

Evaluating contamination levels in fresh foods markets and assessing the likelihood of
implementing food safety programs in Paraguay

by

Ellen Andrea Méndez Sosa

B.S., Zamorano University - Honduras, 2017
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AN ABSTRACT OF A DISSERTATION

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Abstract

Paraguay is a country located in the southern cone region of the Americas; its population reaches over 7 million people, of which 26.4% lies under the poverty line and 11% is considered undernourished. Paraguay is a highly agricultural country; however, most of the food produced is destined for exportation. Paraguay sits among the top exporters of soybean and beef, and exports most of the corn and wheat produced in the country. Most of the domestically produced food that is destined for local consumption is produced by the denominated family agriculture or family farming which are small-scale farms operated mainly by family members and considered a rural productive activity. Vegetable producers are not required to have a food safety plan; however, they must follow Good Agriculture Practices (GAP) to produce vegetables products. Moreover, meat processors are required to implement Hazard Analysis and Critical Control Points (HACCP), but only for meat products that are intended for export.

Family farmers commonly distribute their products in fresh foods markets where other traders, distributors, and intermediaries also commercialize different products. Among the foods sold within these markets are vegetables that are typically consumed raw (e.g., lettuce, tomato, herbs, cucumber); therefore, it is critical that these markets maintain hygienic conditions and implement practices that reduce the likelihood of microbial contamination of the products sold. To adequately develop and assess the efficacy of strategies that address food safety in fresh food markets, it is important to collect baseline data regarding contamination levels and types of microorganisms present in the foods sold within the markets and the market environment itself.

Implementing food safety management systems (FSMS) in any stage of the food production chain can reduce the likelihood of contamination. HACCP is a process-based FSMS that is effective in preventing, reducing or eliminating hazards from food products. In addition to

having a FSMS, there is a need to have a system that addresses cultural factors and the way people behave around food safety: a behavior-based food safety system. The likelihood a practitioner performs the necessary behaviors to effectively implement a HACCP system can be a function of the practitioners own perceptions as to their capabilities, opportunities, and motivations to perform said behaviors. By evaluating and identifying factors that influence capabilities, opportunities, and motivations necessary to implement a HACCP system, it is possible to design education or engagement programs that increase the likelihood of implementing HACCP as a system in different Paraguayan food commodities and products.

Toward this goal, the first part of this dissertation describes a study aimed at establishing a baseline for microbial contamination in both vegetables (i.e., lettuce and tomato) and the market environment (i.e., food contact [FC] and non-food contact [NFC] surfaces) by enumerating indicator microorganisms and detecting pathogenic bacteria. The second part of the dissertation describes a study that uses behavior theory to understand the likelihood that public sector practitioners implement HACCP programs within food processing facilities of Paraguay.

A total of 750 samples were collected from fresh food markets (275 FC, 274 NFC, 97 lettuces, and 104 tomatoes) for microbial analysis. Enumeration data of indicator microorganisms (i.e., aerobic counts, Enterobacteria, total coliforms, and generic *Escherichia coli*) were measured for each sample as well as the presence of *Salmonella enterica* and *Listeria monocytogenes*. Enterobacteria showed high levels of contamination in all sample types with lettuce samples presenting the highest average (5.01 log CFU/g, Confidence Interval [CI]: 4.56, 5.46 log CFU/g), and NFC the lowest average (0.29 log CFU/cm², CI: -0.08, 0.66 log CFU/cm²). Results for generic *E. coli* showed levels below 2.5 log CFU/g or cm² for all sample types. Regarding pathogenic bacteria, presumptive positive results for *Salmonella* were observed in 13% of NFC surfaces, 42%

of FC surfaces, 49% of tomato, and 54% of lettuce samples; while for *L. monocytogenes*, presumptive positive results were obtained from 51% of NFC surfaces, 50% of FC surfaces, 29% of tomato, and 43% of lettuce samples. Nevertheless, surprisingly, no presumptive samples were confirmed as positive through PCR analysis for either pathogen. These results suggest that both vegetables and the environments within these markets contain high levels of microbial contamination. Levels observed in the environment are especially problematic for cross-contamination and may increase the likelihood of contaminated final products.

In the second study, a validated survey instrument was used to measure the perception of capability, opportunity, and motivation to implement HACCP as perceived by personnel from food-regulating bodies from the public sector who have an active role in the implementation of food safety programs within the food industry in Paraguay. A total of 38 responses were collected from both male (N=19) and female (N=19) participants who had (N=23) or did not have (N=15) a HACCP certification. Overall, participants' perceived opportunity to implement HACCP was lower ($p < 0.0001$) than participants' perceived capability or motivation to implement HACCP. Additionally, female participants showed a lower perceived capability to implement HACCP as compared to male participants ($p < 0.0001$). Analysis showed no statistical difference ($p > 0.05$), between male and female participants' overall perceived capabilities to implement HACCP; while perceived motivation was higher among male participants compared to female participants ($p < 0.0001$). Furthermore, having a HACCP certification increased male perceived capability ($p < 0.05$) and female perceived motivation ($p < 0.05$) to implement HACCP, although it did not significantly affect the perceived opportunity between male and female participants ($p > 0.05$). These data indicate that participants, particularly females, have lower perceived opportunity to implement HACCP, which could decrease the overall likelihood of implementing HACCP

systems. Nonetheless, education or engagement programs aimed at increasing perceived opportunity of members from food regulatory bodies could be effective in increasing the likelihood of implementing a HACCP system.

In summary, this dissertation shows that there is a need to address hygiene and sanitary conditions in fresh food markets in Paraguay to reduce risk of microbial contamination of the products being sold. Moreover, it is critical to improve opportunities for Paraguayan food-regulating public sector personnel—particularly women—that can lead to an increased likelihood of implementing HACCP as a system in the food industry.

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Approved by:

Major Professor
Jessie Vipham, Ph.D.

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Abstract

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Implementing food safety management systems (FSMS) in any stage of the food production chain can reduce the likelihood of contamination. HACCP is a process-based FSMS that is effective in preventing, reducing or eliminating hazards from food products. In addition to

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Dedication

To my family, present and future.

Chapter 1 - Literature Review

1.1 The importance of food safety programs in the food supply

Globally, an estimated 1 in 10 people suffer a foodborne illness each year with children under 5 years of age representing almost 30% of the affected population (64). In the Latin American Region, it is estimated that five pathogenic microorganisms (*Campylobacter* spp., non-typhoidal *Salmonella* spp., norovirus, *Taenia solium*, and *Toxoplasma gondii*) are responsible for more than 8,000 cases of foodborne diseases per 100,000 habitants and more than 2,500 deaths annually (49). These pathogens can be introduced into the food supply at any point of the production chain (i.e., from production/harvest to consumption). Therefore, developing and implementing effective food safety management systems (FSMS) across the production chain can help reduce the likelihood of contamination and ultimately reduce the incidence of foodborne illnesses (9, 19). FSMS involve creating strategic and systematic approaches that help identify, prevent, and reduce foodborne hazards with the main goal of creating an adequate environment for food production (19). While FSMS can be specific for different commodities or facilities and are developed around the needs and hazards identified in each product or location, there are internationally recognized guidelines and standards that serve as a guide for facilities to develop their own food safety systems (9). One of the most recognized FSMS is the Hazard Analysis and Critical Control Points (HACCP) system; which serves as the basis for many food safety certifications such as: Safe Quality Foods (SQF), Brand Reputation through Compliance (BRC, previously British Retail Consortium), Food Safety System Certification (FSSC 22000), Food Safety Preventive Controls Alliance (FSPCA), and the Codex Alimentarius Commission (Codex) (19, 37, 63).

When FSMS are implemented adequately, they contribute to the reduction of foodborne illnesses. In the US, after the regulatory requirement to implement HACCP in meat processing facilities (1996), it was estimated that foodborne illnesses were reduced by 20% by 2003 (63). An effective FSMS usually requires complex interactions among consumers, government, and the private sector. For instance, FSMS protect consumers from potential hazards while keeping the businesses in compliance with the regulatory requirements and demonstrate the company's commitment to food safety which can improve its reputation in the market and among consumers (19). Additionally, FSMS must be science-based and are generally supported by a risk analysis, and studies conducted by other supportive players such as universities or independent organizations (44). Figure 1.1 depicts the outcomes of an effective FSMS where public health is protected by effective FSMS that involves consumers, government, and private sector.

1.1.1 Hazard Analysis and Critical Control Points (HACCP)

The HACCP system is a prevention-based FSMS with a foundation of technical and scientific principles focused on prevention rather than inspection and with the main goal of producing safe food and the evidence to prove it (3). As previously stated, HACCP is an internationally recognized approach to ensuring food safety and it is a regulatory requirement in many countries including Australia, Canada, Japan, the United States (US), and the European Union (EU) (12). A HACCP plan aims to prevent, reduce, or eliminate significant hazards (i.e., physical, chemical, or biological) that can potentially contaminate food products (63). To successfully implement a HACCP system, a facility must follow a series of steps: develop prerequisite programs, conduct preliminary tasks, develop a HACCP plan that follows the seven principles, and ensure that all personnel comply with the requirements (Figure 1.2).

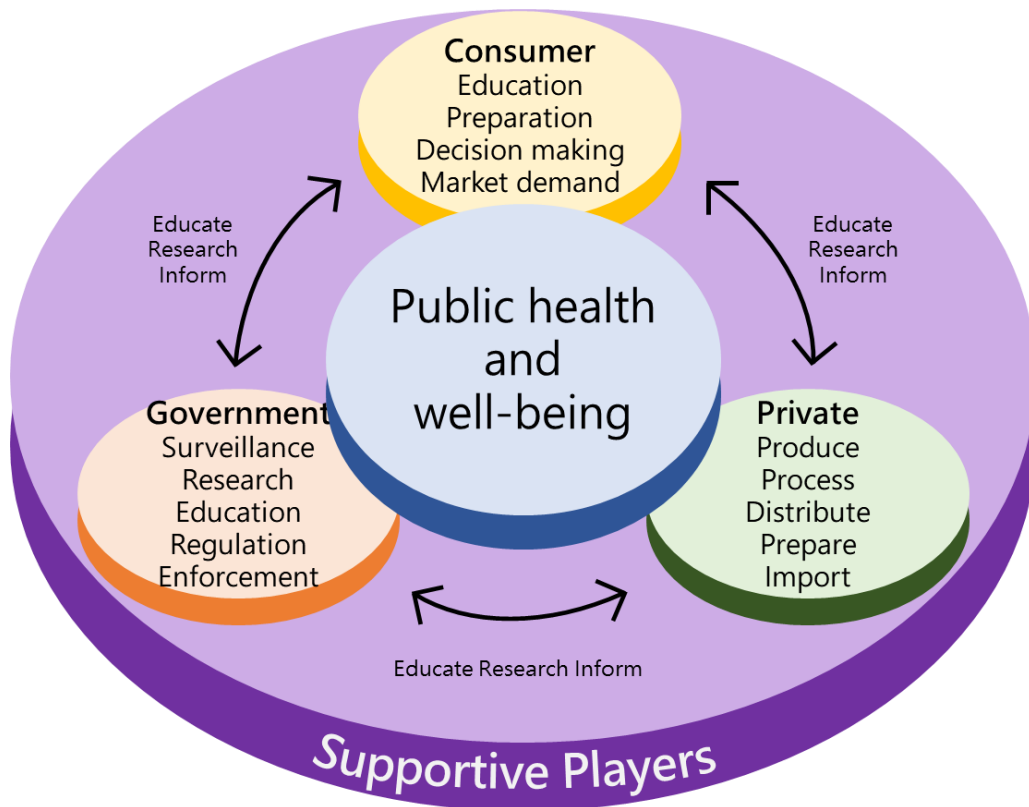


Figure 1.1. Attributes of an effective food safety system involves a dynamic interdependence among consumers, government, and the private sector. Supportive players have a role in education, research and spread of information and can be universities, social media or news, organizations, and others. Adapted from NAS et al., 1998 (44)

Prerequisite programs are a set of documents, procedures, and practices that provide the foundation for the HACCP system and serve as a support and reference for decision-making within the HACCP plan. Some examples of prerequisite programs are Good Manufacturing Practices (GMP), ingredient specifications program, allergen management programs, environmental monitoring program, and facilities (54). Prior to developing a HACCP plan, there are preliminary tasks that need to be completed by a facility to ensure the effectiveness of the HACCP system. These preliminary tasks are aimed to forming a HACCP team that oversees the implementation

and maintenance of the HACCP plan, and providing the context for the HACCP system including describing the food product, intended use and consumer, and developing and verifying a flow diagram that will facilitate subsequent steps in the HACCP plan (54). Finally, a facility must follow the seven principles of HACCP to effectively develop a HACCP plan that is specific for a product or process. The HACCP principles are 1) conduct a hazard analysis, 2) determine the critical control points, 3) establish critical limits, 4) establish monitoring activities, 5) establish corrective actions, 6) establish recordkeeping procedures, and 7) establish verification procedures (54).

In the US, facilities that process products, such as meat and poultry, that are regulated by the US Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS) or their delegates (e.g., state agencies), are required to be HACCP-compliant (9CFR417). However, the principles of HACCP can be implemented throughout the food production chain, and it will require knowledge of the product and production/processing activities, as well as commitment and involvement of management and personnel (18). Besides enhancing food safety and reducing the incidence of foodborne illnesses, a HACCP system allows for a more efficient process and use of resources, prevents recalling products, and improves export potential by providing evidence of compliance with international food safety standards (18). Despite all these benefits, in most countries of Latin American, implementation of HACCP as a system is not a regulatory requirement for food production/processing facilities. Specifically in Paraguay, meat processing facilities are required to be HACCP compliant only when their products are destined for exportation (55). Having a better understanding of the food production system in Paraguay would help identify areas for improvement in regard to food safety.

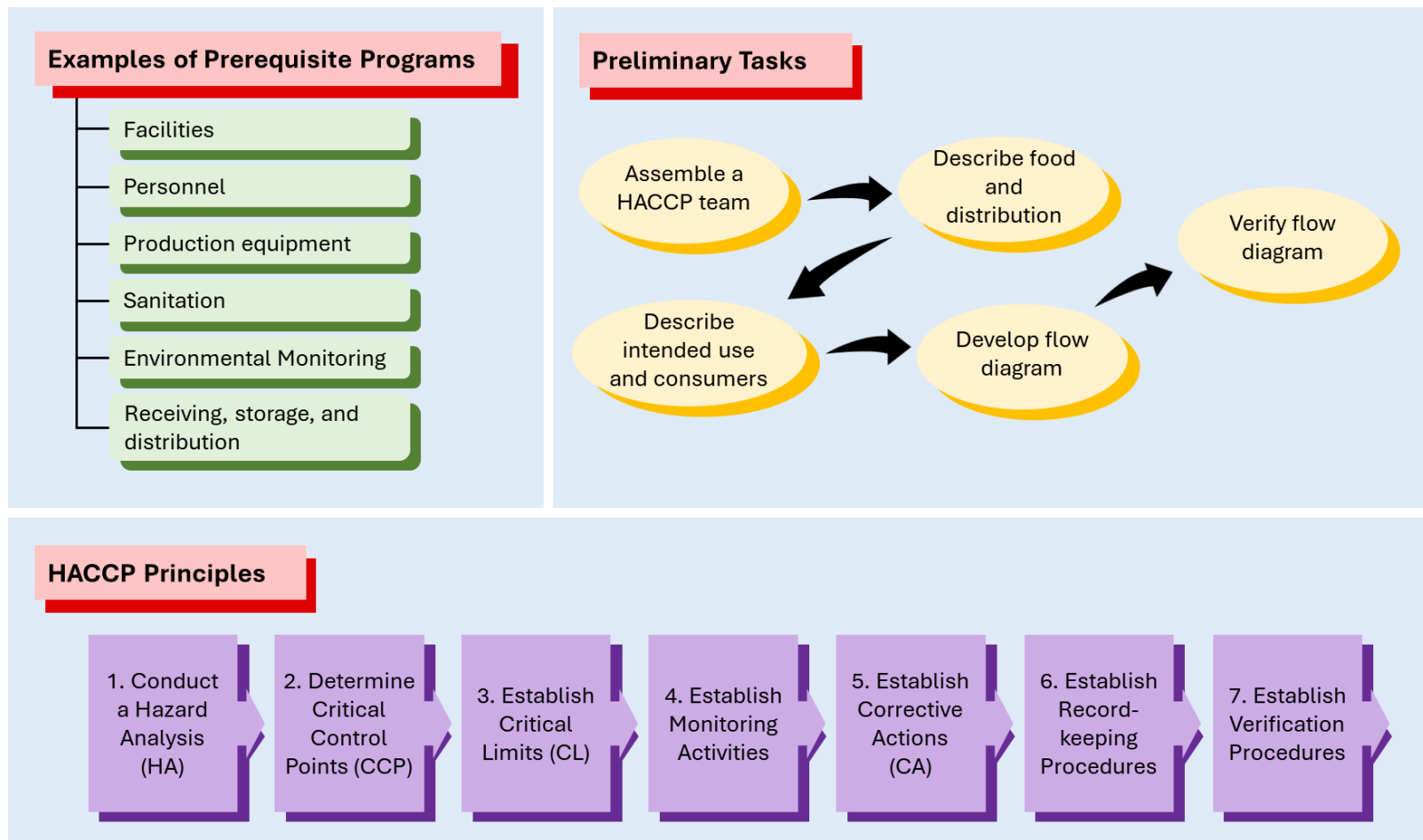


Figure 1.2. Implementation of HACCP as a system require development of prerequisite programs that will support the HACCP plan, preliminary tasks must be conducted and finally a HACCP plan must follow the seven principles.

1.2 Overview of the food system in Paraguay

Paraguay is a country located in the southern cone region of South America, and it has a population of just over 7 million people, of which 36.7% lives in rural areas (22). Paraguay is a highly agricultural country, as 42% of its territory (406,752 Km²) is considered agricultural land (i.e., arable, under permanent crops or pastures). Paraguay is among the top five soybean producers and exporters worldwide, and the top ten exporters of beef; it also export most of the corn and wheat produced in the country (35, 60). Agriculture, livestock, forestry, fishery, and mining comprise Paraguay's primary sector and account for 10.2% of their Gross Domestic Product (GDP) or 5,083.28 million USD. However, it is estimated that agriculture contributes directly and indirectly to 25% of the Paraguayan economy through other sectors that are connected to the food production chain, such as transport, logistics, or technology (13, 22, 35).

Nevertheless, the agricultural sector is unequally distributed as evidenced by the census conducted in 2008, where it was estimated that more than 90% of the agricultural land was owned by 2% of the population in the form of medium and large production systems, while the remaining 10% of the land was allotted for the denominated family agriculture (13, 34, 35). Paraguay defines family agriculture or family farming as a rural productive activity where family members are the primary labor in the production of agricultural products; moreover, no more than 20 employees are hired on a temporary basis during high production periods and farm sizes are under 50 Ha in the eastern region and 500 Ha in the western region (11, 15). Most of the domestically produced foods destined for local consumption are provided by family agriculture, such as cassava, beans, sesame, corn, onions, and tomato; however, the production is not enough to feed the population (13). In consequence, Paraguay is highly dependent on food importation particularly for vegetable products; for example, half of the fresh products that comprise the basic food basket (BFB) are

imported (35). In 2013 Paraguay imported 43.2 ton of vegetables and by 2017 that amount increased to 92.1 ton representing a 213% increase over 5 years. When looking at specific food products, importation of tomato from Argentina increased from 24% to 34%, bell pepper imported from Brazil increased from 6% to 73% and oranges imported from Brazil went from 0% to 55% in just 3 years (2013 to 2016) (34).

In rural areas, 42% of the population work in family agriculture, and farmers have limited access to resources such as technical assistance, new technologies, or financial credit. A 2008 assessment found that only 13.9% of Paraguayan farmers indicated receiving technical assistance mainly from the Directory for Agricultural Outreach (DEAg) within the Ministry of Agriculture, and only 15.9% had access to financial credits (13). Additionally, data shows that 26.4% of the population in Paraguay lives under the poverty line and 11% is considered undernourished with rural populations being particularly vulnerable to food insecurity (26). Moreover, during 2019-2021, 5.6% of the population were considered severely food insecure, meaning that at least one person in the household spent at least one full day without food (16, 26, 35). Food insecurity affects family farmers, and thus, a large proportion of these families (44.3%) produce foods for their own consumption, while 47% produce for both self-consumption and sale, and only 8.7% produce exclusively for commercial purposes (13). Of the farms that sell their products, most sell it to traders/merchants and distribution centers (62.1%), directly to consumers (23.4%), or to intermediaries (14.6%) (13).

Family farmers commonly distribute their products in informal markets or fresh foods markets and receive prices below the market rate for their products. They face challenges such as the internationalization of markets, standardization of products, upcoming regulations, participation of other intermediaries, and even illegal importation of fresh products (15, 26).

Moreover, in 2021, it was estimated that almost 15% of tomatoes, 35% of carrots and 56% of bell peppers consumed were illegally imported into the country (35). In 2019, the Ministry of Agriculture promoted the production of seven crops: sesame, sugarcane, onion, banana, cotton, and tomato; while these crops are not necessarily part of the BFB, they were potential targets for income generation for families (34). Commercialization of these crops is possible through distribution centers or directly to consumers in fresh foods markets that are located in both rural and urban areas, and they offer flexibility in terms of the type of products that can be sold within these markets.

1.3 Fresh foods markets

Fresh food markets or traditional markets can be defined as a space (on the street, public place, or delimited municipal space) where different products, including fresh foods, are sold. These markets are a source of food for families in rural, urban, and semiurban area; and they offer convenience in location, low price, and accessibility (48). There are different types of fresh foods markets depending on the legal framework, size, types of products commercialized, and even the type of target consumer (48). The 16/92 Municipal Ordinance of Asuncion, Paraguay, recognizes two types of vendors: *stationary street vendors* and *mobile street vendors* (Figure 1.3). Stationary street vendors must have a permit to use a public space for the sale of their products and they use materials that are fixed to or on the ground such as tables, kiosks, carts, etc. Mobile street vendors must have a municipal permit to sell products in public spaces and use mobile or portable tools to sell their products, such as baskets, portable stools, or wooden boxes (31).

