epidemiology reference group *2007-2015*. https://apps.who.int/iris/handle/10665/199350

WHO. (2022, May 19). Major Foodborne Illness and Causes. Food Safety. https://www.who.int/news-room/fact-sheets/detail/food-safety

Woh, P. Y., Thong, K. L., Behnke, J. M., Lewis, J. W., & Zain, S. N. M. (2017). Characterization of nontyphoidal *Salmonella* isolates from asymptomatic migrant food handlers in peninsular Malaysia. *Journal of Food Protection*, *80*(8), 1378–1383. https://doi.org/10.4315/0362-028X.JFP-16-342

Woh, P. Y., Thong, K. L., Lim, Y. A. L., Behnke, J. M., Lewis, J. W., & Mohd Zain, S. N. (2017). Microorganisms as an Indicator of Hygiene Status Among Migrant Food Handlers in Peninsular Malaysia. *Asia-Pacific Journal of Public Health*, *29*(7), 599–607. https://doi.org/10.1177/1010539517735856

Wu, S., Huang, J., Wu, Q., Zhang, J., Zhang, F., Yang, X., Wu, H., Zeng, H., Chen, M., Ding, Y., Wang, J., Lei, T., Zhang, S., & Xue, L. (2018). *Staphylococcus aureus* isolated from retail meat and meat products in China: Incidence, antibiotic resistance and genetic diversity. *Frontiers in Microbiology, 9* (Nov). https://doi.org/10.3389/fmicb.2018.02767

Wu, X., Suksawat, F., Richards, A. L., Phommachanh, S., Phongaran, D., & Angkititrakul, S. (2020). Evaluation of the containment of antimicrobial-resistant *Salmonella* species from a hazard analysis and critical control point

(HACCP) and a non-HACCP pig slaughterhouses in Northeast Thailand. *Pathogens*, *9*(1). https://doi.org/10.3390/pathogens9010020

Xing, X., Li, G., Zhang, W., Wang, X., Xia, X., Yang, B., & Meng1, J. (2014). Prevalence, Antimicrobial Susceptibility, and Enterotoxin Gene Detection of *Staphylococcus aureus* Isolates in Ready-to-Eat Foods in Shaanxi, People's Republic of China. *Journal of Food Protection*, *77*(2), 331–334. https://doi.org/doi: 10.4315/0362-028X.JFP-13-301

Yadav, H., Mahna, R., & Rkehi, T. (2015). HACCP System and Difficulties in its Implementation in Food Sector Home Science. *PARIPEX- Indian Journal of Research*, *4*(7).

Yang, J. J., Cheng, A., Tai, H. M., Chang, L. W., Hsu, M. C., & Sheng, W. H. (2020). Selected Mutations by Nemonoxacin and Fluoroquinolone Exposure among Relevant Gram-Positive Bacterial Strains in Taiwan. *Microbial Drug Resistance*, *26*(2), 110–117. https://doi.org/10.1089/mdr.2019.0048

Yulistiani, R., Praseptiangga, D., Supyani, & Sudibya. (2019). Occurrences of *Salmonella* spp. and *Escherichia coli* in chicken meat, intestinal contents and rinse water at slaughtering place from traditional market in Surabaya, Indonesia. *IOP Conference Series: Materials Science and Engineering*, *633*(1). https://doi.org/10.1088/1757-899X/633/1/012007

Zeaki, N., Johler, S., Skandamis, P. N., & Schelin, J. (2019). The Role of Regulatory Mechanisms and Environmental Parameters In Staphylococcal Food Poisoning And Resulting Challenges To Risk Assessment. *Frontiers in Microbiology*, *10*(JUN). https://doi.org/10.3389/fmicb.2019.01307

Zerabruk, K., Retta, N., Muleta, D., & Tefera, A. T. (2019). Assessment of Microbiological Safety and Quality of Minced Meat and Meat Contact Surfaces in Selected Butcher Shops of Addis Ababa, Ethiopia. *Journal of Food Quality*, *2019*. https://doi.org/10.1155/2019/3902690

Zhang, X., Peng, Z., Li, P., Mao, Y., Shen, R., Tao, R., Diao, X., Liu, L., Zhao, Y., & Luo, X. (2020). Complex Internal Microstructure of Feather Follicles on Chicken Skin Promotes the Bacterial Cross-Contamination of Carcasses During the Slaughtering Process. *Frontiers in Microbiology*, *11*. https://doi.org/10.3389/fmicb.2020.571913

Zhao, F., Zhou, G., Ye, K., Wang, S., Xu, X., & Li, C. (2015). Microbial changes in vacuum-packed chilled pork during storage. *Meat Science*, *100*, 145–149. https://doi.org/10.1016/j.meatsci.2014.10.004

Zoellner, C., Aguayo-Acosta, A., Siddiqui, M. W., & Dávila-Aviña, J. E. (2018). Peracetic Acid in Disinfection of Fruits and Vegetables. *Postharvest Disinfection of Fruits and Vegetables*, 53–66. https://doi.org/10.1016/b978-0-12-812698-1.00002-9