In many countries, regulation of fresh foods markets falls under responsibility of government authorities who develop and enforce regulations that outline requirements for hygienic



Figure 1.3. Fresh foods markets in Paraguay, stationary street market (left) and mobile street market (right)

conditions, environmental conditions, and safety (48). The Pan-American Health Organization (PAHO) and the World Health Organization (WHO) recommend governments to encourage training for market vendors regarding food safety and other topics that benefit vendors. However, it is the responsibility of individual vendors to implement good practices when it comes to transporting, displaying, handling, and storing food products (48).

These markets are generally not included in public data collection systems, which leads to a lack of support when it comes to improving nutrition, food safety, infrastructure, and overall conditions of the markets (14, 48). As an example, a study conducted in Paraguay by the Food and Agriculture Organization of the United Nations (FAO), surveyed 11 traditional markets and found that the three largest groups of products sold in these markets were fruits (92,493 kg/month); other vegetables (61,870 kg/month); and grains, whiteroots/tuber (e.g., cassava, potatoes) and plantains (57,265 kg/month). This study evaluated demographic information and found that the participation of women ranged from 63% to 100% of the vendors present in the markets yet, the net take-home income was higher for male participants by more than double their female counterparts (14). The study also found that most vendors had access to water (~82%) and electricity (~79%), about half (~51%) had access to toilets, but only 30% reported having access to any type of cold storage (14).

Food safety risks within fresh foods markets are associated with hazards that can be physical, chemical, or biological in nature. Biological hazards include microorganisms that can be found in the environment, in animals, plants, and humans. These microorganisms can be transferred through food via primary contamination (e.g., during harvest or slaughter, transportation, storage), direct contamination (e.g., an infected person transfers the contaminant to the food), or cross-contamination (e.g., via contaminated surfaces or utensils). Other food safety risks in fresh foods markets are dependent on market size, location, infrastructure, and flow of

personnel, products or animals. Pests and animals may be reservoirs for pathogens that can be transferred to food if there is an inadequate program for pests/animal control (17). Moreover, these markets have been shown to serve as a potential source of zoonotic diseases, particularly those located in open spaces where animals and pests run freely throughout the market. One of the most common transmission routes of foodborne pathogens is through the fecal-oral route, this route can be either “short” or “long”. For example, a short fecal-oral route may occur when a food handler—carrying a foodborne pathogen—fails to follow proper hygienic measures after using the toilet and transfers the pathogen to a food product. Conversely, a long fecal-oral route occurs when fecal matter contaminates water or soil used to grow crops and pathogens are transfer to the edible crops (17, 48). This is why access to potable water and adequate toilet facilities and handwashing stations is essential for any food handler and must be available within fresh foods markets.

1.3.1 Hygiene and sanitation within fresh foods markets

Good hygienic practices (GHP) and effective sanitation are key to ensuring safe foods, particularly within the environment of fresh foods markets; it is critical that market vendors understand the importance of complying with GHP and sanitation. Adequate hygiene and sanitation may be determined by different approaches such as organoleptic evaluation (e.g., smell, color) or laboratory testing (e.g., indicator microorganisms, pathogens) (36). The level of indicator microorganisms is generally used to assess cleaning and sanitation; low levels of microorganisms such as total aerobic counts, total coliforms, Enterobacteria, and generic *Escherichia coli* are a good indication of hygiene and sanitation (23).

In fresh foods markets of Paraguay, data on microbial contamination of the environment and products sold is scarce. Two studies conducted in 2017 (19, 47) evaluated: 1) the food safety practices of vendors, and 2) levels of indicator microorganisms in ready-to-eat vegetable

sandwiches sold within a fresh foods market of Paraguay. The first study found several practices inconsistent with good hygienic practices; for example, open trash in close proximity to fresh foods, presence of animals and pests within the markets, and unhygienic environments (e.g., doors, walls, ceiling). However, most of the vendors (86%) washed their hands before and after handling food products, only 20% of the surveyed vendors reported having received training on adequate hygiene and food handling practices, and 28% had a valid food handling permit. Lastly, 43% reported that their operations were inspected by the municipality within the previous year (20).

The second study analyzed sandwich samples for total aerobic counts, total coliforms, *E. coli*, and *Staphylococcus aureus*. Their results showed that more than 70% of the samples were outside the permissible limits for aerobic counts, total coliforms, and *S. aureus*; and 30% of samples were non-compliant for *E. coli* as established by the Sanitary Norm of Peru (the Paraguayan Norm does not establish limits for microbial contamination) (53). As exemplified in these studies, there is a need to address hygiene and sanitation within fresh foods markets and develop interventions and policies aimed to improve food safety. Currently, in Paraguay, the requirements for food safety are not clear, and thus it is critical to discuss what laws and programs are in place that can be directed or adapted to address food safety.

1.4 Regulatory framework of food safety in Paraguay

To understand the development of public policies and regulations pertaining to food in Paraguay, it is essential to look at the history of the agricultural development in the country. After gaining independence in 1811, all land became property of the state with farmers managing and producing food for both domestic consumption and exportation. During that time, they exported mainly yerba mate, cattle, and fruits particularly to Argentina. Years later, during the War of the

Triple Alliance (1865-1870), lands were sold to multinational companies which concentrated land management under a few powerful families. During the Chaco War (1932-1935), most Paraguayan men were conscripted and as a consequence women oversaw production of food for their families and the Paraguayan military. Later, during the military dictatorship (1954-1988) there was increased foreign capital/investment in rural areas and the introduction of extensive cropping systems, new food industries, and transgenic grains. This period led to an agrarian reform where land was unequally distributed, and dictatorship's officials were granted most of this land. After the dictatorship period (1988-present) public policy dramatically changed due to the introduction of democratization. Moreover, in the National Constitution of 1992 was established where the right to food was codified with a particular focus on the elderly and children (34).

In 1991 the Southern Common Market (MERCOSUR) trade agreement was formed by Argentina, Brazil, Paraguay, and Uruguay; this agreement facilitates trade and market between these countries and internationally. In 1993 the "General Principles to Establish Microbiological Criteria and Patterns for Foods" resolution was adopted by MERCOSUR countries. This resolution broadly describes food classification according to epidemiological risk, sampling plans, microbial limits, and test methods to determine microbial contamination (38). However, the resolution establishes that microbiological criteria are based on recommendations made by the Codex Alimentarius and the International Commission on Microbiological Specifications for Foods (ICMSF).

Recently in October 2013, a draft framework *Law on Sovereignty, Food and Nutritional Security and the Right to Food* was presented to the Paraguayan Congress. The law was passed by Paraguay's legislative bodies on September 2018 but it was vetoed by the executive body in May 2019, who argued that existing public policies were sufficient and the resources required to

implement the new law were excessive (34). Several programs aiming to improve food security in Paraguay have been implemented with support from international organizations, some examples are the *National Plan for Food and Nutrition Sovereignty and Security* (PLANAL), *Comprehensive Nutritional Food Program* (PANI), *Food Pension for the Elderly in Poverty*, and others. However, most of these programs have not been continued over time and often, they finish once the international financial support ends (34).

The current national sanitary code (Ley N° 836/80) regulates the overall activities that have an impact on public health, including general requirements for food hygiene, facilities, culinary preparations, and food storage and transport (8). Additionally, three agencies at the national level are responsible for regulating and enforcing laws pertaining to specific food commodities: the National Institute for Food and Nutrition (INAN) regulates processed foods, the National Plant and Seed Quality and Health Service (SENAVE) oversees foods of vegetable origin, and the National Service of Quality and Animal Health (SENACSA) is responsible for foods of animal origin (1). Moreover, within the Ministry of Public Health and Social Welfare (MSPBS) there is a National Program for Food and Waterborne Communicable Diseases (PNETAYA) which states that *all* suspected cases of foodborne diseases must be reported to the General Directory of Health Surveillance (DGVVS) and PNETAYA (50). On the other hand, within INAN the Food Surveillance Program (PVA) controls physicochemical and microbiological aspects of food products. The resolution S.G. 887/21 of the MSPBS describes 17 categories of food products under surveillance by the PVA, none of which includes fresh fruits and vegetables. Moreover, most of the microbiological criteria used are borrowed from the MERCOSUR technical regulation, the Argentinean Food Code, the Peruvian Sanitary Norm, the Chilean Food Sanitary Regulation and just a few are established by the Paraguayan Norm (43).

The most recent report of the PVA describes the results for the food products (representing 14 food categories) surveilled during 2021, and outlines compliance and non-compliances for physicochemical and microbial characteristics by food category. Except for “Paraguayan” cheese, all the other food categories under surveillance, were in compliance for the physicochemical properties. However, for microbial testing, products in 8 out of the 12 food categories evaluated resulted in at least 1 sample as non-compliant. The group with the greatest non-compliances (39%) was ready to eat products (e.g., salad, sandwich, dressings, etc.) for which enumeration of total coliforms, *E. coli* and coagulase positive *S. aureus* were above the established limit (10^3 MPN/g for total coliforms, 10^2 MPN/g for presumptive *E. coli*, and 10^2 CFU/g for *S. aureus*), and only detection of *Salmonella* spp. was in compliance (non-detected) (27).

In a special report published in 2023, the PVA reported 16 foodborne outbreaks and 454 individual cases in Paraguay between 2019 to 2022. Samples were collected only for 5 of the 16 outbreaks and found the following: in 2019 they detected *E. coli* on a food sample, fecal coliforms on utensils and food handler, *Salmonella* spp. on utensils, and *S. aureus* on a food processor. For the investigated outbreak in 2021, they identified *Salmonella* spp. in water samples; in 2022 they isolated *E. coli* and *Salmonella* spp. from food samples, and *Salmonella* Enteritidis from fecal samples (52). Despite the requirement to report all suspected foodborne cases to the surveillance programs, there is still an underestimation of foodborne diseases and an ineffective or lack of communication between the health officers and the food surveillance programs. Reports from PNETAYA and DGVS show that certain cases were notified with delays that limited the opportunity to collect samples, and that certain regions did not submit any information regarding foodborne diseases in over three years (51, 52). In order to reduce the likelihood of foodborne

illnesses, it is important to have a multidisciplinary approach and effective collaboration among stakeholders who are involved in the prevention of foodborne diseases.

1.5 A food safety culture approach

As discussed in section 1.1, FSMS are designed to reduce the likelihood of contamination and thus, the incidence of foodborne disease. However, often times, the key to achieving food safety is in the organizational culture and the way people behave (66). Several definitions for “Food Safety Culture” have been proposed; for example, the UK Health and Safety Commission (1993) define safety culture as “the product of the individual and group values, attitudes, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety programs” (65). Yiannas (2009) define food safety culture as “how and what the employees in a company or organization think about food safety. It’s the food safety behaviors that they routinely practice and demonstrate” (66).

Companies with a strong food safety culture share similar core values such as: *i) leadership at the top* when top leaders are committed to food safety and influence others to understand their role in food safety; *ii) confidence in the part of all employees* as all personnel trusts that the company is consistent and value food safety throughout; *iii) clear management visibility and leadership* when managers across all levels demonstrate and exemplify a proper attitude in regard to food safety; *iv) accountability at all levels* as employees throughout the organization understand the importance of food safety and behave in such way that demonstrate their commitment; and *v) sharing of knowledge and information* because sharing information and knowledge can influence someone’s attitude toward food safety (66). Through these values, a company provides the means for employees and management to be truly committed to food safety and at the same time, the

culture within the organization influences and motivates everyone to promote food safety from their position (66). Commonly, FSMS are process- or product-focused systems, but in recent years an additional people-focused approach has been proposed, a “behavior-based food safety management system” that addresses food safety, human behavior, and organizational culture (66). Food safety has been discussed broadly in previous sections, behavior will be discussed in section 1.6, thus, the following subsections will address cultural and social aspects that influence the effectiveness of an overall food safety system.

1.5.1 How “culture” influences food safety

The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines culture as “the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses lifestyles, ways of living together, value systems, traditions, and beliefs” (61). In a broader sense, culture can be understood as a socially learned behavior (59). Many factors influence the creation and shaping of culture, such as history, experience, and norms; moreover, many layers are comprised within a particular culture including a national level, regional level, gender, generation, social class, and a corporate level (2, 59) Hence, it can be inferred that extrinsic factors (e.g., location, company) and intrinsic factors (e.g., gender, age) will influence a person’s behavior regarding food safety.

A recent study evaluated the role of cultural dimensions (e.g., power distance, masculinity, uncertainty avoidance) in the prevailing food safety culture of companies across different countries (not including Latin America). Data showed that countries with a more masculine culture had more supportive enabling conditions (e.g., training, time, sanitation) and positive attitudes (e.g., personal hygiene, checking temperatures) toward food safety; while the perception of risk for food safety and hygiene were better under environments of low power distance and high individualism (46).

Data on the cultural aspects that influence food safety in Latin America are scarce; however, it is known that the Latin American region is often characterized by personalism (i.e., sense of connection and avoidance of direct confrontation to personal dignity), particularism (i.e., use of personal connections for individual benefit), and paternalism (i.e., authorities make decisions for subordinates) (25). Latin American countries have cultural practices that result in high in-group collectivism; medium power distance, assertiveness, and gender egalitarianism; and low uncertainty avoidance, future orientation, and institutional collectivism (25). The present document focuses on gender egalitarianism and how this can influence the effective implementation of food safety systems (i.e., HACCP system).

1.5.2 Gender inequality in Latin America and Paraguay

In the Latin America and the Caribbean region, more than 70 million women have joined the workforce since the 1980s and women participation has grown from 57% to 68% since 1997 (62). The Inter-American Development Bank (IDB) evaluated the gender gap in companies of Latin America for 2021 and showed that only 14% of the surveyed companies (N=1015, from 20 different countries) were owned or partially owned by women with 11% having a woman as the general manager. Moreover, junior positions had more female representation (36%) than higher positions (25%), but companies that had a female as general manager showed overall greater female participation than those managed by males (4). Furthermore, females had more participation (> 50%) in areas considered “soft” (e.g., human resources) as compared to other Science, Technology, Engineering, Mathematics (STEM)-related areas (< 35%). It has been suggested that this gap in STEM-related fields is affected by the lower opportunity that women have of being hired even when they have the right qualifications (4).

In Paraguay, the male to female population is close to equal, in 2022 it was estimated that 50.3% of the population were males while 49.7% were females (30). Statistics show that in 2023, the working-age population was comprised of 48.6% males and 51.4% females; nevertheless, the actual working force population had more male representation (57.1%) than female (42.9%) while the non-working population was predominantly female (72.2%) (29). Additionally, it was reported that the average national monthly wage in 2023 was \$384.63 with male wages being 125% higher than those for females. In the primary sector (i.e., agriculture, farming, hunting, and fishing) the average monthly wage was \$290.09 with males earning 198% higher salaries than women (\$313.46 vs. \$157.97) (29).

Regarding access to education, article 76 of the Paraguayan Constitution states that primary education shall be obligatory and free which allows most of children and adolescents (ages 6-11) to have access to education (> 94%). Data shows that females in Paraguay enroll in tertiary education more than males (43% vs 36.7%). Among the reasons why males stop attending schools were the need to work (38.6% vs 21% in females) and because they “did not want to study” (10.6% vs 5.5% in females). Whereas females more frequently stopped their education due to family obligations or responsibilities (22.8% vs 5.9%) (47).

Paraguayan agriculture is gendered in other manners: land ownership, extensive agriculture, and financial credits are all higher in male populations (47). The primary sector has more male participation (28.4%) than female (16.5%), and while female leadership has increased in agricultural holdings since the 1990s (22% vs 9%), women are more likely to lead small farms of less than 5 Ha (26%) than farms larger than 50 Ha (15%) (47). In 2012, the majority of recipients of technical assistance from the Ministry of Agriculture were male participants (83%) as compared to females (17%). Similarly Financial Agricultural Loan Facility beneficiaries were 88% male and

only 12% female (47). In the Latin American and the Caribbean region, food security impacts males and females differently, this gender gap grew from 9.4 in 2020 to 11.3 in 2021. During times of crisis (e.g., COVID-19 Pandemic) women have less access to resources, information, and opportunities making them more vulnerable to food shortages and scarcity conditions (16). In Paraguay, for the years 2014-2015, it was estimated that 18.33% of males and 20.36% of females were food insecure creating a gender gap of 2.03 (62).

In Paraguay there are several organizations that work towards closing the gap between males and females, particularly within the agricultural field. In the 1980s, the Peasant Women Coordination was founded, and it became one of the pioneer women's groups in the country. Certain organizations are nationwide such as the National Coordination for Indigenous and Rural Working Women Organizations (CONAMURI), while others operate on a community, district, or departmental level. These organizations seek to improve access to land, basic services, public and free education, maternal and child health, equal rights and opportunities, participation of women in politics, and overall a more equalitarian society (47).

1.6 Behavior theory and the COM-B model

As mentioned before, human behavior is directly related to the food safety culture of an organization and thus the overall effectiveness of a food safety system. Behavior has been extensively studied; in the literature there are numerous (> 50) behavioral theories that aim to explain or classify behavior, but there is no accepted consensus of the definition of “behavior” or “behavioral theory” (33). Baum W. (2013) proposes four principles for understanding behavior: *i.* only whole living organisms behave, *ii.* behavior is purposive, *iii.* behavior takes time, and *iv.* behavior is a choice (5). Additionally, Levitis et al. (2009), propose the definition of *behavior* as

“the internally coordinated responses (actions or inactions) of whole living organisms (individuals or groups) to internal and/or external stimuli” (5). On the other hand, a definition of *theory* proposed by Kerlinger (1986) is a structured framework consisting of interrelated concepts, their definitions, and propositions that establish organized connections between variables, with the goal of explaining and predicting phenomena (21). On a study published in 2005, Michie et al., identified a total of 128 exploratory constructs from 33 psychological theories of which, 33 key constructs were identified as relevant for either understanding and changing behavior or particularly relevant to change behavior of healthcare professionals. This framework called “Theoretical Domains Framework (TDF)” was further validated (7) and the constructs were classified or grouped into 14 broader “domains” listed below:

- | | |
|---|--|
| • Knowledge | • Intentions |
| • Skills | • Goals |
| • Social/professional role and identity | • Memory, attention and decision processes |
| • Beliefs about capabilities | • Environmental context and resources |
| • Optimism | • Social influences |
| • Beliefs about consequences | • Emotion |
| • Reinforcement | • Behavioral regulation |

More recently, Michie et al. (2011) developed a framework for understanding behavior that involved the interaction of three components or constructs: *Capability*, *Opportunity*, and *Motivation* creating the **COM-B System**. Under this framework, capability is understood as an individual’s psychological and physical capacity to engage in an activity, which requires knowledge and skills; therefore, it can be divided into physical or psychological capabilities (7, 36, 37). Opportunity involves all the factors that lie outside the individual that make the behavior

possible or prompt it, this is further classified as physical or social opportunities. Finally, motivation is defined as the brain processes that energize and direct behavior and include the habitual processes, analytical decision making, and emotional responding; as such this is divided into reflective or automatic motivation (7, 36, 37). The interaction between each of these constructs and a behavior has a bidirectional influence, for example, capabilities influence behavior and in return behavior influence capabilities. Additionally, there is a unidirectional influence from capability to motivation and opportunity to motivation (Figure 1.4).

When there is a lower perception of one or more of the COM-B system constructs, initiating or maintaining a change in behavior becomes very challenging. Therefore, a behavior change intervention can be introduced to effectively modify a behavior or behavior pattern; said intervention should be effective in the short-term and provide long-term benefits (40, 45). Michie et al. (2014), state that any given intervention can have several functions, and thus, proposes nine interventions functions: education, persuasion, incentivization, coercion, training, restriction, environmental restructuring, modelling, and enablement (40). *Education* increases knowledge and understanding and is directly linked to enhance psychological capabilities and reflective motivation. *Persuasion* utilizes communication to evoke feelings (positive or negative) and prompt a response; therefore, persuasion will influence both automatic and reflective motivation. *Incentivization* creates an expectation to receive a reward which will affect someone's motivation to behave in a certain way. Conversely, *coercion* creates an expectation to receive a punishment which also affects motivation. A *training* intervention promotes skills, as such, it influences both physical and psychological capabilities, physical opportunities, and automatic motivation. *Restriction* is based on the use of rules that reduce or increase opportunities to engage in a specific behavior, this type of intervention function is linked to both physical and social opportunities. By

restructuring the environment there is a change in the physical or social context that will influence physical and social opportunities, and the automatic motivation to perform a behavior. Through a *modelling* intervention, it is possible to provide examples that others can imitate or follow; therefore, modelling will impact social opportunities and automatic motivation. Finally, *enablement* allows to increase means or reduce barriers that can enhance someone's capability and/or opportunity; therefore, it is directly linked to physical and psychological capabilities, physical and social opportunities, and also automatic motivation (39, 40).

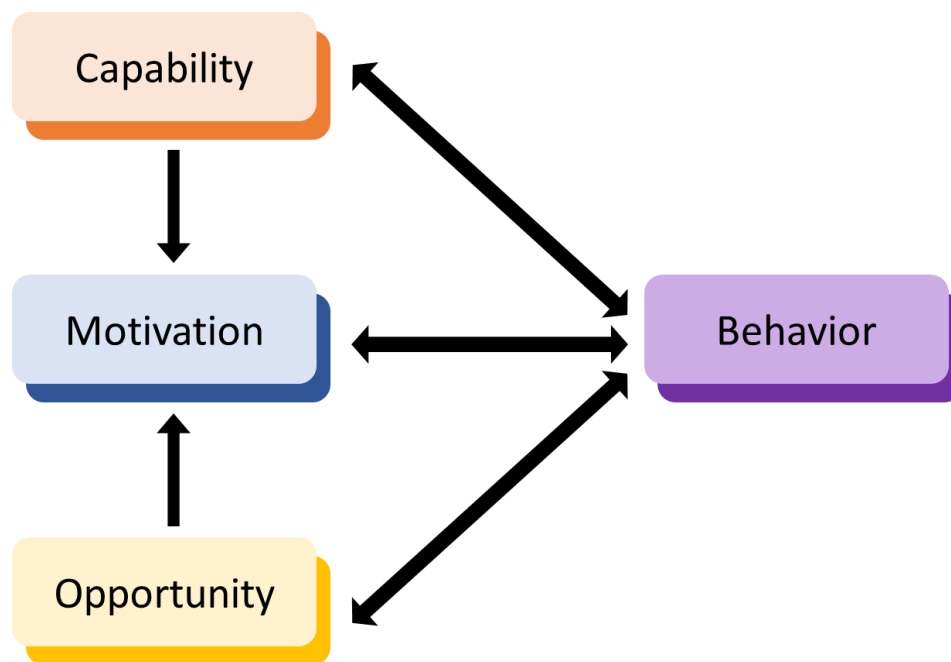


Figure 1.4. The COM-B model provides a framework for understanding behavior based upon three constructs. Adapted from Michie et. al., 2014 (39)

The COM-B model is the basis for the Behavioral Change Wheel (BCW), which serves to help understand behavior within the context it occurs (39). The BCW synthesizes common features of the behavioral frameworks and links them to a model that is broad enough that it can be applied

to any behavior in any setting (39). Any given intervention has the potential to change more than just one component of the behavior system and when using the BCW, the TDF fits well within each of the BCW components as illustrated in Figure 1.5. (39, 40). The COM-B model and TDF have been applied towards studying behavior change in different fields, but mainly in the health sciences, for example the amount of physical activity in a population, reduction in the use of cigarette, improving oral and dental hygiene, or changing eating habits (6, 10, 24). More recently, Mosimann et.al (2023), used the COM-B model and TDF framework to study food safety behaviors in fresh food market vendors in Cambodia providing a precedent to use these behavioral models to facilitate behavior changes and design effective interventions around food safety (41).

1.7 Implementing a HACCP system as a target behavior

To have a better understanding of the factors that influence the successful implementation of Hazard Analysis and Critical Control Points (HACCP) as a system in food producing facilities in Paraguay, the COM-B model can be utilized. Through the COM-B model, it is possible to assess capabilities, opportunities and motivations to implement HACCP as perceived from key stakeholders, such as inspectors, regulators, and directors within the food regulatory public sector in Paraguay. To this end, a review of the context for HACCP implementation in Paraguay is provided.

In 2006, a resolution was passed by the National Service of Quality and Animal Health (SENACSA) stating that developing and implementing a HACCP system was optional for all meat processing facilities (56). Driven by international requirements to comply with food safety standards when exporting food products, in 2019 this resolution was modified to require that all meat facilities that export their products must develop and implement a HACCP system (55).

Sources of behavior		TDF Domains
Physical	Capability	Physical skills
Psychological		Knowledge
		Cognitive and interpersonal skills
		Memory, attention and decision processes
		Behavioral regulation
Social	Opportunity	Social influences
Physical		Environmental context and resources
Automatic	Motivation	Reinforcement
Reflective		Emotion
		Social/professional role and identity
		Beliefs about Capabilities
		Optimism
		Intentions
	Goals	
		Beliefs about consequences

Figure 1.5. TDF domains fit well within the COM-B model. Adapted from Michie et. al., 2014 (39)

A 2014 report from representatives from the World Organization for Animal Health (OIE) highlights the differences in food safety between meat products destined for exportation versus products destined for local markets in Paraguay. The OIE recommended that inspections and food safety programs be implemented in all meat processing facilities regardless of the target market, and that efforts to strengthen collaboration between SENACSA and the Ministry of Public Health and Social Welfare (MSPBS) be made to support a “one-health” approach that protects public health (32). However, as stated before, currently meat facilities in Paraguay that do not export their products are not required to implement a HACCP system, and collaboration between SENACSA and the MSPBS remains on an *ad hoc* basis (55). Given that meat facilities that export their products have to comply with HACCP standards, it can be hypothesized that personnel from SENACSA have the capability and opportunity to implement HACCP as a system in all meat facilities. However, more research is needed to understand what motivates or limits personnel from SENACSA to implement HACCP in facilities that produce products for local consumption.

On the other hand, the National Plant and Seed Quality and Health Service (SENAVE) in their most recent compendium of guidelines published in 2014, provides a definition for the HACCP system but it does not required or recommend producers or processors to develop and implement HACCP (58). More recently in 2022, SENAVE approved a project aimed to improve the safety of food products of vegetable origin. A report from the working group of this project identifies as a central problem a limited control regarding the safety of products of vegetable origin and that current measures are not in accordance with national and international requirements in both quantity and quality (57). Among the potential causes identified for the limited control were limited laboratory capacity, unclear assignment of responsibilities, insufficient human resources, inadequate planification, and deficiency in norms and regulations. The report also describes that

negative consequences of inadequate control of food safety may result in restrictions and rejections for exported foods; closure of international markets; economic loss; negative image for the country; potential negative effects in human, animal, and environmental health; and contaminated food products (57). Based on this recent effort by SENAVE, it can be hypothesized that they are motivated to work towards improving food safety in the country; however, their perceived capabilities and opportunities to implement a food safety system such as the HACCP system need to be determined.

Additionally, in 2017 the National Institute for Food and Nutrition (INAN) issued a decree that required facilities that produce further processed foods to have a technical director who oversees implementation and control of food quality and safety systems. Regarding food safety systems, the only requirement established is the development and implementation of Good Manufacturing Practices (GMP), and the document has no mention of the HACCP system (28). Moreover, recently in November 2023 the MSPBS signed a technical regulation that establishes the quality and safety requirements for dairy products, becoming the first food category in the country to have a specific technical regulation. This document describes chemical and microbial characteristics for dairy products and the requirements to implement GMP in a processing facility, but no requirement around HACCP is mentioned (42).

Implementing HACCP systems in different food commodities in Paraguay would bring many benefits, it can open international markets in countries where the level of protection provided by their food safety systems can be deemed equivalent as to that provided by the HACCP system. Implementing HACCP can improve collaboration among the food-regulating public agencies in Paraguay as they could work together, share experience and knowledge toward developing and implementing the HACCP system. Moreover, an increased food safety culture and commitment

can be achieved by effectively implementing a HACCP system, and this will result in a higher protection of public health. Furthermore, strengthening public policies around food safety and increasing local capacity may lead to a higher likelihood of implementing HACCP as a system. However, before developing an intervention towards implementing HACCP in Paraguay, it is critical to identify what elements need to be addressed or changed, for example, improve opportunities, maximize capabilities, or increase motivation. Therefore, the implementation of HACCP as a system can serve as a target behavior to assess the perceived capabilities, opportunities, and motivation of personnel who work at public agencies that oversee food safety in Paraguay.

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Chapter 2 - Statement of the problem

Every year, millions of people around the world fall ill due to contaminated foods which represents a burden for public health, economies, social welfare, nutritional outcomes, and food security. Thus, it is critical that the food industry provides products that will cause no harm to consumers, particularly for vulnerable population (i.e., children, elderly, pregnant women, immunocompromised). Individuals who live under the poverty line are more susceptible to encountering food products of low quality and safety.

In the Latin American region, large amounts of foods are purchased in fresh foods markets; hence, ensuring the safety of foods sold in these environments can help prevent potential diseases due to contaminated foods. Unfortunately, there is a lack of information regarding the current status of microbial contamination in foods and environments of fresh foods markets of Latin America and more specifically, in Paraguay. Studies in other regions (e.g., Southeast Asia, Africa) have isolated pathogenic bacteria such as *Salmonella enterica*, *Escherichia coli*, *Listeria monocytogenes*, *Vibrio* spp. in fresh foods markets environments. It would be logical to hypothesize that similar foodborne pathogens are present in fresh foods markets of Latin America as well. The environments where these foods are sold provide the necessary conditions (e.g., temperature, humidity, time) for the proliferation of microorganisms especially when no intervention strategies (e.g., cleaning and sanitation procedures) are followed to prevent, reduce or eliminate such microorganisms. Before developing intervention strategies to control the presence of harmful microorganisms, it is necessary to have information on the current level of microbial contamination and types of microorganisms present to establish a baseline and measure longitudinal efficacy of the intervention. This information will help develop adequate interventions that prevent, reduce, or eliminate unwanted microorganisms and provide insights on the best

approaches towards maintaining good hygienic conditions that will ensure the safety of food products.

An effective intervention for improving food safety is to develop and implement Food Safety Management Systems (FSMS), that can be applied in all stages of the food chain (i.e., from farm to fork). An internationally recognized FSMS is the Hazard Analysis and Critical Control Points (HACCP) system, which is focused on preventing the presence of hazards into the final product. To develop and implement a HACCP program, it is required to have knowledge of the food product and production/processing process as well as the hazards and risks associated with them. Certain countries have mandatory requirements for food facilities to comply with the HACCP standards; however, in Paraguay, only meat facilities that export their products are required to have a HACCP system.

Furthermore, within food production environments it is critical to have a strong food safety culture among the personnel. While HACCP is a process-focused system, a behavior-based food safety system would be centered around people. It is important to understand what factors influence the way people behave around food safety and how this can impact the effective implementation of HACCP as a system. A behavioral model such as the Capability, Opportunity, Motivation-Behavior (COM-B) can be used to determine the perception of Paraguayan's food-regulating public sector personnel (e.g., regulators, inspectors, directors), regarding their perceived capabilities, opportunities, and motivations to implement HACCP. Additionally, external factors such as gender and having a previous knowledge of HACCP (e.g., HACCP certification) may also play a role in the perceived constructs of this model.

For these reasons, the present dissertation was designed to address the lack of information on microbial contamination in fresh foods markets in Paraguay and to understand the factors that

influence the implementation of HACCP as a system in the food industry of Paraguay. The main goals of this dissertation are to provide useful information regarding the microbial contamination in fresh foods markets of Paraguay utilizing indicator microorganisms (i.e., aerobic counts, Enterobacteria, coliforms and generic *E. coli*) as indication of hygiene, and foodborne pathogens (i.e., *Salmonella* and *L. monocytogenes*) that represent a risk for public health. Additionally, to assess the capability, opportunity, and motivation to implement HACCP as a system as perceived by the personnel from food regulatory bodies in Paraguay; and provide insights on perceived gender differences regarding implementation of HACCP.

Chapter 3 - Assessment of the microbial contamination levels in fresh foods markets of Paraguay utilizing indicator microorganisms and pathogenic bacteria

Abstract

Fresh foods markets represent a source of fresh fruits and vegetables for families in Paraguay; however, the environment within these markets allow for proliferation of microorganisms and pathogenic bacteria. To develop intervention strategies that address cleaning and sanitation, it is necessary to understand the current status of microbial contamination in fresh vegetables and the environment where they are sold. This research aims to enumerate indicator microorganisms and detect pathogenic bacteria in vegetables (i.e., lettuce and tomato) and surfaces (i.e., food contact [FC] and non-food contact [NFC]) found in fresh foods markets in Paraguay. Results showed high levels of Enterobacteria in all sample types with lettuce samples presenting the highest average (5.01 log CFU/g, Confidence Interval [CI]: 4.56, 5.46 log CFU/g), and NFC the lowest average (0.29 log CFU/cm², CI: -0.88, 0.66 log CFU/cm²). Moreover, results for generic *E. coli* enumeration showed levels below 2.5 log CFU/g or cm² for all sample types. No pathogenic bacteria (i.e., *Salmonella enterica* or *Listeria monocytogenes*) were confirmed positive through PCR analyses. Data suggests the need to improve cleaning and sanitation practices within the markets to reduce contamination levels, fecal contamination, and potential proliferation of pathogenic microorganisms. Further research is needed to identify other stages of food production where fresh vegetables may be susceptible to microbial contamination prior to reaching the markets.

3.1 Introduction

Fresh foods markets, also known as traditional markets or informal markets, are a source of food products mainly for families in rural areas of low- and middle-income countries, such as Latin American. These markets allow for a direct vendor-consumer interactions, similar to a farmer's market in the United States (US). Additionally, these markets often have exposed products that can be handled by consumers, and come into contact with animals, pests and insanitary conditions in the environment, all of which are potential sources for microbial contamination (16). Fresh fruits and vegetables are particularly susceptible to cross-contamination and pose a significant risk to public health as they are often consumed raw. Therefore, having a clean and hygienic environment is critical to ensure the safety of fresh fruits and vegetables sold in fresh foods markets. In Latin American countries, particularly Paraguay, there is a lack of awareness about food safety and a need to improve hygiene and sanitation within fresh foods markets (1).

When evaluating cleaning and sanitation in food environments, the use of indicator microorganisms helps determine the level of contamination. Moreover, these indicator organisms can be used to establish limits for proper sanitation or be utilized as a proxy to indicate control of pathogen within a food system (3). Pathogens—such as *Salmonella enterica*, *Listeria monocytogenes*, or pathogenic *Escherichia coli*—are commonly associated with foodborne outbreaks linked to fresh fruits and vegetables around the world. In the US for the year 2021, 40% of illnesses due to *Salmonella* were attributed to fruits (15.8%), seeded vegetables (10.9%), other produce (9.4%), and vegetable row crops (3.9%) [90% CI for all]; while 49.5% of illnesses due to *L. monocytogenes* were attributed to vegetable row crops (21.5%), fruits (18.0%), and other produce (10.0%) [90% CI for all] (6).

In Paraguay, there is a lack of data on the prevalence of bacterial pathogens in fresh foods markets and the products sold there. Likewise, data on foodborne illnesses attributed to fruits and vegetables is scarce. The National Program for Foodborne and Waterborne Diseases (PNETAYA) is responsible for surveillance and identification of etiological agents that cause isolated diseases or outbreaks in the country (19). From 2019-2022, PNETAYA reported 454 cases of foodborne illnesses where *Salmonella* was the most commonly identified etiological agent. However, none of these reports include traceback or source attribution data (19).

Currently, there is no surveillance program in Paraguay that actively monitors contamination levels in fresh foods markets environments or the products sold, or a baseline that can be used to develop and measure the efficacy of intervention strategies that address cleaning and sanitation. By establishing a baseline for microbial contamination through quantification of indicator microorganisms and prevalence of pathogenic bacteria it is possible to generate information that will support decision-making towards improving food safety within these markets. Therefore, the objectives of this study are *i)* to establish the contamination level of indicator microorganisms (i.e., aerobic bacteria, Enterobacteria, coliforms and generic *E. coli*) to determine the level of hygiene and sanitation within these markets; and *ii)* to determine the prevalence of *Salmonella* and *L. monocytogenes* on surfaces and vegetable products (i.e., lettuce and tomato) sold in fresh foods markets located in Paraguay.

3.2 Materials and Methods

3.2.1 Samples collection

Three sampling trips to fresh foods markets located in Paraguay were conducted, two for pathogen detection in June 2022 (winter) and December 2022 (summer), and one for indicator

microorganisms' enumeration in August 2023 (winter); a total of 46 vendors were sampled each trip. From each vendor the following samples were collected: at least 4 tomatoes, at least 3 lettuce heads, 2 food contact (FC) surfaces, and 2 non-food contact (NFC) surfaces. Lettuces and tomatoes were purchased while surfaces samples were collected using a 3M™ Sponge-stick hydrated with 10 mL of Neutralizer broth (3M, St. Paul, MN); permission was obtained from the vendor to swab the surfaces from his or her stand. All samples were kept on ice and immediately transported to the National Service for Vegetable and Seeds Quality and Health (SENAVE) Laboratory for further analyses.

3.2.2 Enumeration of indicator microorganisms

Quantification of Total Aerobic Counts, Enterobacteria, Total Coliforms, and generic *E. coli* (henceforth *E. coli*) were assessed in all vegetables and environmental samples using AOAC Official MethodsSM (990.12 Aerobic Plate Count in Foods, 2003.01 Enumeration of *Enterobacteriaceae* in Selected Foods, and 991.14 Coliform and *Escherichia coli* Counts in Foods). Briefly, 10 ± 0.2 g of vegetables (i.e., lettuce leaves or tomato skin) was weighed and diluted into 90 ml of Buffered Peptone Water (BPW; BD Difco, Sparks, MD), followed by vigorous hand massage for 1 min; this homogenate was used to perform serial dilutions. For environmental samples, the sponge was squeezed several times to homogenize and then 1 ml was extracted and used to perform serial dilutions. Appropriate dilutions were plated onto the 3M™ Petrifilm™ Aerobic Count (AC), 3M™ Petrifilm™ *Enterobacteriaceae* Count Plate (EB), and 3M™ Petrifilm™ *E. coli* / Coliform Count (ECC) Plates respectively. AC plates were incubated at 35 ± 1 °C for 48 ± 3 h, EB plates were incubated at 37 ± 1 °C for 24 ± 2 h, ECC plates were incubated at 35 ± 1 °C for 24 ± 2 h for coliforms enumeration and an extra 24 ± 2 h at 35 ± 1 °C for *E. coli* enumeration. After incubation, colonies were counted following manufacturer

guidelines: for AC, all red colonies regardless of size or color intensity were counted; for EB, all red colonies with yellow zones and/or red colonies with gas bubbles with or without yellow zones were counted; for ECC, any red colony associated with entrapped gas was counted towards coliforms and any blue to red-blue colony associated with entrapped gas regardless of size or intensity was counted towards *E. coli* counts.

3 2.3 *Salmonella* detection

A protocol adapted from the FDA Bacteriological Analytical Manual (BAM) was followed for the detection of *Salmonella*. Briefly, 10 ± 0.2 g of vegetables (i.e., lettuce leaves or tomato skin) was weighed and diluted into 90 ml of Buffered Peptone Water (BPW), followed by vigorous hand massage for 1 min and 1 ml of this rinsate was transferred to 9 ml of Tryptic Soy Broth (TSB; BD Difco, Sparks, MD). Regarding environmental samples, sponges were diluted into 50 ± 1 ml of BPW. All samples were incubated at 35 ± 2 °C for 24 ± 2 h. After that, 0.1 ml of the overnight culture was transferred to 10 ml of Rappaport-Vassiliadis (RV; BD Difco, Sparks, MD) medium. An additional 1 ml for produce samples and 0.5 ml for environmental samples, were transferred from the overnight culture to 9 ml of Tetrathionate (TT; BD Difco, Sparks, MD) broth. These (RV and TT) were incubated at 42 ± 0.2 °C for 24 ± 2 h. Following incubation, all cultures were streaked onto Hektoen Enteric (HE; Remel, Lenexa, KS) agar and Xylose Lysine Desoxycholate (XLD; Remel, Lenexa, KS) agar and incubated at 35 ± 2 °C for 24 ± 2 h. After incubation, typical *Salmonella* colonies were considered presumptive positives and isolated onto Tryptic Soy Agar (TSA; BD Difco, Sparks, MD) for PCR confirmation. Typical *Salmonella* colonies were defined as blue-green to blue colonies with or without black centers on HE agar plates and pink colonies with or without black centers on XLD agar (27).

3.2.4 *Salmonella* confirmation

All presumptive positive samples were subjected to confirmation through real time PCR analysis using the *invA* gene (Table 3.1). A reaction volume of 25 μ L was prepared using 12.5 μ L of iQ Multiplex Powermix 2X (Bio-Rad, Hercules, CA), 1 μ L of primer mix (LGC Biosearch Technologies, Hoddesdon, UK) at 10 μ M concentration per primer, 0.5 μ L of probe at 10 μ M concentration and 11 μ L of PCR grade water, the DNA template was obtained from a fresh overnight colony grown on TSA. The PCR cycling was as follows: 95 °C for 10 minutes followed by 44 cycles of 95 °C for 15 sec and 60 °C for 50 sec and plate read (2).

3.2.5 *Listeria monocytogenes* detection

A protocol adapted from the FDA Bacteriological Analytical Manual (BAM) was followed for the detection of *L. monocytogenes*. Briefly, 10 ± 0.2 g of vegetables (i.e., lettuce leaves or tomato skin) was weighed and diluted into 90 ml of Buffered *Listeria* Enrichment Broth (BLEB; BD Difco, Sparks, MD) while environmental samples were directly diluted in 90 ml of BLEB. Samples were incubated at $30 \pm 2^\circ\text{C}$ for 4 h and then the BLEB supplement (BD Difco, Sparks, MD) was added as indicated by the manufacturer, then samples were incubated at $35 \pm 2^\circ\text{C}$ for 20 ± 2 h. Following incubation, all samples were streaked onto CHROMagar™ *Listeria* (CHROMagar, Paris, France) and Modified Oxford Agar (MOX; BD Difco, Sparks, MD) and incubated at $35 \pm 2^\circ\text{C}$ for 24-48 h. Plates were screened at 24 ± 2 h for typical *L. monocytogenes* colonies, if typical colonies were detected, these were considered presumptive positive and transferred to TSA, if no colonies were identified, plates were re-incubated for an additional 24 h. Typical colonies were defined as blue colonies (< 3 mm diameter) with regular and white halo on CHROMagar and black colonies with a black halo on MOX agar (27).

3.2.6 *L. monocytogenes* confirmation

All presumptive positives were subjected to confirmation using traditional PCR (22). The primers used are detailed in Table 3.1, the *iap* gene was used for *Listeria* spp. confirmation and the *lmo2234* was the target for *L. monocytogenes* confirmation. DNA was extracted from fresh overnight culture grown on TSB by centrifuging at 15,000 xg for 15 min, washing with DNase free water, centrifuging again at 15,000 xg for 15 min and resuspending the pellet in 50 µL of DNase free water, subsequently, cells were heated in a water bath at 95 °C for 10 min and centrifuged at 15,000 xg for 10 min to remove cell debris. Supernatant containing the DNA was used for PCR analysis. A 10 µL reaction was prepared using 5 µL of Promega GoTaq Green Mastermix (Promega, Madison, WI), 0.9 µL of each of the *iap* primers at 1 µM concentration, 0.3 µL of each of the *lmo2234* primers at 1 µM concentration and 1.6 µL of PCR grade water. The PCR cycling was as follows: 1 cycle at 95 °C for 15 min; 15 cycles of 94 °C for 1 min, 55 to 51 °C for 1 min touchdown of 3 cycles per temperature, and 72 °C for 1 min; 15 cycles of 94 °C for 1 min, 50 °C for 1 min, and 72 °C for 1 min; 1 cycle at 72 °C for 8 min. Results were visualized by gel electrophoresis using a 1.5% agarose gel and a band between 1450 and 1600 bp was expected for *Listeria* spp. while a band at 420 bp was indicative of *L. monocytogenes*.

3.2.7 Statistical Analysis

Results from indicator microorganism enumeration were reported and analyzed as log CFU/g or log CFU/cm². Statistical differences were determined using the SAS software (SAS Institute Inc., Cary, NC) and the GLIMMIX procedure was used to fit the statistical model, a Kenward-Rogers approach was used for the estimation of degrees of freedom and to make corrections on the estimated standard errors. The least square means were calculated and relevant pairwise comparisons were conducted using a significance level of $p < 0.05$. A block and nested

design were used where markets were considered the blocking factor for each vendor and sample type was nested within each vendor.

3.3 Results

A total of 750 samples were collected from fresh foods markets of which 245 were used for enumeration of indicator microorganisms and 505 for detection of pathogenic bacteria. Specifically, 92 food contact samples (FC), 92 non-food contact (NFC), 34 tomatoes, and 27 lettuces samples were collected for enumeration of indicator microorganism; while 183 FC, 182 NFC samples, 70 lettuces, and 70 tomatoes samples were collected for pathogen detection. Table 3.2 shows the levels of indicator microorganisms (i.e., aerobic counts, total coliforms, generic *E. coli*, and Enterobacteria) for all sample types. Lettuce samples showed a statistically higher ($p < 0.05$) levels for aerobic counts (7.19 log CFU/g, Confidence Interval [CI]: 6.79, 7.59 log CFU/g), total coliforms (4.86 log CFU/g, CI: 4.41, 5.32 log CFU/g), and Enterobacteria (5.01 log CFU/g, CI: 4.56, 5.46 log CFU/g) as compared to all other sample types; whereas NFC surfaces resulted in the lowest levels for all indicator microorganisms ($p < 0.05$). Not surprisingly, overall aerobic counts represented the highest levels of indicator microorganisms followed by Enterobacteria, then total coliforms, and lastly *E. coli*. Prevalence of *E. coli* (Table 3.3) was statistically higher on lettuce samples (62.96%, CI: 36.65%, 100%; $p < 0.05$) as compared to all other sample types. Interestingly, prevalence of *E. coli* in tomato samples (11.76%, CI: 3.09%, 30.25%) showed no statistical difference to that on FC surfaces (25%, CI: 15.84%, 37.52%) and to that on NFC surfaces (5.43%, CI: 1.73%, 12.72%). Conversely, enumeration data for tomato samples showed statistically higher ($p < 0.05$) levels of contamination as compared to both FC and NFC.

For pathogen analyses prior to confirmation, traditional microbiological analysis showed presumptive positive results for *Salmonella* in 54% of lettuce samples, 49% of tomato samples, 42% of FC samples, and 13% of NFC samples. Additionally, for *L. monocytogenes* presumptive positive results were observed in 43% of lettuce samples, 29% of tomato samples, 50% of FC samples, and 51% of NFC samples. However, surprisingly, no presumptive samples were confirmed positive through PCR analyses for either pathogen.

3.4 Discussion

This study presents bacterial contamination characteristics of Paraguayan fresh foods markets' environments and vegetables sold in such markets. All confirmatory tests were negative for both pathogens, which was surprising as both *Salmonella* and *L. monocytogenes* are commonly found in fresh foods markets throughout Latin America (5, 19, 21, 25). For example, *Salmonella* has been identified as the responsible agent for foodborne diseases in Paraguay (19) and both *Salmonella* and *L. monocytogenes* have been isolated from ready to eat or minimally processed vegetables in Brazil (21). However, it has also been proposed that when competing with other background microorganisms the ability of *Salmonella* and *L. monocytogenes* to adhere to surfaces is reduced (13, 14, 15, 26). It is possible that the negative detection results for these two pathogens is due to them being present at very low levels or their inability to proliferate over the competing background flora.

Nonetheless, an alternative explanation for the negative confirmatory results in *Salmonella* is a low specificity by the XLD and HE agars. Studies have found that in some cases, *Salmonella*-looking colonies grown on both XLD and HE belong to the genera *Citrobacter* spp. and *Proteus* spp. These two bacteria share characteristics with *Salmonella*, like the lack of fermentation of

lactose and the ability to produce hydrogen sulfide (H₂S) which creates the characteristic black colonies in both XLD and HE (17, 18, 23). *Citrobacter* spp. are one of the genera that comprise the total coliform group and *Proteus* spp. is part of the *Enterobacteriaceae* family. Given the high levels of coliforms and Enterobacteria obtained from the samples, it can be hypothesized that presumptive positive results for *Salmonella* could rather be *Citrobacter* spp. and/or *Proteus* spp. contamination.

Furthermore, regarding *L. monocytogenes*, the protocol followed for isolation was based on the FDA BAM while the protocol for PCR confirmation was based on the one described by Tan et al., (2019) (22). An initial PCR confirmation was conducted in Paraguay which resulted in inconclusive results due to many bands showing up during the gel electrophoresis visualization. Due to limitations with time and logistics, isolated cultures were frozen in duplicates using the cryocare beads (Key Scientific, Stamford, TX) and one set of isolates was shipped to Kansas State University for a second PCR confirmatory test while the second set remained in the SENAVE laboratory in Paraguay. During transport, several isolates were damaged and compromised the quality of the isolates; moreover, during subsequent confirmatory tests, positive controls resulted in negative results as well. A different protocol for PCR confirmation will be used in an attempt to confirm the identity of the isolates; however, due to time constraints, results are not shown in the present document.

When evaluating the quantities of indicator microorganisms, a high level of aerobic counts, total coliforms, and Enterobacteria were observed. Aerobic counts help determine the bacterial population in a sample, although it does not represent the entirety of the microbial population. They are commonly used to determine sanitary conditions within food environments, sensory acceptability, shelf-life, and compliance with good manufacturing practices (4). In the US, studies

have evaluated levels of AC in leafy greens (e.g., lettuce, spinach) and tomatoes obtained from farmers markets and have obtained levels of 5.6 and 3.7 log CFU/g respectively (12, 20). These levels are lower than the ones observed in the present study (7.2 [CI: 6.8, 7.6] and 5.7 [CI: 5.3, 6.1] log CFU/g respectively). Farmer's markets in the US are regulated by state or local (e.g., county) governments who require markets' managers to enforce food safety practices. Certain products that do not require temperature control or represent a low risk for food safety may be deemed exempt from having a food establishment license; however, those foods that are of higher risk (e.g., dairy, meats, cut produce) may have to meet additional standards or requirements for sale in farmer's markets (10). In Paraguay, there are no regulations for the types of products that may be sold in fresh foods markets and good handling practices are not enforced by the government.

On the other hand, Enterobacteria and coliforms are highly related to sanitation and the hygienic conditions during processing (4). In the US, the *Enterobacteriaceae* family is not commonly tested within the produce industry and rather coliforms and *E. coli* testing are used. The *Enterobacteriaceae* family comprises bacteria associated with the natural flora present in the intestines of animals and humans; but it also includes pathogens such as *Salmonella*, *E. coli*, and *Shigella* (9). It is important to note that coliforms are also a part of the *Enterobacteriaceae* family but are more commonly used as an indicator of fecal contamination. Low levels of coliforms in certain food products do not always represent a risk for public health; however, they can indicate poor production practices and inadequate sanitation (8). Studies that have evaluated the levels of coliforms in farmers markets observed 2.3 log CFU/g in leafy greens and between 1.5-3.8 log CFU/g in tomatoes while the levels of *E. coli* were < 1 log CFU/g for both (12, 20). The levels observed in our study for coliforms were higher for lettuce (4.86 log CFU/g, CI: 4.41, 5.32 log CFU/g) and similar for tomato (3.8 log CFU/g, CI: 3.38, 4.22 log CFU/g); whereas, for *E. coli* we

observed higher levels for both lettuce and tomato (2.04 log CFU/g [CI: 1.71, 2.37 log CFU/g]; and 1.53 log CFU/g [CI: 0.84, 2.21 log CFU/g] respectively). Studies in the US have also found prevalence of *Salmonella* in tomato (10.9%) and of *L. monocytogenes* in tomato (1.6%) and leafy greens (2.6%) (12, 20).

The presence of high levels of indicator microorganisms indicates that the environment within these markets is favorable for the proliferation of microorganisms, and the levels of coliforms and *Enterobacteria* show that there is a potential route for fecal contamination. Introduction of enteric pathogens into vegetable products may occur at any point during production, harvest, processing, transportation, or sale (7, 11). During pre-harvest, the two main contamination routes are through irrigation water and manure-amended soils; fecal matter and enteric pathogens may be introduced into water bodies via surface runoffs, discharge or treatment of wastewaters (7). If contaminated water is used to irrigate crops, it is possible to transfer microorganisms to the plant and/or to the edible part of the crop. Although vegetables have not traditionally been considered hosts for human pathogens, recent studies have shown that internalization of human pathogens into the plant tissue, formation of bacterial biofilms on plant surfaces, and a positive interaction between human and plant pathogen are possible (7, 24). For example, *Salmonella* has been isolated more frequently from produce affected by bacterial-rot and fungal-rot as compared to healthy samples; moreover, it was observed to have a larger population when *Xanthomonas vesicatoria* (a plant pathogen) was also present (24).

In summary, the present study provided information on the current level of contamination for the environment and two types of vegetables sold in fresh foods markets of Paraguay. Data suggests the need to improve cleaning and sanitation practices to reduce the proliferation of microorganisms and potential growth of harmful bacteria. Further research is needed to understand

the prevalence of pathogenic microorganisms that may represent a risk for consumers; however, this study presents an initial baseline that can be used to develop intervention strategies to enhance food safety within these markets.

3.5 Tables

Table 3.1. Target genes, primers and probe for confirmatory PCR for *Salmonella enterica*, *Listeria* spp., and *Listeria monocytogenes*

Bacterial specie	gene	Name	Sequence	Amplicon size	Reference
<i>Salmonella enterica</i>	<i>invA</i>	<i>invA</i> -F	5'-CGTGTTTCCGTGCGTAATA-3'	138 bp	Bai J., et al., 2014 (2).
		<i>invA</i> -R	5'-GCCATTGGCGAATTTATG-3'		
		<i>invA</i> -Pr	5'-FAM-ATTATGGAAGCGCTCGCATT-BHQ1-3'		
<i>Listeria</i> spp.	<i>iap</i>	<i>iap</i> -F	ATGAATATGAAAAAAGCAAC	1,450-1,600 bp	Tan X., et al., 2019 (20).
		<i>iap</i> -R	TTATACGCGACCGAAGCCAAC		
<i>Listeria monocytogenes</i>	<i>lmo2234</i>	<i>lmo2234</i> -F	TGTCCAGTTCCATTTTAACT	420 bp	Tan X., et al., 2019 (20).
		<i>lmo2234</i> -R	TTGTTGTTCTGCTGTACGA		

Table 3.2. Estimated levels of indicator microorganisms in samples collected from fresh food markets vendors in Asuncion, Paraguay

Indicator organism	Sample type	Log CFU/g or CFU/cm ²	95% CI
Aerobic Counts	Tomato	5.70 ^b	5.34, 6.07
	Lettuce	7.19 ^a	6.79, 7.59
	Food Contact	4.58 ^c	4.34, 4.83
	Non-food Contact	2.77 ^d	2.52, 3.01
Total Coliforms	Tomato	3.80 ^b	3.38, 4.22
	Lettuce	4.86 ^a	4.41, 5.32
	Food Contact	1.88 ^c	1.61, 2.15
	Non-food Contact	0.25 ^d	- 0.15, 0.65
Generic <i>Escherichia coli</i>	Tomato	1.53 ^a	0.84, 2.21
	Lettuce	2.04 ^a	1.71, 2.37
	Food Contact	0.77 ^b	0.46, 1.07
	Non-food Contact	0.05 ^c	-0.56, 0.66
<i>Enterobacteriaceae</i>	Tomato	3.92 ^b	3.51, 4.34
	Lettuce	5.01 ^a	4.56, 5.46
	Food Contact	2.37 ^c	2.08, 2.65
	Non-food Contact	0.29 ^d	-0.08, 0.66

Values are presented as estimated means with 95% confidence intervals (95% CI).

Statistical differences within microorganisms are indicated by different letters ^{a,b,c}

Alpha was set at $p < 0.05$

Table 3.3. Estimated prevalence of generic *Escherichia coli* in samples collected from fresh food markets vendors in Asuncion, Paraguay

Sample type	Prevalence (%)	95% CI
Tomato	11.76 ^{bc}	3.09, 30.25
Lettuce	62.96 ^a	36.65, 100.00
Food Contact	25.00 ^b	15.84, 37.52
Non-food Contact	5.43 ^c	1.73, 12.72

Values are presented as estimated means with 95% confidence intervals (95% CI).

Statistical differences are indicated by different letters ^{a,b,c}

Alpha was set at $p < 0.05$

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Chapter 4 - Assessing the Capabilities, Opportunities, and Motivations of Participants from Food Regulatory Agencies to Implement HACCP as a System in Paraguay

Abstract

Food Safety Management Systems (FSMS) allow for control of hazards that may cause foodborne illnesses in consumers; the Hazard Analysis and Critical Control Points (HACCP) is an internationally recognized FSMS within the food industry. There are numerous factors that influence the adequate development and implementation of HACCP as a system and to determine behavioral factors, a model such as the Capability, Opportunity, Motivation-Behavior (COM-B) can be used. This study aims to evaluate the perceived capabilities, opportunities, and motivations of participants, and the effect of gender and HACCP certification in the implementation of HACCP as a system. Results showed that the construct of opportunity was perceived as the most limiting factor, particularly for females ($p < 0.05$). Additionally, having a HACCP certification increased the perceived capability of males ($p < 0.05$); and enhanced the perceived motivation of females ($p < 0.05$). Data showed an effect of gender in the factors that influence the implementation of HACCP and provided information on the need to enhance opportunities for personnel in the public sector involved with food safety, particularly for women, to successfully implement HACCP as a system in Paraguay.

4.1 Introduction

Global estimates suggest that 1 in 10 individuals suffer from foodborne disease, with children under 5 years old constituting nearly 30% of those affected (13). In the Latin America

region, it's estimated that pathogens such as *Campylobacter* spp., non-typhoidal *Salmonella* spp., norovirus, *Taenia solium*, and *Toxoplasma gondii* contribute to over 8,000 cases of foodborne diseases per 100,000 inhabitants, resulting in more than 2,500 deaths annually (7). The presence of these pathogens in the food system can be prevented or reduced by the effective development and implementation of Food Safety Management Systems (FSMS) (3).

FSMS provide strategic and systematic approaches to identify, prevent, and mitigate foodborne hazards during food production (3). The primary goal of an FSMS is to establish an environment that is suitable for processing foods by ensuring that food safety is a top priority throughout the production process, from raw material to the distribution and sale of the final product (3). There are several FSMS that allow facilities to produce safe foods, but the Hazard Analysis and Critical Control Point (HACCP) System is the gold standard. HACCP is a dynamic system with a scientific base that addresses physical, chemical, and biological hazards, and is focused on preventing these hazards from entering the process or product (1). Additionally, HACCP is an internationally-recognized system for food safety control, with many countries (i.e., Australia, Canada, Japan, United States, and the European Union) requiring HACCP systems for the production of many different commodities or products (2).

In Latin America, most countries are in the early stages of developing food safety programs and their implementation is inconsistent throughout the region, very few countries have a legal requirement for food processing facilities to implement a HACCP system (12). In Paraguay, there is no legal requirement to implement HACCP in food-producing facilities, the National Service of Quality and Animal Health (SENACSA) only requires implementation of HACCP for meat processing facilities that export their products, but not for facilities that process products for domestic consumption (8). Meanwhile, the National Plant and Seed Quality and Health Service

(SENAVE) only requires that vegetable producers, processors, holders, or transporters comply with Good Agriculture Practices (GAP) which contribute to the production of safer food (9). The implementation of HACCP across commodities and for products destined for both domestic consumption and exportation in Paraguay would be possible through a joint effort between the private industry and public sector.

While FSMS are effective in controlling the process, it is critical to have a system focused on the people that addresses the food safety culture of an organization, this approach is a ‘behavior-based food safety management system’ (14). Numerous behavioral theories, such as the Theoretical Domains Framework (TDF) or the Capability, Opportunity, Motivation-Behavior (COM-B) model, have been proposed to study behavior. Recently, Mosimann et al., (2023) utilized the COM-B model to study food safety practices from market’s vendors in Cambodia (15). The COM-B model enables the assessment of perceived capabilities, opportunities, and motivations (i.e., constructs) of individuals or groups to engage in a behavior, for example a practice related to food safety (4).

It is important to note that perception of capability, opportunity, and motivation may also be influenced by other factors such as gender, age, or location. In Latin America, gender inequality is a relevant challenge that affects societies. Since 1997, women’s participation in the workforce in Latin America increased from 57% to 68%; however, women still experience unequal access to labor market and significant wage differentials (11). In Paraguay, 65.6% of the inactive labor force are women, and employed women make on average 70.6% the wages of their male counterparts. In agriculture, technical assistance favors male participants (83%) over females (17%) and women have less access to financial credits (12% vs 88%). Overall, these gender gaps are most pronounced in agriculture (6). To have a better understanding of the factors that can influence behavior around

food safety it is critical to address factors such as gender and HACCP knowledge (e.g., HACCP certification). Therefore, the objective of this research was to assess the capabilities, opportunities, and motivations to implement HACCP as a system as perceived by personnel within the Paraguayan food regulatory public sector. Moreover, to evaluate the effect that gender and having a HACCP certification has in the perception of these constructs.

4.2 Materials and Methods

4.2.1 Ethical approval

All research described was reviewed by the Institutional Review Board (IRB) at Kansas State University (Manhattan, KS) and by the Ethics Committee for Research at the Central Laboratory for Public Health (Asuncion, Paraguay) and deemed exempt (IRB-11592-Various and 234-2023). No participant received any form of remuneration for participating in the study.

4.2.2 Data collection

For this study, a survey instrument previously validated by Mosimann et. al. (2023) consisting of 33 questions was used (15). Questions were adapted to address likelihood of implementing HACCP in Paraguay, and all questions and instructions were translated to Spanish prior to distribution. The questionnaire (Table 4.1) was digitalized using Qualtrics XM (Seattle, WA) and distributed to potential respondents via email. Participants were asked to select their level of agreement with the statement presented (e.g., I know the reasons why food producers/processors adopt the HACCP system) using a 7-point Likert scale (1=Strongly disagree, 2=Disagree, 3=Somewhat disagree, 4=Neither agree nor disagree, 5=Somewhat agree, 6=Agree, and 7=Strongly agree). The survey instrument also collected demographic information of respondents

including gender, age, type of food products with which respondents work, and previous training on the HACCP system.

4.2.3 Participant selection

Two groups of participants were contacted to request voluntary participation in the present study. The first group consisted of attendees of two previous HACCP-certified courses provided by a team from Kansas State University to personnel from Paraguayan food regulatory bodies from the public sector (e.g. SENACSA, SENAVE). The HACCP courses were conducted in Paraguay during June 2022, and March 2023, and attendees were contacted via email 6 months after the end of the course with two reminder email 3 weeks apart. The second group was comprised by personnel from Paraguayan food regulatory bodies from the public sector who had not previously attended a HACCP-certified course. Potential participants for the second group were reached through points of contact within the food regulatory bodies who helped distribute the survey among personnel. Targeted participants were inspectors, regulators, advisors, directors, and other staff members from public regulatory bodies who play an active role in the development and implementation of food safety programs in the food industry in Paraguay.

4.2.4 Data analysis

Results were analyzed using the SAS Software (SAS Institute Inc., Cary, NC), a linear predictor included a fixed effect of gender (i.e., males and females), HACCP certification (i.e., having the certification and not having the certification) and the behavioral construct (i.e., capability, opportunity, and motivation) as well as their interactions. Dates for when participants received their HACCP certification were considered a random effect when applicable. The GLIMMIX procedure was used to fit the statistical model, and a Kenward-Rogers approach was used for the estimation of degrees of freedom and to make corrections on the estimated standard

errors. The least square means were calculated and relevant pairwise comparisons were conducted using a Bonferroni adjustment factor. A significant level of $p < 0.05$ was considered to make statistical inferences.

4.3 Results

4.3.1 Demographic information

A total of 72 participants opened the survey and proceeded to answer the questions but only 38 participants completed the questionnaire, responders were equally represented by self-identified males (19/38) and self-identified females (19/38). Out of the 38 respondents, 60.53% (23/38) belonged to the group with a HACCP certification (11 females and 12 males) and 39.47% (15/38) comprised the group without a HACCP certification (8 females and 7 males). Moreover, most of the participants (42.11%) were in the range of 35-44 years old, followed by 45-54 years old (23.68%), 25-34 years old (21.05%), and over 55 years old (13.16%). Participants were asked to define what type of products they regulate/produce/process to understand representativity within the food industry. More than half of the participants (52.63%) reported working with foods of animal origin, while the remaining 47.37% reported working with foods of vegetable origin, mixed origin, processed foods, or did not specify a food product (Figure 4.1).

4.3.2 Capability to implement HACCP

Perceived capability to implement HACCP received an overall score of 5.98 (Confidence Interval [CI]: 5.74, 6.22) showing a high perceived capability by all participants. Perceived capability was statistically higher ($p < 0.0001$) than perceived opportunity to implement HACCP; while no significant difference ($p = 0.4164$) was obtained between participants' perceived capability or motivation to implement HACCP (Figure 4.2A). Furthermore, there were no

significant differences in perceived capability between male (6.07, CI: 5.75, 6.41) and female (5.88, CI: 5.55, 6.21) respondents ($p = 0.4016$) as shown in Figure 4.2B.

To have a better understanding of each construct, the effect of gender, HACCP certification and their interaction was evaluated on the perception of each construct. Figure 3.3 shows the perceived capability from males and females with or without a HACCP certification. Interestingly, there were no statistical differences in participants' perceived capability to implement HACCP between females who had a HACCP certification (5.82, CI: 5.48, 6.15) and females who did not have a HACCP certification (5.96, CI: 5.57, 6.36; $p = 0.5674$). In contrast, perceived capability to implement HACCP was higher in males who had a HACCP certification (6.35, CI: 6.03, 6.68) versus males who did not have the certification (5.61, CI: 5.18, 6.03; $p = 0.0062$). Additionally, there were no statistical difference in participants' perceived capability to implement HACCP between males and females who reported having a HACCP certification nor between males and females who did not have a HACCP certification ($p = 0.1474$ and $p = 0.2184$ respectively).

4.3.3 Opportunity to implement HACCP

Participants' perceived opportunity to implement HACCP received an overall score of 5.12 (CI: 4.96, 5.28) which was significantly lower ($p < 0.0001$) than both participant's capability and motivation to implement HACCP (Figure 4.2A). Moreover, males showed in a statistically higher ($p < 0.0001$) perceived opportunity (5.71, CI: 5.13, 6.29) than females (4.50, CI: 3.88, 5.12; Figure 4.2B and Figure 4.3). Analysis showed no significant difference in the perceived opportunity to implement HACCP between participants with a HACCP certification and those without the certification ($p = 0.8515$), nor an interaction between gender and having a HACCP certification in participant's perceived opportunity to implement HACCP (Figure 4.3).

4.3.4 Motivation to implement HACCP

Overall, participants' perceived motivation to implement HACCP received a score of 5.87 (CI: 5.76, 5.98). There was no significant difference between perceived motivation or capability to implement HACCP ($p = 0.4164$); however, perceived motivation was statistically higher than perceived opportunity to implement HACCP ($p < 0.0001$; Figure 3.2A). Additionally, male participants showed a statistically higher ($p < 0.0001$) perceived motivation (6.19, CI: 6.04, 6.35) than female participants (5.55, 5.39, 5.69; CI: Figure 4.2B). When evaluating the interaction between gender and HACCP certification in the perceived motivation (Figure 4.3), no statistical differences were observed ($p = 0.8558$) between males with or without HACCP certification but a significant difference ($p = 0.0040$) was observed for females with or without HACCP certification. Furthermore, when comparing within the groups with and without HACCP certification, male participants had a higher perceived motivation ($p < 0.01$) than their respective female group counterpart (Figure 4.3).

4.3.5 Role of gender and HACCP certification

To further understand the variability of perceived behavioral constructs within each gender and groups with or without HACCP certification, results were evaluated for each functional group (i.e., females with HACCP certification, females without HACCP certification, males with HACCP certification, and males without HACCP certification). Except for males without HACCP certification, all other functional group showed a similar pattern where opportunity to implement HACCP was perceived as the lowest construct ($p < 0.05$) and no significant difference was observed between the perceived capability or motivation to implement HACCP ($p > 0.05$). Conversely, within the group of males without HACCP certification, perceived motivation to implement HACCP resulted in the highest perceived construct ($p < 0.05$) and no significant

difference ($p > 0.05$) was observed between capability or opportunity to implement HACCP (Figure 4.4).

4.4 Discussion

In this study, the perceived capabilities, opportunities, and motivations to implement HACCP were assessed through an online questionnaire distributed to personnel from food regulatory bodies in Paraguay. The effects of gender and having a HACCP certification were considered as external factors that could potentially introduce variability among participants; therefore, the role of gender and HACCP certification in the perception of the behavioral constructs was also assessed.

Perceived opportunity to implement HACCP resulted in the lowest perceived construct overall, and a noteworthy finding was that females perceived that they had less opportunities to implement HACCP than male participants. The construct of opportunity can be divided into physical and social opportunities; physical opportunities are afforded by the environment and involve factors such as time, resources, location or infrastructure, and physical affordance (e.g., have the physical strength). Social opportunities are afforded by interpersonal influences, cultural norms, and social cues as they influence the way people think and act (4). Results from this study showed that stakeholders perceive low opportunities towards implementing HACCP as a system and could benefit from an increased support (e.g., financial, technical) to introducing HACCP in the Paraguayan food system. Additionally, having received a HACCP certification did not result in an increased perception of opportunity to implement HACCP for neither male nor female participants or their overall perceived opportunity. Thus, other interventions are necessary to increase the perceived opportunity to implement HACCP in Paraguay.

Furthermore, publicly available data show that, in Paraguay, women have fewer opportunities than men to access resources (e.g., financial, technical) (6). In fact, findings from a study conducted in 2012 in Paraguay, found that men had more access to technical assistance from the Ministry of Agriculture than women (83% vs 17%). Additionally, access to financial agricultural credits also favored males over females (88% vs 12%) (6). Moreover, a census conducted in 2008 reported that 22% of agricultural land was managed by women; however, when it came to farm size, women more commonly lead small farms as compared to large. Data showed that 26% of small farms (< 5 Ha) were managed by women, and only 15% of large farms (> 50 Ha) had a female manager (6). Enhancing the perceived opportunity can influence the perceived motivation and directly influence the change of a behavior, therefore making efforts towards increasing the perceived opportunity – particularly for females – may increase the likelihood of implementing HACCP as a system.

The construct of capability can be further divided into physical capabilities (i.e., physical skills) and psychological capabilities which are related to knowledge, cognitive and interpersonal skills, and behavioral regulation. Not surprisingly, for this study, capabilities seemed to be perceived similarly by male and female stakeholders and it was a top construct for all functional groups except for males without HACCP certification. To develop cognitive skills, having access to education at an early age plays a crucial role. A report published by UN Women in 2015, showed that in Paraguay there is a small gap between males and females who have a formal education and there is a slight higher proportion of females (75.9%) who attend an academic institution as compared to males (73.8%) (6). The 4088/2010 Law in Paraguay states that basic and elementary education shall be obligatory and free in public schools; moreover, it was reported that for the period of 2006-2016 access to higher education increased by 61.7%. By 2016, 25.3% of people

between the ages of 18-24 had obtained a college degree (10). Data shows that perceived capabilities are similar for male and females, and while having a HACCP certification had no effect for female participants, it did increase the perceived capability for males. The COM-B model shows that capability directly influence motivation and behavior, it would be critical that to improve the likelihood of implementing HACCP as a system in Paraguay, capability remains a highly perceived construct among personnel in the food-regulating public sector.

Motivation is related to the brain processes that can energize and direct behavior and it can be further divided into reflective and automatic (5). Reflective motivation is related to those planned and conscious processes (intentions) and evaluations of our beliefs (good and bad). Automatic motivations are more intrinsic and are related to emotional reactions and desires, impulses and inhibitions (4). Motivation is influenced by both capability and opportunity, therefore the higher the capability and/or opportunity, the higher the motivation can be and ultimately, the greater impact on the behavior. Results from this study showed that overall male participants had a higher perceived motivation to implement HACCP than females, it is interesting to note that while males with or without HACCP certification showed no difference in the perceived motivation, females with a HACCP certification showed a significantly higher motivation than those without the HACCP certification. Having a HACCP certification did not have a significant effect for females in their perceived capability or opportunity; but, it enhanced their motivation significantly. As described before, motivation is influenced by opportunity and capability but not vice versa; unfortunately, although females feel motivated by obtaining their HACCP certification, this may not significantly affect their capability and/or opportunity to implement HACCP as a system. Lastly, it is interesting to observe that both males with and without HACCP certification have a higher perceived motivation than their females counterpart. This pattern could be related to

male participants also having a higher perceived opportunity that enhances their motivational construct.

Implementation of a HACCP system has proven to be effective in reducing the burden of foodborne diseases, in the United States, after the regulatory requirement to implement HACCP in meat processing facilities, it was estimated that foodborne diseases were reduced by 20% in 7 years (12). The HACCP system is an internationally recognized food safety management system and its implementation can benefit food companies, and consumers locally and internationally. Efforts from public and private sectors towards developing and implementing HACCP would provide the food industry with an effective strategy towards improving food safety and ultimately safeguarding public health.

Overall, the present study shows that opportunity to implement HACCP was the lowest perceived construct; therefore, in order to change (i.e. increase) the likelihood of implementing HACCP in Paraguay, an intervention that focuses on enhancing opportunities can be designed. The behavioral change wheel (BCW) proposed by Michie et al. (2014) suggests a group of 9 intervention functions that can be expected to be effective in changing a behavior in a target individual or group. The intervention functions specifically related to the construct of opportunities include the following: training, restriction, environmental restructuring, modelling, and enablement (4). Training imparts skills, and beyond educational knowledge, training someone in the practical approaches to implementing HACCP may result in an increased opportunity to do so. If regulations stated that food processing facilities must comply with HACCP, this would increase the social opportunity to implement HACCP through a restriction intervention function (4, 5). A challenging intervention is an environmental restructuring as this requires changes in the physical or social context which can involve changes in the culture; while this can be a highly effective

approach, it is also a slow process that may take a long time. Through a modelling approach, social opportunities can be enhanced; for example, if a food processing facility implements HACCP and sets an example, other industries may follow and implement a HACCP system as well. Finally, enablement through guidelines or technical support can provide the means and reduce barriers that result in improved opportunities to implement HACCP (4, 5).

In summary, this study provides data on the factors that influence the implementation of HACCP as a system in Paraguay. Participants perceived to have the capabilities to implement HACCP and a high motivation to do so; however, to successfully implement HACCP it is critical to improve the opportunities of stakeholders, particularly for women. Intervention strategies, such as financial support, regulations and guidelines, or technical training may increase such opportunities. The COM-B framework shows that enhancing opportunities will influence motivations and directly affect behavior; in return, behavior will influence all three constructs. In other words, by contributing to more opportunities to implement HACCP, the likelihood of implementing HACCP as a system may increase and in return, capabilities, opportunities, and motivations of personnel within food regulatory public sector will also be enhanced.

4.5 Tables and Figures

Table 4.1. Questionnaire used to assess perceived capabilities, opportunities, and motivations to implement HACCP as a system in Paraguay.

Question	COM-B construct
CAPABILITIES	
1. Have you received a HACCP certification?	Capability – Physical
2. I am very familiar with the HACCP standards and requirements.	Capability – Psychological
3. I know the reasons why producers/processors adopt HACCP programs.	Capability – Psychological
4. I know how much time is required to adopt HACCP standards and requirements in a food production/processing establishment.	Capability – Psychological
5. I know how much it costs to adopt HACCP standards and requirements in a food production/processing establishment.	Capability – Psychological
OPPORTUNITIES	
6. Most regulators/producers/processors in my zone have obtained a HACCP certification.	Opportunity – Social
7. Most regulators/producers/processors in my zone believe that it is important to obtain a HACCP certification.	Opportunity – Social
8. Other regulators/producers/processors in my zone frequently talk about the benefits of obtaining the HACCP certification.	Opportunity – Social
9. Government officers encourage me to obtain the HACCP certification for my food production/processing establishment.	Opportunity – Social
10. I have enough money to implement HACCP standards in my food production/processing establishment.	Opportunity – Physical
11. I have enough time to implement HACCP standards in my food production/processing establishment.	Opportunity – Physical
12. I have enough workforce to produce/process food products as described by the HACCP standards.	Opportunity – Physical
13. I know where I can learn more about the HACCP standards.	Opportunity – Physical

- | | |
|--|------------------------|
| 14. I know where financial aid is available to help me obtain the HACCP certification. | Opportunity – Physical |
|--|------------------------|

MOTIVATION

- | | |
|--|-------------------------|
| 15. Other regulators/producers/processors similar to me, think that I should obtain the HACCP certification. | Motivation – Reflective |
| 16. Consumers who buy food products from my food production/processing establishment expect me to have a HACCP certification. | Motivation – Reflective |
| 17. It would be difficult for me to produce/process food products according to the HACCP standards. | Motivation – Reflective |
| 18. It would be easy for me to obtain the HACCP certification for my food production/processing establishment. | Motivation – Reflective |
| 19. I plan to obtain the HACCP certification in the next 12 months. | Motivation – Reflective |
| 20. Producing according to the HACCP standards would improve the quality of my food products. | Motivation – Reflective |
| 21. My food production/processing establishment would make more money if it had the HACCP certification. | Motivation – Reflective |
| 22. It would be beneficial for my food production/processing establishment if I obtained the HACCP certification. | Motivation – Reflective |
| 23. I could sell my food products to more exporters if I had the HACCP certification. | Motivation – Reflective |
| 24. I could prevent people from getting sick if I produced/processed my food products according to the HACCP standards. | Motivation – Reflective |
| 25. I would obtain the HACCP certification if it increased my profits. | Motivation – Automative |
| 26. I would obtain the HACCP certification for my food production/processing establishment if this meant I can sell my products to new buyers. | Motivation – Automative |
| 27. I would obtain the HACCP certification if this would make my food products more popular among consumers. | Motivation – Automative |

28. I would produce/process my food products according to the HACCP standards if this made my products safer.	Motivation – Automative
29. Obtaining the HACCP certification would enhance my food production/processing establishment's reputation.	Motivation – Automative
30. I would produce/process according to HACCP standards if this would enhance the quality of my food products.	Motivation – Automative
31. The safety of my products affects my reputation as a regulator/producer/processor.	Motivation – Automative
32. The safety of my food products makes me proud.	Motivation – Automative
33. The quality of the food products of my food production/processing establishment makes me proud.	Motivation – Automative

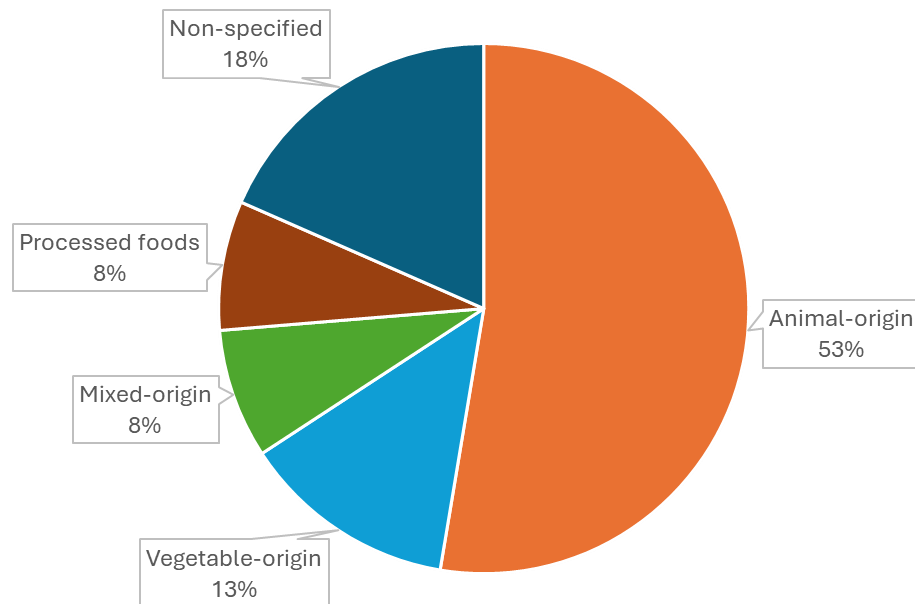


Figure 4.1. Food sectors represented among the participants of the questionnaire.

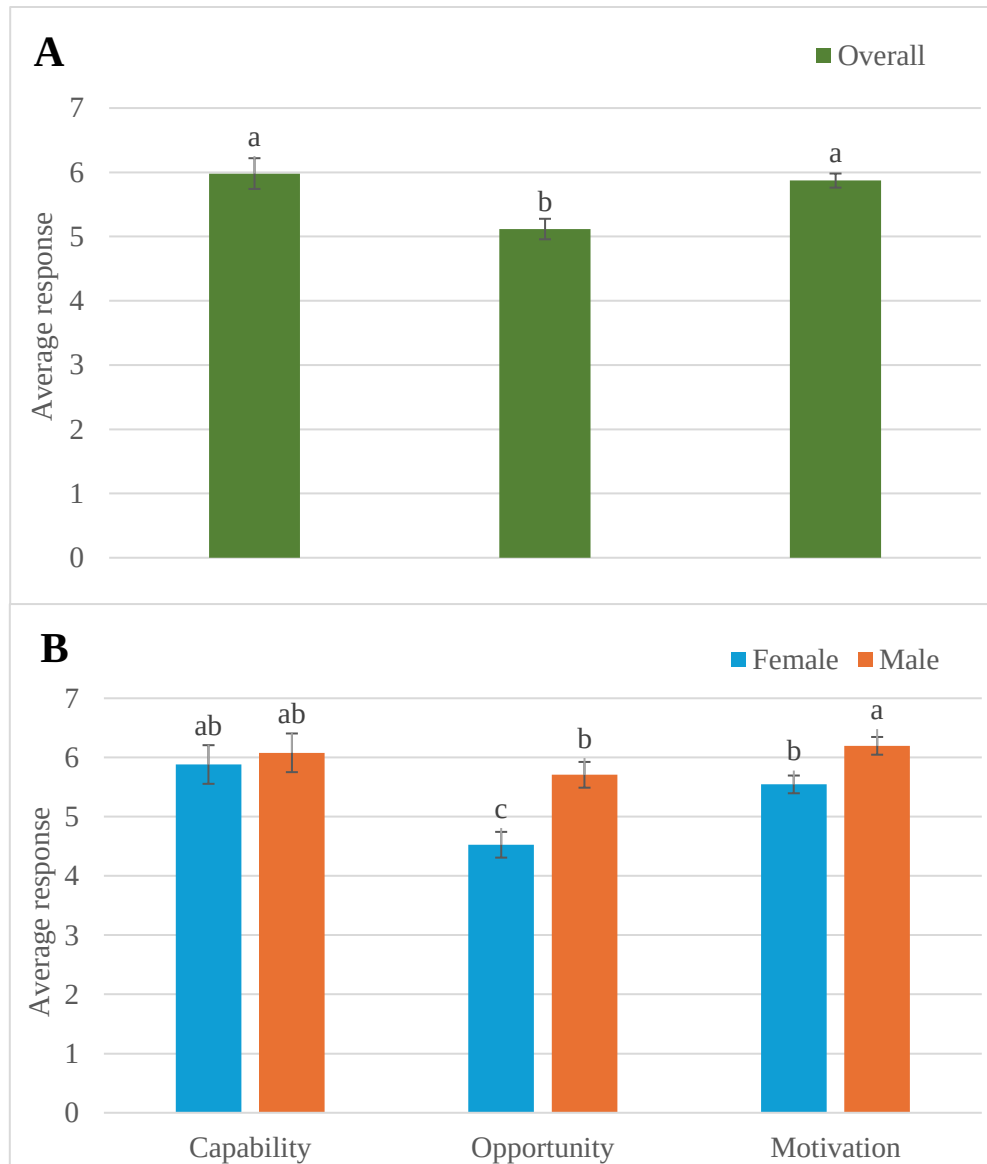


Figure 4.2. Estimated mean responses (1=Strongly disagree to 7=Strongly agree) with corresponding SE to the questions comprising the constructs of capability, opportunity and motivation; A) overall responses and B) by gender. Significant differences ($p < 0.05$) are indicated by different letters.

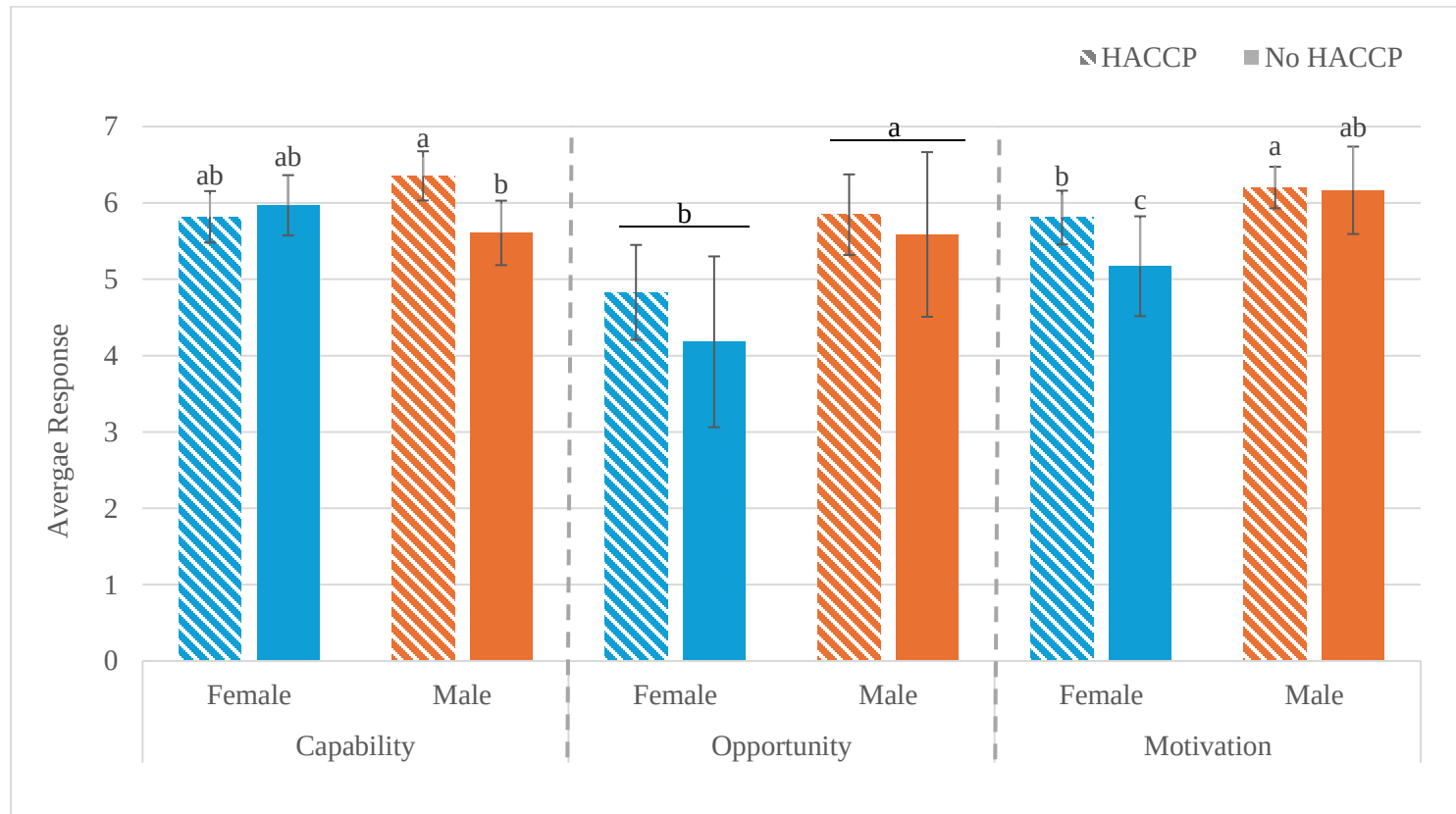


Figure 4.3. Estimated mean responses (1=Strongly disagree to 7=Strongly agree) with corresponding SE to the questions comprising the constructs of capability, opportunity and motivation by males and females with (stripped bars) or without (solid bars) a HACCP certification. Significant differences ($p < 0.05$) within each behavioral construct are indicated by different letters.

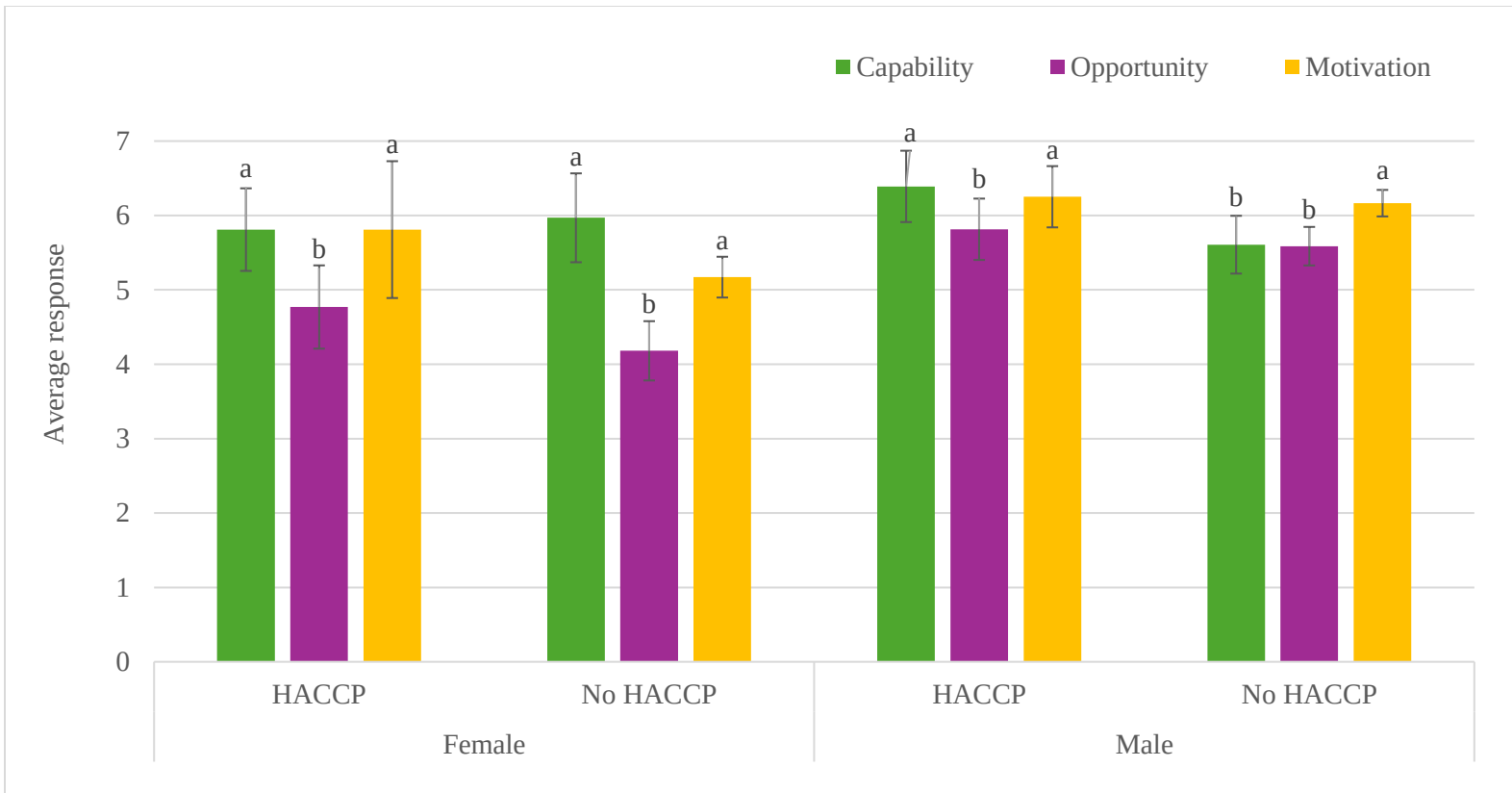


Figure 4.4. Estimated mean responses (1=Strongly disagree to 7=Strongly agree) with corresponding SE to the questions comprising the constructs of capability, opportunity and motivation by functional group (males or females with or without a HACCP certification). Significant differences ($p < 0.05$) within each functional group are indicated by different letters.

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Chapter 5 - Conclusions and Recommendations

The burden of foodborne illnesses is a challenge that affects the world, understanding the conditions that affect food safety on a local level can help implement more effective interventions that can reduce the incidence of foodborne diseases. The data presented in this document describe the current contamination levels in fresh foods markets of Paraguay and the limiting factors that influence the implementation of Hazard Analysis and Critical Control Points (HACCP) as a food safety system. In fresh foods markets, indicator microorganisms were found on levels that indicate the need to implement better sanitation and hygienic practices. Collecting samples along the production chain (i.e., from production to consumption) would provide a better understanding of the stages with higher risk for contamination prior to commercialization within these markets. Results from this study showed high levels of bacteria linked to fecal contamination (i.e., Enterobacteria, coliforms, and generic *Escherichia coli*) in all sample types and particularly high in lettuce samples. As lettuce is mainly consumed raw, it is important to maintain hygienic conditions that prevent the growth of harmful microorganisms, it would be interesting to further research at-home practices to sanitize these types of vegetables prior to consumption. Additionally, since neither of the pathogenic bacteria tested in this study was confirmed positive, hypotheses can be made that they were either present in very low levels, that cells were dormant, or that other type of microorganism restrict their growth. Analyzing other pathogenic microorganisms might provide insights of the risks associated with vegetable sold in fresh foods markets in Paraguay.

On the other hand, the second study provides insights on the factors that influence the implementation of HACCP as a system in the food industry in Paraguay. It was not surprising to learn that opportunities were a limiting factor toward implementation of HACCP and that gender played a role in the results. Moreover, having a HACCP certification impacted men and women

differently; for men having the certification enhanced their perceived capabilities whereas for women it improved their perceived motivation. Unfortunately, having a HACCP certification did not play a role in improving women's perceived opportunities. Overall, a trend was observed within all groups except males without HACCP certification (i.e., females with and without HACCP certification and males with HACCP certification), they perceived capabilities and motivations as significantly higher than opportunities. As the participants from this study were exclusively from the public sector, it would be interesting to extend participation to other stakeholders within the private industry and evaluate whether there is a difference between these sectors. While having a HACCP system is not mandatory in Paraguay, certain companies do comply with the HACCP requirements and would be compelling to evaluate their perception on expanding this practice throughout the country.

In summary, data presented in this document may be used to develop intervention strategies to improve hygienic and sanitation practices in fresh foods markets in Paraguay and to enhance the implementation of a food safety management system such as HACCP in Paraguay. These efforts can lead to producing safer food, reducing the incidence of foodborne disease, and protecting public health.

Appendix A - Online survey used to assess capabilities, opportunities, and motivations to implement HACCP in Paraguay



ACUERDO DE CONSENTIMIENTO:

El proyecto T-Fast (Sistemas y Tecnología Agrícolas para Facilitar el Comercio) en Paraguay tiene como objetivo simplificar, modernizar y armonizar los procesos para la exportación, importación y tránsito de productos agrícolas en Paraguay. El éxito de los programas depende de los aportes de las partes interesadas como usted. Está invitado a participar en esta encuesta porque su opinión, experiencia y recomendaciones son fundamentales para garantizar que los programas sean lo más eficaces posible.

Estimamos que esta encuesta se puede completar en aproximadamente 10 minutos.

Si bien se agradece, su participación en esta encuesta es voluntaria. Puede optar por no participar, no está obligado a responder ninguna pregunta que no desee responder y puede interrumpir la encuesta en cualquier momento sin ninguna penalización. Sus resultados se mantendrán confidenciales y no se solicitará ninguna información personal como nombre, correo electrónico o dirección postal que permita identificarlo. Además, todas las respuestas se mantienen en formato electrónico y protegidas con contraseña. Los resultados se utilizarán solo con fines académicos y no se compartirán con terceros. El protocolo ha sido aprobado por la Junta de Revisión Institucional de la Universidad Estatal de Kansas (KSU).

Le agradecemos su participación y si tiene alguna pregunta, no dude en ponerse en contacto con la Dra. Jessie Vipham en jessiev@ksu.edu.

Al marcar la casilla "Acepto", indica que:

- Ha leído la información anterior.
- Tiene 18 años o más.
- Participa en la encuesta de forma voluntaria.

☐ Acepto

☐ No Acepto



DIRECCIONES:

En esta encuesta se le preguntará acerca de las prácticas de inocuidad alimentaria que se llevan a cabo durante la producción, procesamiento y desarrollo de los alimentos. Cuando hablamos de prácticas de "inocuidad alimentaria" nos referimos a aquellas prácticas que buscan garantizar que los alimentos no ponen en riesgo la salud de los consumidores.

En esta encuesta nos interesa conocer lo que hace como regulador, productor, o procesador de alimentos. Por lo tanto, cuando responda a cada pregunta, piense en lo que hace en su día a día como regulador/productor/procesador, no en lo que podría hacer en su hogar o en otro trabajo. Cuando hablemos de "productora/procesadora" nos referimos a cualquier actividad de producción o procesamiento de alimentos tanto de origen animal como de origen vegetal ya sea en el campo, en un establecimientos ganadero, en una planta de procesamiento y otras actividades relacionadas.

Tenga en cuenta que algunas de las preguntas pueden parecer similares. Le pedimos que piense en cada pregunta de manera independiente a medida que las escuche. Tómese todo el tiempo que necesite para responder cada pregunta.

Hoy nos enfocaremos en el Análisis de Peligros y Puntos Críticos de Control (HACCP, por sus siglas en inglés). HACCP es un sistema de estándares y prácticas que aseguran que los productos alimenticios se produzcan de la manera más segura posible.

Para todas las preguntas le leeremos una declaración. Luego le preguntaremos si está de acuerdo o en desacuerdo con la declaración. Por ejemplo, leeremos una declaración como "Hoy lloverá", luego le preguntaremos si está de acuerdo con esa afirmación y usted responderá utilizando la escala de abajo. Puede utilizar una X para marcar la respuesta que representa mejor su opinión en relación con la declaración.

- Totalmente en desacuerdo
- En desacuerdo
- Ligeramente en desacuerdo
- Ni de acuerdo ni en desacuerdo
- Ligeramente de acuerdo
- De acuerdo
- Totalmente de acuerdo



¿Ha obtenido la certificación HACCP?

Si

No

En caso afirmativo, ¿Qué entidad/organización le otorgó su certificación de HACCP?

En caso afirmativo, ¿Cuándo obtuvo su certificación de HACCP?



Instrucciones: Lea las siguientes afirmaciones y piense en qué medida está de acuerdo. Coloque una X en el círculo que mejor se ajuste a su opinión.

	Totalmente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
1. Estoy muy familiarizado con los estándares y requisitos de HACCP. CPS1_KNO1	☐	☐	☐	☐	☐	☐	☐
2. Conozco las razones por las que los productores/procesadores de alimentos adoptan el sistema HACCP. CPS2_KNO2	☐	☐	☐	☐	☐	☐	☐
3. Sé cuánto tiempo se requiere para adoptar los estándares y requisitos de HACCP en una productora/procesadora de alimentos. CPS4_OIS1	☐	☐	☐	☐	☐	☐	☐
4. Conozco los costos en que se incurren para adoptar los estándares y requisitos de HACCP en una producción/procesadora de alimentos. CPS5_OIS2	☐	☐	☐	☐	☐	☐	☐
5. La mayoría de los reguladores/productores/procesadores en mi zona han obtenido la certificación HACCP. OS1_SI1	☐	☐	☐	☐	☐	☐	☐
6. La mayoría de los reguladores/productores/procesadores en mi zona creen que es importante obtener la certificación HACCP. OS2_SI2	☐	☐	☐	☐	☐	☐	☐
7. Otros reguladores/productores/procesadores en mi zona hablan con frecuencia sobre los beneficios de obtener la certificación HACCP. OS3_SI3	☐	☐	☐	☐	☐	☐	☐

	Totalmente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
8. Los funcionarios del gobierno me animan a obtener la certificación HACCP para mi productora/procesadora de alimentos. OS4_S14	☐	☐	☐	☐	☐	☐	☐
9. Tengo el dinero que se requiere para implementar los estándares de HACCP en mi productora/procesadora de alimentos. OP2_ECR2	☐	☐	☐	☐	☐	☐	☐
10. Tengo el tiempo que se requiere para implementar los estándares de HACCP en mi producción/procesadora de alimentos. OP3_ECR3	☐	☐	☐	☐	☐	☒	☐
11. Tengo suficientes trabajadores o mano de obra para la producción/el procesamiento de alimentos según los estándares de HACCP. OP4_ECR4	☐	☐	☐	☐	☐	☐	☐
12. Sé dónde podría aprender más acerca de los estándares de HACCP. OP5_ECR5	☐	☐	☐	☐	☐	☐	☐
13. Sé dónde hay asistencia financiera disponible para ayudarme a obtener la certificación HACCP. OP7_ECR7	☐	☐	☐	☐	☐	☐	☐
14. Otros reguladores/productores/procesadores similares a mi, piensan que debería obtener la certificación HACCP. MR1_SP1	☐	☐	☐	☐	☐	☐	☐
15. Las personas que compran los productos alimenticios de mi productora/procesadora de alimentos esperan que yo obtenga la certificación HACCP. MR2_SP2	☐	☐	☐	☐	☐	☐	☐
16. Sería difícil para mí producir/procesar mis productos alimenticios según los estándares de HACCP. MR3_BCAP1	☐	☐	☐	☐	☐	☐	☐
17. Producir/procesar según los estándares de HACCP mejoraría la calidad de mis productos. MR6_OPT1	☐	☐	☐	☐	☐	☐	☐
18. Planeo obtener la certificación de HACCP en los próximos 12 meses. MR8_INT1	☐	☐	☐	☐	☐	☐	☐
19. Sería muy beneficioso para mi productora/procesadora si yo obtuviera la certificación de HACCP. MR14_BCON4	☐	☐	☐	☐	☐	☐	☐
20. Obtener la certificación de HACCP mejoraría la reputación de mi productora/procesadora. MAS_REM1	☐	☐	☐	☐	☐	☐	☐
21. Produciría/procesaría según los estándares de HACCP si con esto mejorara la calidad de mis productos alimenticios. MAS_REF5	☐	☐	☐	☐	☐	☐	☐

	Totalmente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
22. Obtendría la certificación HACCP si esto hiciera que mis productos fueran más populares entre las personas que los compran. MA3_REF3	☐	☐	☐	☐	☐	☐	☐
23. La inocuidad de mis productos afecta mi reputación como regulador/productor/procesador. MA7_REM2	☐	☐	☐	☐	☐	☐	☐
24. Obtendría la certificación de HACCP si esto hiciera que ganara más dinero. MA1_REF1	☐	☐	☐	☐	☐	☐	☐
25. Podría evitar que las personas se enfermen si produjera/procesara productos alimenticios según los estándares de HACCP. MR13_BCON3	☐	☐	☐	☐	☐	☐	☐
26. Si obtuviera la certificación de HACCP, mi productora/procesadora podría vender mis productos alimenticios a más exportadores. MR12_BCON2	☐	☐	☐	☐	☐	☐	☐
27. Produciría/procesaría según los estándares de HACCP si esto mejorara la inocuidad de mis productos alimenticios. MA4_REF4	☐	☐	☐	☐	☐	☐	☐
28. La inocuidad de los productos alimenticios de mi productora/procesadora son un motivo de orgullo para mí. MA8_REM3	☐	☐	☐	☐	☐	☐	☐
29. Obtendría la certificación de HACCP para mi productora/procesadora si esto significara que puedo vender mis productos alimenticios a nuevos compradores. MA2_REF2	☐	☐	☐	☐	☐	☐	☐
30. Mi productora/procesadora ganaría más dinero si obtuviera la certificación HACCP. MR11_BCON1	☐	☐	☐	☐	☐	☐	☐
31. La calidad de los productos alimenticios de mi productora/procesadora es un motivo de orgullo para mí. MA9_REM4	☐	☐	☐	☐	☐	☐	☐
32. Sería fácil para mí obtener la certificación de HACCP para mi productora/procesadora. MR5_BCAP3	☐	☐	☐	☐	☐	☐	☐



Género

Femenino

Masculino

Edad

18-24 años

25-34 años

35-44 años

45-54 años

55-64 años

>65 años

Por favor escriba los productos que regulan/producen/procesan



Agradecemos su participación en esta encuesta
Sus respuestas han sido guardadas

Appendix B - Raw data collected in fresh foods markets

Sample ID	Duplicate	AEROBIC COUNTS				Result CFU/ml	CFU/g	Log (CFU/g)
		10 [^] -3	Colonies counts	10 [^] -4	10 [^] -5			
1T	A	0	0	0				<3.954
	B	0	0	0				
1L	A	TNTC	144	10		1.47E+06	1.32E+07	7.12E+00
	B	TNTC	152	17				
2T	A	20	0	1		1.95E+04	1.76E+05	5.24E+00
	B	16	4	0				
2L	A	TNTC	255	31		2.52E+06	2.27E+07	7.36E+00
	B	TNTC	226	43				
3T	A	30	4	0		2.64E+04	2.37E+05	5.38E+00
	B	23	1	0				
3L	A	TNTC	192	18		2.03E+06	1.82E+07	7.26E+00
	B	TNTC	209	27				
4T	A	137	16	1		1.44E+05	1.29E+06	6.11E+00
	B	124	24	0				
4L	A	TNTC	TNTC	148		1.52E+07	1.37E+08	8.14E+00
	B	TNTC	TNTC	156				
5T	A	TNTC	198	15		1.97E+06	1.77E+07	7.25E+00
	B	TNTC	195	25				
5L	A	TNTC	185	19		1.95E+06	1.75E+07	7.24E+00
	B	TNTC	197	27				
6T	A	12	1	0		1.00E+04	9.00E+04	4.95E+00
	B	8	1	0				
6L	A	TNTC	TNTC	44		4.75E+06	4.28E+07	7.63E+00
	B	TNTC	TNTC	51				
7T	A	6	0	0		8.00E+03	7.20E+04	4.86E+00
	B	10	0	0				
8L	A	TNTC	TNTC	75		7.10E+06	6.39E+07	7.81E+00
	B	TNTC	TNTC	67				
9L	A	TNTC	227	26		2.21E+06	1.99E+07	7.30E+00
	B	TNTC	208	26				
10T	A	76	13	0		8.95E+04	8.06E+05	5.91E+00
	B	99	9	0				
11T	A	TNTC	49	3		5.09E+05	4.58E+06	6.66E+00
	B	TNTC	54	6				
12T	A	TNTC	TNTC	37		3.75E+06	3.38E+07	7.53E+00
	B	TNTC	TNTC	38				
13T	A	TNTC	TNTC	64		7.00E+06	6.30E+07	7.80E+00
	B	TNTC	TNTC	76				
14L	A	TNTC	TNTC	50		5.05E+06	4.55E+07	7.66E+00
	B	TNTC	TNTC	51				
15T	A	1	0	0		1.00E+03	9.00E+03	3.95E+00
	B	1	0	0				
16L	A	TNTC	106	11		1.20E+06	1.08E+07	7.04E+00
	B	TNTC	138	10				
17T	A	26	7	0		2.76E+04	2.49E+05	5.40E+00
	B	25	0	0				
17L	A	TNTC	TNTC	60		6.35E+06	5.72E+07	7.76E+00
	B	TNTC	TNTC	67				
18T	A	42	7	1		4.64E+04	4.17E+05	5.62E+00
	B	49	2	1				
18L	A	TNTC	248	26		2.47E+06	2.22E+07	7.35E+00
	B	TNTC	243	26				
19L	A	TNTC	TNTC	60		6.30E+06	5.67E+07	7.75E+00
	B	TNTC	TNTC	66				
20T	A	2	0	0		3.50E+03	3.15E+04	4.50E+00
	B	5	0	0				
21L	A	TNTC	72	5		6.36E+05	5.73E+06	6.76E+00
	B	TNTC	60	3				
22L	A	TNTC	91	10		8.77E+05	7.90E+06	6.90E+00
	B	TNTC	83	9				
23L	A	TNTC	62	10		6.86E+05	6.18E+06	6.79E+00
	B	TNTC	70	9				
24L	A	TNTC	132	14		1.32E+06	1.19E+07	7.08E+00
	B	TNTC	125	20				
25T	A	TNTC	65	5		6.05E+05	5.44E+06	6.74E+00
	B	TNTC	56	7				
26T	A	9	0	0		7.00E+03	6.30E+04	4.80E+00
	B	5	0	0				
27T	A	75	10	0		8.86E+04	7.97E+05	5.90E+00
	B	90	10	1				
27L	A	TNTC	75	3		6.55E+05	5.89E+06	6.77E+00
	B	TNTC	57	9				
28T	A	0	0	0		2.00E+03	1.80E+04	4.26E+00
	B	2	0	0				
28L	A	TNTC	TNTC	50		4.45E+06	4.01E+07	7.60E+00
	B	TNTC	TNTC	39				
29T	A	TNTC	53	6		5.41E+05	4.87E+06	6.69E+00
	B	TNTC	57	3				
30L	A	TNTC	80	6		8.09E+05	7.28E+06	6.86E+00
	B	TNTC	85	7				
31T	A	66	6	1		6.38E+04	5.74E+05	5.76E+00
	B	57	4	0				
32T	A	7	0	0		5.00E+03	4.50E+04	4.65E+00
	B	3	0	0				
33T	A	23	5	0		2.23E+04	2.00E+05	5.30E+00
	B	19	2	0				
33L	A	TNTC	TNTC	19		2.72E+06	2.45E+07	7.39E+00
	B	TNTC	264	43				
34T	A	58	2	3		6.00E+04	5.40E+05	5.73E+00
	B	59	4	0				
35T	A	10	2	1		1.43E+04	1.29E+05	5.11E+00
	B	17	0	0				
36T	A	33	2	0		3.50E+04	3.15E+05	5.50E+00
	B	39	3	0				
36L	A	TNTC	68	4		6.27E+05	5.65E+06	6.75E+00
	B	TNTC	62	4				
37L	A	TNTC	TNTC	26		2.50E+06	2.25E+07	7.35E+00
	B	TNTC	TNTC	24				
38T	A	31	2	0		3.23E+04	2.90E+05	5.46E+00
	B	28	10	0				
38L	A	TNTC	TNTC	45		5.15E+06	4.64E+07	7.67E+00
	B	TNTC	TNTC	58				
39T	A	5	0	0		6.50E+03	5.85E+04	4.77E+00
	B	8	0	0				
40L	A	TNTC	157	16		1.48E+06	1.33E+07	7.12E+00
	B	TNTC	129	23				
40T	A	167	13	1		1.59E+05	1.43E+06	6.16E+00
	B	142	26	1				
41T	A	TNTC	141	18		1.38E+06	1.24E+07	7.09E+00
	B	TNTC	134	11				
42T	A	44	4	4		4.95E+04	4.46E+05	5.65E+00
	B	48	4	0				

42L	A	TNTC	TNTC	71		6.60E+06	5.94E+07	7.77E+00
	B	TNTC	TNTC	61				
43T	A	70	7	1		7.33E+04	6.60E+05	5.82E+00
	B	74	2	0				
44L	A	TNTC	134	21		1.27E+06	1.15E+07	7.06E+00
	B	TNTC	121	4				
45T	A	3	1	1		3.33E+03	3.00E+04	4.48E+00
	B	2	0	0				
46T	A	29	1	0		2.10E+04	1.89E+05	5.28E+00
	B	14	0	0				
1aFC	A	1	0	0		1.00E+04	1.00E+03	3.00E+00
	B	1	0	0				
1bFC	A	66	10	1		7.19E+05	7.19E+04	4.86E+00
	B	69	5	0				
1aNC	A	0	0	0				<3.00
	B	0	0	0				
1bNC	A	0	0	0				<3.00
	B	0	0	0				
2aFC	A	211	28	3		2.25E+06	2.25E+05	5.35E+00
	B	232	19	1				
2bFC	A	TNTC	35	4		3.95E+06	3.95E+05	5.60E+00
	B	TNTC	47	1				
2aNC	A	1	0	0		1.00E+04	1.00E+03	3.00E+00
	B	0	0	0				
2bNC	A	6	0	0		8.00E+04	8.00E+03	3.90E+00
	B	10	0	0				
3aFC	A	177	24	3		1.91E+06	1.91E+05	5.28E+00
	B	194	18	4				
3bFC	A	TNTC	66	8		7.23E+06	7.23E+05	5.86E+00
	B	TNTC	80	5				
3aNC	A	2	0	0		2.00E+04	2.00E+03	3.30E+00
	B	0	0	0				
3bNC	A	6	0	0		4.00E+04	4.00E+03	3.60E+00
	B	2	0	0				
4aFC	A	TNTC	TNTC	41		4.85E+07	4.85E+06	6.69E+00
	B	TNTC	TNTC	56				
4bFC	A	TNTC	41	5		4.18E+06	4.18E+05	5.62E+00
	B	TNTC	45	1				
4aNC	A	1	0	0		1.00E+04	1.00E+03	3.00E+00
	B	0	0	0				
4bNC	A	1	0	0		1.00E+04	1.00E+03	3.00E+00
	B	0	0	0				
5aFC	A	TNTC	43	1		3.77E+06	3.77E+05	5.58E+00
	B	TNTC	36	3				
5bFC	A	TNTC	34	4		3.64E+06	3.64E+05	5.56E+00
	B	TNTC	38	4				
5aNC	A	0	0	0				<3.00
	B	0	0	0				
5bNC	A	0	0	0				<3.00
	B	0	0	0				
6aFC	A	201	21	3		1.95E+06	1.95E+05	5.29E+00
	B	185	14	4				
6bFC	A	0	0	0				<3.00
	B	0	0	0				
6aNC	A	3	0	0		3.00E+04	3.00E+03	3.48E+00
	B	3	0	0				
6bNC	A	1	1	0		1.82E+04	1.82E+03	3.26E+00
	B	0	0	0				
7aFC	A	166	17	2		1.67E+06	1.67E+05	5.22E+00
	B	166	15	2				
7bFC	A	77	18	1		9.64E+05	9.64E+04	4.98E+00
	B	100	15	1				
7aNC	A	1	0	0		1.00E+04	1.00E+03	3.00E+00
	B	1	0	0				
7bNC	A	19	1	0		2.27E+05	2.27E+04	4.36E+00
	B	26	4	0				
8aFC	A	75	5	1		6.95E+05	6.95E+04	4.84E+00
	B	67	4	1				
8bFC	A	101	14	3		9.81E+05	9.81E+04	4.99E+00
	B	83	5	0				
8aNC	A	30	0	0		2.81E+05	2.81E+04	4.45E+00
	B	28	1	0				
8bNC	A	0	0	0				<3.00
	B	0	0	0				
9aFC	A	TNTC	222	19		2.04E+07	2.04E+06	6.31E+00
	B	TNTC	179	29				
9bFC	A	TNTC	169	22		1.74E+07	1.74E+06	6.24E+00
	B	TNTC	174	17				
9aNC	A	0	0	0				<3.00
	B	0	0	0				
9bNC	A	2	0	0		2.00E+04	2.00E+03	3.30E+00
	B	2	0	0				
10aFC	A	12	1	0		1.45E+05	1.45E+04	4.16E+00
	B	18	1	0				
10bFC	A	TNTC	TNTC	67		6.30E+07	6.30E+06	6.80E+00
	B	TNTC	TNTC	59				
10aNC	A	0	0	0				<3.00
	B	0	0	0				
10bNC	A	1	0	0		2.00E+04	2.00E+03	3.30E+00
	B	3	0	0				
11aFC	A	TNTC	TNTC					>5
	B	TNTC	TNTC					
11bFC	A	TNTC	TNTC					>5
	B	TNTC	TNTC					
11aNC	A	2	0			1.91E+03	1.91E+02	2.28E+00
	B	2	0					
11bNC	A	6	1			6.27E+03	6.27E+02	2.80E+00
	B	7	1					
12aFC	A	13	1			9.86E+03	9.86E+02	2.99E+00
	B	13	1					
12bFC	A	15	1			1.06E+04	1.06E+03	3.02E+00
	B	16	4					
12aNC	A	2	0			3.68E+03	3.68E+02	2.57E+00
	B	6	0					
12bNC	A	39	5			3.55E+04	3.55E+03	3.55E+00
	B	30	4					
13aFC	A	41	4			3.95E+04	3.95E+03	3.60E+00
	B	41	1					
13bFC	A	19	1			1.01E+04	1.01E+03	3.01E+00
	B	18	0					
13aNC	A	12	2			1.02E+04	1.02E+03	3.01E+00
	B	6	1					
13bNC	A	2	1			1.43E+03	1.43E+02	2.15E+00
	B	1	0					

14aFC	A	TNTC	TNTC				>5.5
14bFC	B	TNTC	TNTC				>5.5
14aNC	A	160	15		1.44E+05	1.44E+04	4.16E+00
14bNC	B	131	11				
15aFC	A	0	0		4.50E+02	4.50E+01	1.65E+00
15bFC	B	0	0				
15aNC	A	10	1		9.14E+03	9.14E+02	2.96E+00
15bNC	B	9	0				
16aFC	A	15	4		1.09E+04	1.09E+03	3.04E+00
16bFC	B	15	3				
16aNC	A	3	0		2.24E+03	2.24E+02	2.35E+00
16bNC	B	0	0				
17aFC	A	1	0		1.86E+03	1.86E+02	2.27E+00
17bFC	B	2	0				
18aFC	A	TNTC	186	26	2.06E+06	2.06E+05	5.31E+00
18bFC	B	TNTC	212	29			
19aFC	A	10	0	0	1.05E+04	1.05E+03	3.02E+00
19bFC	B	11	0	0			
20aNC	A	0	0		4.50E+02	4.50E+01	1.65E+00
20bNC	B	0	0				
21aFC	A	7	1		5.73E+03	5.73E+02	2.76E+00
21bFC	B	5	2				
22aFC	A	TNTC	TNTC	256	2.55E+07	2.55E+06	6.41E+00
22bFC	B	TNTC	TNTC	253			
23aFC	A	580	60	0	6.00E+05	6.00E+04	4.78E+00
23bFC	B	620	60	0			
24aNC	A	4	0		3.82E+03	3.82E+02	2.58E+00
24bNC	B	9	0				
25aFC	A	89	8		8.59E+04	8.59E+03	3.93E+00
25bFC	B	84	8				
26aFC	A	43	4	1	4.64E+04	4.64E+03	3.67E+00
26bFC	B	49	3	2			
27aNC	A	2	0	0	3.00E+03	3.00E+02	2.48E+00
27bNC	B	4	0	0			
28aFC	A	61	8		6.50E+04	6.50E+03	3.81E+00
28bFC	B	69	5				
29aNC	A	24	2		2.53E+04	2.53E+03	3.40E+00
29bNC	B	31	3				
30aFC	A	TNTC	TNTC	TNTC			>5.5
30bFC	B	TNTC	TNTC	TNTC			>5.5
31aNC	A	TNTC	TNTC	1100			
31bNC	B	TNTC	TNTC				
32aFC	A	108	4		9.95E+04	9.95E+03	4.00E+00
32bFC	B	99	8				
33aNC	A	10	2		1.43E+04	1.43E+03	3.16E+00
33bNC	B	17	0				
34aFC	A	74	8	4	8.86E+04	8.86E+03	3.95E+00
34bFC	B	89	12	8			
35aNC	A	165	22	2	1.64E+05	1.64E+04	4.21E+00
35bNC	B	148	7	0			
36aFC	A	49	1		4.36E+04	4.36E+03	3.64E+00
36bFC	B	44	2				
37aNC	A	37	4		3.68E+04	3.68E+03	3.57E+00
37bNC	B	35	5				
38aFC	A	TNTC	141	11	1.63E+06	1.63E+05	5.21E+00
38bFC	B	TNTC	181	25			
39aNC	A	TNTC	TNTC	TNTC			>5.5
39bNC	B	TNTC	TNTC	TNTC			>5.5
40aFC	A	1	0		1.18E+03	1.18E+02	2.07E+00
40bFC	B	1	0				
41aNC	A	7	1		4.10E+03	4.10E+02	2.61E+00
41bNC	B	1	0				
42aFC	A	TNTC	TNTC	37	4.00E+06	4.00E+05	5.60E+00
42bFC	B	TNTC	TNTC	43			
43aNC	A	58	2	1	6.27E+04	6.27E+03	3.80E+00
43bNC	B	72	4	1			
44aFC	A	1	0		2.00E+03	2.00E+02	2.30E+00
44bFC	B	0	0				
45aNC	A	33	1		1.50E+04	1.50E+03	3.17E+00
45bNC	B	25	0				
46aFC	A	TNTC	TNTC	198	2.05E+07	2.05E+06	6.31E+00
46bFC	B	TNTC	TNTC	211			
47aNC	A	540	65	0	6.30E+05	6.30E+04	4.80E+00
47bNC	B	720	61	0			
48aFC	A	3	2		2.73E+03	2.73E+02	2.44E+00
48bFC	B	3	1				
49aNC	A	0	0		5.50E+02	5.50E+01	1.74E+00
49bNC	B	0	0				
50aFC	A	14	2	0	1.43E+04	1.43E+03	3.15E+00
50bFC	B	14	0	0			
51aNC	A	102	9	0	1.09E+05	1.09E+04	4.04E+00
51bNC	B	120	8	0			
52aFC	A	TNTC	520		5.90E+06	5.90E+05	5.77E+00
52bFC	B	TNTC	660				
53aNC	A	TNTC	204		2.16E+06	2.16E+05	5.33E+00
53bNC	B	TNTC	228				
54aFC	A	TNTC	111	7	1.05E+06	1.05E+05	5.02E+00
54bFC	B	TNTC	105	9			
55aNC	A	51	7	0	4.91E+04	4.91E+03	3.69E+00
55bNC	B	46	4	0			
56aFC	A	3	0		2.24E+03	2.24E+02	2.35E+00
56bFC	B	0	0				
57aNC	A	3	0		3.09E+03	3.09E+02	2.49E+00
57bNC	B	5	0				
58aFC	A	5	2	0	5.71E+03	5.71E+02	2.76E+00
58bFC	B	5	0	0			
59aNC	A	132	21	5	1.40E+05	1.40E+04	4.15E+00
59bNC	B	140	10	1			
60aFC	A	0	0		4.00E+02	4.00E+01	1.60E+00
60bFC	B	0	0				
61aNC	A	1	0		2.38E+02	2.38E+01	1.38E+00
61bNC	B	0	0				
62aFC	A	TNTC	TNTC	440	5.00E+07	5.00E+06	6.70E+00
62bFC	B	TNTC	TNTC	560			
63aNC	A	TNTC	24	1	2.48E+05	2.48E+04	4.39E+00
63bNC	B	TNTC	27	0			
64aFC	A	0	0		3.50E+02	3.50E+01	1.54E+00
64bFC	B	0	0				
65aNC	A	0	0				<1.0
65bNC	B	0	0				<1.0

28aFC	A	TNTC	79	7	7.57E+05	7.57E+04	4.88E+00
28bFC	B	TNTC	73	0			
29aNC	A	0	1		9.09E+02	9.09E+01	1.96E+00
29bNC	B	1	1				
30aFC	A	44	3		4.05E+04	4.05E+03	3.61E+00
30bFC	B	40	2				
31aNC	A	3	1	0	5.24E+03	5.24E+02	2.72E+00
31bNC	B	7	0	0			
32aFC	A	TNTC	TNTC	158	1.69E+07	1.69E+06	6.23E+00
32bFC	B	TNTC	TNTC	179			
33aNC	A	0	0				<1.0
33bNC	B	0	0				<1.0
34aFC	A	1	0		1.59E+03	1.59E+02	2.20E+00
34bFC	B	2	0				
35aNC	A	TNTC	TNTC	180	1.81E+07	1.81E+06	6.26E+00
35bNC	B	TNTC	TNTC	181			
36aFC	A	TNTC	TNTC	386	3.86E+07	3.86E+06	6.59E+00
36bFC	B	TNTC	TNTC				
37aNC	A	23	0		2.05E+04	2.05E+03	3.31E+00
37bNC	B	17	3				
38aFC	A	TNTC	46	2	5.05E+05	5.05E+04	4.70E+00
38bFC	B	TNTC	55				
39aNC	A	TNTC	46	3	3.91E+05	3.91E+04	4.59E+00
39bNC	B	TNTC	35	3			
40aFC	A	TNTC	TNTC	23	2.65E+06	2.65E+05	5.42E+00
40bFC	B	TNTC	TNTC	30			
41aNC	A	76	14		8.45E+04	8.45E+03	3.93E+00
41bNC	B	87	9				
42aFC	A	1	0		2.09E+03	2.09E+02	2.32E+00
42bFC	B	2	0				
43aNC	A	TNTC	TNTC	33	3.40E+06	3.40E+05	5.53E+00
43bNC	B	TNTC	TNTC	35			
44aFC	A	2	0	0	3.00E+03	3.00E+02	2.48E+00
44bFC	B	4	0	0			
45aNC	A	1	0		7.14E+02	7.14E+01	1.85E+00
45bNC	B	0	0				
46aFC	A	6	1		3.86E+03	3.86E+02	2.59E+00
46bFC	B	1	0				
47aNC	A	TNTC	TNTC	227	2.42E+07	2.42E+06	6.38E+00
47bNC	B	TNTC	TNTC	256			
48aFC	A	1	0	0	1.00E+03	1.00E+02	2.00E+00
48bFC	B	0	0	0			
49aNC	A	16	0		1.07E+04	1.07E+03	3.03E+00
49bNC	B	19	0				
50aFC	A	0	0				<1.0
50bFC	B	0	0				<1.0
51aNC	A	21	1	0	2.62E+04	2.62E+03	3.42E+00
51bNC	B	33	0	0			
52aFC	A	1	0	0	3.00E+03	3.00E+02	2.48E+00
52bFC	B	5	0	0			
53aNC	A	2	0		8.18E+02	8.18E+01	1.91E+00
53bNC	B	1	0				
54aFC	A	0	0		2.50E+02	2.50E+01	1.40E+00
54bFC	B	0	0				
55aNC	A	6	2	0	4.55E+03	4.55E+02	2.66E+00
55bNC	B	1	1	0			
56aFC	A	TNTC	20	1	2.23E+05	2.23E+04	4.35E+00
56bFC	B	TNTC	24	4			
57aNC	A	1	1		1.00E+03	1.00E+02	2.00E+00
57bNC	B	1	0				
58aFC	A	0	0		9.50E+02	9.50E+01	1.98E+00
58bFC	B	0	0				
59aNC	A	21	4	0	2.32E+04	2.32E+03	3.37E+00
59bNC	B	25	1	0			
60aFC	A	35	3	1	4.29E+04	4.29E+03	3.63E+00
60bFC	B	48	3	0			
61aNC	A	1	0		3.62E+03	3.62E+02	2.56E+00
61bNC	B	0	0				
62aFC	A	5	1		4.09E+03	4.09E+02	2.61E+00
62bFC	B	5	1				
63aNC	A	TNTC	TNTC	740	7.00E+07	7.00E+06	6.85E+00
63bNC	B	TNTC	TNTC	660			
64aFC	A	TNTC	TNTC	115	1.23E+07	1.23E+06	6.09E+00
64bFC	B	TNTC	TNTC	130			
65aNC	A	1	0		2.41E+03	2.41E+02	2.38E+00
65bNC	B	1	0				
66aFC	A	2	0		1.09E+03	1.09E+02	2.04E+00
66bFC	B	1	0				
67aNC	A	6	1	0	4.55E+03	4.55E+02	2.66E+00
67bNC	B	2	1	0			
68aFC	A	TNTC	TNTC	85	7.90E+06	7.90E+05	5.90E+00
68bFC	B	TNTC	TNTC	73			
69aNC	A	16	1		9.52E+03	9.52E+02	2.98E+00
69bNC	B	5	0				
70aFC	A	2	0		2.00E+03	2.00E+02	2.30E+00

42aFC	A	TNTC	278	29	2.80E+06	2.80E+05	5.45E+00
	B	TNTC	288	20			
42bFC	A		30	3	3.86E+04	3.86E+03	3.59E+00
	B		50	2			
42aNC	A		2	1	7.14E+02	7.14E+01	1.85E+00
	B		1	0			
42bNC	A		2	0	8.10E+02	8.10E+01	1.91E+00
	B		0	0			
43aFC	A		33	2	3.91E+04	3.91E+03	3.59E+00
	B		47	4			
43bFC	A	TNTC	69	13	7.45E+05	7.45E+04	4.87E+00
	B	TNTC	71	11			
43aNC	A		2	0	2.05E+03	2.05E+02	2.31E+00
	B		0	0			
43bNC	A		2	0	1.95E+03	1.95E+02	2.29E+00
	B		2	0			
44aFC	A	TNTC	156	6	1.50E+06	1.50E+05	5.17E+00
	B	TNTC	154	13			
44bFC	A	TNTC	155	9	1.62E+06	1.62E+05	5.21E+00
	B	TNTC	175	18			
44aNC	A		0	0			<1.0
	B		0	0			
44bNC	A		1	0	1.41E+03	1.41E+02	2.15E+00
	B		1	0			
45aFC	A		31	7	3.55E+04	3.55E+03	3.55E+00
	B		36	4			
45bFC	A	TNTC	47	8	6.50E+05	6.50E+04	4.81E+00
	B	TNTC	74	14			
45aNC	A		7	0	1.33E+03	1.33E+02	2.12E+00
	B		0	0			
45bNC	A		3	0	3.27E+03	3.27E+02	2.51E+00
	B		3	0			
46aFC	A		7	0	7.50E+03	7.50E+02	2.88E+00
	B		8	0			
46bFC	A	TNTC	26	5	2.55E+05	2.55E+04	4.41E+00
	B	TNTC	22	3			
46aNC	A		9	1	7.76E+03	7.76E+02	2.89E+00
	B		7	0			
46bNC	A		6	1	7.27E+03	7.27E+02	2.86E+00
	B		8	1			

ENTEROBACTERIA									
Sample ID	Duplicate	10 ⁰	Colonies counts			Result CFU/ml	CFU/g	Log (CFU/g)	
			10 ⁻¹	10 ⁻²	10 ⁻³				
1T	A	0	0	0				< 1.0	
	B	0	0	0					
1L	A	TNTC	TNTC	64		6.85E+03	6.17E+04	4.79E+00	
	B	TNTC	TNTC	73					
2T	A	TNTC	33	7		3.59E+02	3.23E+03	3.51E+00	
	B	TNTC	34	5					
2L	A	TNTC	TNTC	112		1.10E+04	9.86E+04	4.99E+00	
	B	TNTC	TNTC	107					
3T	A	TNTC	21	4		2.59E+02	2.33E+03	3.37E+00	
	B	TNTC	30	2					
3L	A	TNTC	TNTC	200		2.60E+04	2.34E+05	5.37E+00	
	B	TNTC	TNTC	320					
4T	A	TNTC	87	14		8.68E+02	7.81E+03	3.89E+00	
	B	TNTC	75	15					
4L	A	TNTC	TNTC	380		4.10E+04	3.69E+05	5.57E+00	
	B	TNTC	TNTC	440					
5T	A	TNTC	TNTC	360		3.90E+04	3.51E+05	5.55E+00	
	B	TNTC	TNTC	420					
5L	A	TNTC	TNTC	420		4.00E+04	3.60E+05	5.56E+00	
	B	TNTC	TNTC	380					
6T	A	TNTC	15	4		1.90E+02	1.71E+03	3.23E+00	
	B	TNTC	21	0					
6L	A	TNTC	TNTC	81		8.65E+03	7.79E+04	4.89E+00	
	B	TNTC	TNTC	92					
7T	A	TNTC	15	0		1.25E+02	1.13E+03	3.05E+00	
	B	TNTC	10	0					
8L	A	TNTC	TNTC	460		4.00E+04	3.60E+05	5.56E+00	
	B	TNTC	TNTC	340					
9L	A	TNTC	TNTC	180		2.10E+04	1.89E+05	5.28E+00	
	B	TNTC	TNTC	240					
10T	A	TNTC	TNTC	16		1.80E+03	1.62E+04	4.21E+00	
	B	TNTC	TNTC	20					
11T	A	TNTC	93	11		1.04E+03	9.33E+03	3.97E+00	
	B	TNTC	105	19					
12T	A	TNTC	TNTC	340		3.20E+04	2.88E+05	5.46E+00	
	B	TNTC	TNTC	300					
13T	A	TNTC	TNTC	48		4.90E+03	4.41E+04	4.64E+00	
	B	TNTC	TNTC	50					
14L	A	TNTC	TNTC	420		4.20E+04	3.78E+05	5.58E+00	
	B	TNTC	TNTC	420					
15T	A	9	2	0		1.14E+01	1.03E+02	2.01E+00	
	B	13	0	0					
16L	A		TNTC	TNTC	20	2.20E+04	1.98E+05	5.30E+00	
	B		TNTC	TNTC	24				
17T	A	2	0	0		1.50E+01	1.35E+02	2.13E+00	
	B	1	0	0					
17L	A		TNTC	TNTC	25	2.55E+04	2.30E+05	5.36E+00	
	B		TNTC	TNTC	26				
18T	A	43	5	0		4.55E+02	4.09E+03	3.61E+00	
	B	48	4	0					
18L	A	TNTC	75	10		8.00E+03	7.20E+04	4.86E+00	
	B	TNTC	85	6					
19L	A	TNTC	TNTC	107		1.06E+05	9.50E+05	5.98E+00	
	B	TNTC	TNTC	104					
20T	A	1	0	0		1.00E+01	9.00E+01	1.95E+00	
	B	0	0	0					
21L	A	91	12	1		9.68E+02	8.71E+03	3.94E+00	
	B	89	18	2					
22L	A	TNTC	69	9		7.32E+03	6.59E+04	4.82E+00	
	B	TNTC	74	9					
23L	A	TNTC	120	12		1.27E+04	1.14E+05	5.06E+00	
	B	TNTC	133	14					
24L	A	TNTC	TNTC	62		5.70E+04	5.13E+05	5.71E+00	
	B	TNTC	TNTC	52					
25T	A	TNTC	110	9		1.16E+04	1.05E+05	5.02E+00	
	B	TNTC	125	12					
26T	A	6	1	0		8.64E+01	7.77E+02	2.89E+00	
	B	10	2	0					
27T	A	TNTC	TNTC	85		7.75E+04	6.98E+05	5.84E+00	
	B	TNTC	TNTC	70					
27L	A	TNTC	10	3		1.23E+03	1.10E+04	4.04E+00	
	B	TNTC	13	1					
28T	A	TNTC	83	10		9.55E+03	8.59E+04	4.93E+00	
	B	TNTC	105	12					
28L	A	3	0	0		3.00E+01	2.70E+02	2.43E+00	
	B	3	0	0					
29T	A	60	6	2		6.00E+02	5.40E+03	3.73E+00	
	B	58	5	1					
30L	A	TNTC	TNTC	15		1.78E+04	1.61E+05	5.21E+00	
	B	TNTC	167	32					
31T	A	TNTC	24	4		2.36E+03	2.13E+04	4.33E+00	
	B	TNTC	21	3					
32T	A	135	8	1		1.37E+03	1.24E+04	4.09E+00	
	B	144	13	1					
33T	A	36	5	0		3.00E+02	2.70E+03	3.43E+00	
	B	19	6	0					
33L	A	TNTC	TNTC	22		2.30E+04	2.07E+05	5.32E+00	
	B	TNTC	TNTC	24					
34T	A	8	0	0		8.00E+01	7.20E+02	2.86E+00	
	B	8	0	0					
35T	A	TNTC	16	1		1.49E+03	1.34E+04	4.13E+00	
	B	144	16	2					
36T	A	TNTC	32	3		2.62E+03	2.36E+04	4.37E+00	
	B	TNTC	20	0					
36L	A	TNTC	101	8		1.06E+04	9.53E+04	4.98E+00	
	B	TNTC	117	7					
37L	A	TNTC	TNTC	140		1.40E+05	1.26E+06	6.10E+00	
	B	TNTC	TNTC	139					
38T	A	46	3	1		4.24E+02	3.81E+03	3.58E+00	
	B	34	5	0					
38L	A	TNTC	TNTC	280		2.70E+05	2.43E+06	6.39E+00	
	B	TNTC	TNTC	260					
39T	A	2	0	0		2.00E+01	1.80E+02	2.26E+00	
	B	0	0	0					
40L	A	TNTC	TNTC	18		1.95E+04	1.76E+05	5.24E+00	
	B	TNTC	TNTC	21					
40T	A	TNTC	20	3		2.50E+03	2.25E+04	4.35E+00	
	B	TNTC	29	3					
41T	A	TNTC	TNTC	13		1.65E+04	1.49E+05	5.17E+00	
	B	TNTC	TNTC	20					
42T	A	26	2	1		2.45E+02	2.21E+03	3.34E+00	
	B	16	7	2					

42L	A		TNTC	TNTC	260	2.40E+05	2.16E+06	6.33E+00
	B		TNTC	TNTC	220			
43T	A	67	12	0	8.00E+02	7.20E+03	3.86E+00	
	B	91	6	0				
44L	A		TNTC	22	0	2.19E+03	1.97E+04	4.29E+00
	B		TNTC	23	1			
45T	A	0	0	0				
	B	0	0	0				
46T	A	50	4	0	5.27E+02	4.75E+03	3.68E+00	
	B	46	16	0				
1aFC	A	0	0	0				<0.00
	B	0	0	0				
1bFC	A	TNTC	TNTC	25	2.85E+04	2.85E+03	3.45E+00	
	B	TNTC	TNTC	32				
1aNC	A	0	0	0				<0.00
	B	0	0	0				
1bNC	A	0	0	0				<0.00
	B	0	0	0				
2aFC	A	TNTC	TNTC	34	3.55E+04	3.55E+03	3.55E+00	
	B	TNTC	TNTC	37				
2bFC	A	TNTC	TNTC	20	2.75E+04	2.75E+03	3.44E+00	
	B	TNTC	TNTC	35				
2aNC	A	0	0	0				<0.00
	B	0	0	0				
2bNC	A	2	0	0	2.00E+01	2.00E+00	3.01E-01	
	B	0	0	0				
3aFC	A	TNTC	73	7	7.59E+03	7.59E+02	2.88E+00	
	B	TNTC	71	16				
3bFC	A	TNTC	40	5	4.86E+03	4.86E+02	2.69E+00	
	B	TNTC	55	7				
3aNC	A	0	0	0				<0.00
	B	0	0	0				
3bNC	A	5	0	0	5.50E+01	5.50E+00	7.40E-01	
	B	6	0	0				
4aFC	A	TNTC	TNTC	108	1.11E+05	1.11E+04	4.04E+00	
	B	TNTC	TNTC	113				
4bFC	A	TNTC	82	13	8.59E+03	8.59E+02	2.93E+00	
	B	TNTC	83	11				
4aNC	A	0	0	0				<0.00
	B	0	0	0				
4bNC	A	0	0	0				<0.00
	B	0	0	0				
5aFC	A	TNTC	TNTC	76	7.45E+04	7.45E+03	3.87E+00	
	B	TNTC	TNTC	73				
5bFC	A	TNTC	TNTC	12	1.75E+04	1.75E+03	3.24E+00	
	B	TNTC	TNTC	23				
5aNC	A	0	0	0				<0.00
	B	0	0	0				
5bNC	A	0	0	0				<0.00
	B	0	0	0				
6aFC	A	TNTC	TNTC	61	7.55E+04	7.55E+03	3.88E+00	
	B	TNTC	TNTC	90				
6bFC	A	8	2	0	1.09E+02	1.09E+01	1.04E+00	
	B	11	3	0				
6aNC	A	51	8	1	5.48E+02	5.48E+01	1.74E+00	
	B	49	6	0				
6bNC	A	5	0	0	3.50E+01	3.50E+00	5.44E-01	
	B	2	0	0				
7aFC	A	2	0	0	2.00E+01	2.00E+00	3.01E-01	
	B	0	0	0				
7bFC	A	TNTC	TNTC	58	6.15E+04	6.15E+03	3.79E+00	
	B	TNTC	TNTC	65				
7aNC	A	7	0	0	7.00E+01	7.00E+00	8.45E-01	
	B	7	0	0				
7bNC	A	0	0	0				<0.00
	B	0	0	0				
8aFC	A	TNTC	TNTC	14	1.65E+04	1.65E+03	3.22E+00	
	B	TNTC	TNTC	19				
8bFC	A	TNTC	76	9	7.23E+03	7.23E+02	2.86E+00	
	B	TNTC	63	11				
8aNC	A	TNTC	58	3	5.73E+03	5.73E+02	2.76E+00	
	B	TNTC	62	3				
8bNC	A	1	0	0	1.00E+01	1.00E+00	0.00E+00	
	B	1	0	0				
9aFC	A	TNTC	32	6	4.14E+03	4.14E+02	2.62E+00	
	B	TNTC	49	4				
9bFC	A	TNTC	TNTC	110	1.13E+05	1.13E+04	4.05E+00	
	B	TNTC	TNTC	116				
9aNC	A	3	0	0	3.00E+01	3.00E+00	4.77E-01	
	B	0	0	0				
9bNC	A	1	0	0	1.00E+01	1.00E+00	0.00E+00	
	B	1	0	0				
10aFC	A	4	0	0	2.50E+01	2.50E+00	3.98E-01	
	B	1	0	0				
10bFC	A	TNTC	29	3	2.82E+03	2.82E+02	2.45E+00	
	B	TNTC	28	2				
10aNC	A	0	0	0				<0.00
	B	0	0	0				
10bNC	A	0	0	0				<0.00
	B	0	0	0				
11aFC	A	TNTC	TNTC	96	9.20E+04	9.20E+03	3.96E+00	
	B	TNTC	TNTC	88				
11bFC	A	TNTC	TNTC	TNTC				>2.00
	B	TNTC	TNTC	TNTC				
11aNC	A	1	0	0	1.00E+01	1.00E+00	0.00E+00	
	B	0	0	0				
11bNC	A	0	0	0				<0.00
	B	0	0	0				
12aFC	A	0	0	0				<0.00
	B	0	0	0				
12bFC	A	0	0	0				<0.00
	B	0	0	0				
12aNC	A	1	0	0	1.50E+01	1.50E+00	1.76E-01	
	B	2	0	0				
12bNC	A	93	16	1	9.90E+02	9.90E+01	2.00E+00	
	B	88	10	0				
13aFC	A	1	0	0	1.00E+01	1.00E+00	0.00E+00	
	B	0	0	0				
13bFC	A	0	0	0				<0.00
	B	0	0	0				
13aNC	A	1	0	0	1.50E+01	1.50E+00	1.76E-01	
	B	2	0	0				
13bNC	A	0	0	0				<0.00
	B	0	0	0				

14aFC	A		TNTC	TNTC	560	5.20E+05	5.20E+04	4.72E+00
	B		TNTC	TNTC	480			
14bFC	A		TNTC	TNTC	360	3.60E+05	3.60E+04	4.56E+00
	B		TNTC	TNTC	360			
14aNC	A		11	2	1	1.86E+02	1.86E+01	1.27E+00
	B		21	4	0			
14bNC	A		0	0	0			<0.00
	B		0	0	0			
15aFC	A		2	1	0	2.73E+01	2.73E+00	4.36E-01
	B		0	0	0			
15bFC	A		15	5	1	1.68E+02	1.68E+01	1.23E+00
	B		12	2	2			
15aNC	A		0	0	0			<0.00
	B		0	0	0			
15bNC	A		0	0	0			<0.00
	B		0	0	0			
16aFC	A		TNTC	TNTC	26	2.40E+04	2.40E+03	3.38E+00
	B		TNTC	TNTC	22			
16bFC	A		99	20	5	1.22E+03	1.22E+02	2.09E+00
	B		116	17				
16aNC	A	1	0	0		1.00E+00	1.00E-01	-1.00E+00
	B	0	0	0				
16bNC	A	11	1	0		9.05E+00	9.05E-01	-4.35E-02
	B	7	0	0				
17aFC	A		84	11	2	8.00E+02	8.00E+01	1.90E+00
	B		66	5	0			
17bFC	A		TNTC	31	9	3.77E+03	3.77E+02	2.58E+00
	B		TNTC	35	8			
17aNC	A	9	0	0		7.00E+00	7.00E-01	-1.55E-01
	B	5	0	0				
17bNC	A	0	0	0				<-1.00
	B	0	0	0				
18aFC	A		6	3	0	8.10E+01	8.10E+00	9.08E-01
	B		8	0	0			
18bFC	A		0	0	0			<0.00
	B		0	0	0			
18aNC	A	77	12	4		7.82E+01	7.82E+00	8.93E-01
	B	71	7	1				
18bNC	A	14	2	0		1.14E+01	1.14E+00	5.55E-02
	B	8	1	0				
19aFC	A		TNTC	TNTC	300	3.30E+05	3.30E+04	4.52E+00
	B		TNTC	TNTC	360			
19bFC	A		TNTC	TNTC	360	3.30E+05	3.30E+04	4.52E+00
	B		TNTC	TNTC	300			
19aNC	A	TNTC	6	3		6.36E+01	6.36E+00	8.04E-01
	B	TNTC	4	1				
19bNC	A	26	1	0		1.81E+01	1.81E+00	2.58E-01
	B	11	0	0				
20aFC	A		25	5	1	2.77E+02	2.77E+01	1.44E+00
	B		27	2	1			
20bFC	A		36	4	0	3.86E+02	3.86E+01	1.59E+00
	B		40	5	0			
20aNC	A	TNTC	6	1		7.14E+01	7.14E+00	8.54E-01
	B	TNTC	8	0				
20bNC	A	0	0	0				<-1.00
	B	0	0	0				
21aFC	A		65	20	2	7.64E+02	7.64E+01	1.88E+00
	B		70	10	1			
21bFC	A		TNTC	TNTC	240	2.40E+05	2.40E+04	4.38E+00
	B		TNTC	TNTC	240			
21aNC	A	7	0	0		5.50E+00	5.50E-01	-2.60E-01
	B	4	0	0				
21bNC	A	0	1	0		1.00E+01	1.00E+00	0.00E+00
	B	0	0	0				
22aFC	A		TNTC	TNTC	59	5.45E+04	5.45E+03	3.74E+00
	B		TNTC	TNTC	50			
22bFC	A		TNTC	42	9	4.64E+03	4.64E+02	2.67E+00
	B		TNTC	43	8			
22aNC	A	0	0	0				<-1.00
	B	0	0	0				
22bNC	A	1	0	0		1.50E+00	1.50E-01	-8.24E-01
	B	2	0	0				
23aFC	A		TNTC	TNTC	91	1.04E+05	1.04E+04	4.01E+00
	B		TNTC	TNTC	116			
23bFC	A		TNTC	29	4	2.77E+03	2.77E+02	2.44E+00
	B		TNTC	25	3			
23aNC	A	2	0	0		2.50E+00	2.50E-01	-6.02E-01
	B	3	0	0				
23bNC	A	0	0	0				<-1.00
	B	0	0	0				
24aFC	A		0	0	0			<0.00
	B		0	0	0			
24bFC	A		114	9	2	1.31E+03	1.31E+02	2.12E+00
	B		TNTC	19	0			
24aNC	A	TNTC	TNTC	TNTC				>3.5
	B	TNTC	TNTC	TNTC				
24bNC	A	TNTC	TNTC	240		2.50E+04	2.50E+03	3.40E+00
	B	TNTC	TNTC	260				
25aFC	A		42	3	1	5.62E+02	5.62E+01	1.75E+00
	B		67	5	0			
25bFC	A		13	0	0	1.45E+02	1.45E+01	1.16E+00
	B		16	0	0			
25aNC	A	0	0	0				<-1.00
	B	0	0	0				
25bNC	A	0	0	0				<-1.00
	B	0	0	0				
26aFC	A		0	0	0			<0.00
	B		0	0	0			
26bFC	A		0	0	0			<0.00
	B		0	0	0			
26aNC	A	0	0	0				<-1.00
	B	0	0	0				
26bNC	A	0	0	0				<-1.00
	B	0	0	0				
27aFC	A		TNTC	TNTC	360	3.50E+05	3.50E+04	4.54E+00
	B		TNTC	TNTC	340			
27bFC	A		19	0	0	1.85E+02	1.85E+01	1.27E+00
	B		18	0	0			
27aNC	A	0	0	0				<-1.00
	B	0	0	0				
27bNC	A	0	0	0				<-1.00
	B	0	0	0				

28aFC	A		2	1	0	2.73E+01	2.73E+00	4.36E-01
	B		0	0	0			
28bFC	A		TNTC	18	6	2.45E+03	2.45E+02	2.39E+00
	B		TNTC	28	2			
28aNC	A	14	1	0		1.76E+01	1.76E+00	2.46E-01
	B	22	0	0				
28bNC	A	0	0	0				<-1.00
	B	0	0	0				
29aFC	A		0	0	0			<0.00
	B		0	0	0			
29bFC	A		TNTC	TNTC	31	3.15E+04	3.15E+03	3.50E+00
	B		TNTC	TNTC	32			
29aNC	A	0	0	0				<-1.00
	B	0	0	0				
29bNC	A	0	0	0				<-1.00
	B	0	0	0				
30aFC	A		TNTC	TNTC	74	6.20E+04	6.20E+03	3.79E+00
	B		TNTC	TNTC	50			
30bFC	A		TNTC	TNTC	500	4.60E+05	4.60E+04	4.66E+00
	B		TNTC	TNTC	420			
30aNC	A	17	2	0		1.95E+01	1.95E+00	2.91E-01
	B	23	1	0				
30bNC	A	TNTC	48	9		6.00E+02	6.00E+01	1.78E+00
	B	TNTC	65	10				
31aFC	A		19	3	0	2.00E+02	2.00E+01	1.30E+00
	B		17	5	0			
31bFC	A		TNTC	30	2	3.27E+03	3.27E+02	2.51E+00
	B		TNTC	38	2			
31aNC	A	0	0	0				<-1.00
	B	0	0	0				
31bNC	A	TNTC	55	5		5.50E+02	5.50E+01	1.74E+00
	B	TNTC	57	4				
32aFC	A		9	1	0	1.05E+02	1.05E+01	1.02E+00
	B		12	0	0			
32bFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		0	0	0			
32aNC	A	0	0	0				<-1.00
	B	0	0	0				
32bNC	A	0	0	0				<-1.00
	B	0	0	0				
33aFC	A		TNTC	TNTC	260	3.00E+05	3.00E+04	4.48E+00
	B		TNTC	TNTC	340			
33bFC	A		0	0	0			<0.00
	B		0	0	0			
33aNC	A	20	2	0		1.90E+01	1.90E+00	2.80E-01
	B	18	0	0				
33bNC	A	0	0	0				<-1.00
	B	0	0	0				
34aFC	A		2	0	0	2.00E+01	2.00E+00	3.01E-01
	B		0	0	0			
34bFC	A		0	0	0			<0.00
	B		0	0	0			
34aNC	A	2	0	0		2.00E+00	2.00E-01	-6.99E-01
	B	0	0	0				
34bNC	A	0	0	0				<-1.00
	B	0	0	0				
35aFC	A		2	0	0	2.00E+01	2.00E+00	3.01E-01
	B		2	0	0			
35bFC	A		4	1	0	3.33E+01	3.33E+00	5.23E-01
	B		2	0	0			
35aNC	A	0	0	0				<-1.00
	B	0	0	0				
35bNC	A	0	0	0				<-1.00
	B	0	0	0				
36aFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		0	0	0			
36bFC	A		3	0	0	5.50E+01	5.50E+00	7.40E-01
	B		8	0	0			
36aNC	A	1	0	0		1.00E+00	1.00E-01	-1.00E+00
	B	1	0	0				
36bNC	A	3	0	0		2.00E+00	2.00E-01	-6.99E-01
	B	1	0	0				
37aFC	A		TNTC	TNTC	420	4.40E+05	4.40E+04	4.64E+00
	B		TNTC	TNTC	460			
37bFC	A		75	11	2	8.09E+02	8.09E+01	1.91E+00
	B		77	10	3			
37aNC	A	77	9	2		8.55E+01	8.55E+00	9.32E-01
	B	93	6	1				
37bNC	A	0	0	0				<-1.00
	B	0	0	0				
38aFC	A		8	0		1.05E+02	1.05E+01	1.02E+00
	B		13	0				
38bFC	A		TNTC	91	11	9.09E+03	9.09E+02	2.96E+00
	B		TNTC	80	18			
38aNC	A	4	2	0		5.24E+00	5.24E-01	-2.81E-01
	B	5	0	0				
38bNC	A	0	0	0				<-1.00
	B	0	0	0				
39aFC	A		TNTC	11	1	1.00E+03	1.00E+02	2.00E+00
	B		TNTC	9	0			
39bFC	A		0	0	0			<0.00
	B		0	0	0			
39aNC	A	0	0	0				<-1.00
	B	0	0	0				
39bNC	A	0	0	0				<-1.00
	B	0	0	0				
40aFC	A		46	5	0	4.77E+02	4.77E+01	1.68E+00
	B		53	1	0			
40bFC	A		TNTC	TNTC	46	4.20E+04	4.20E+03	3.62E+00
	B		TNTC	TNTC	38			
40aNC	A	3	1	0		4.29E+00	4.29E-01	-3.68E-01
	B	5	0	0				
40bNC	A	0	0	0				<-1.00
	B	0	0	0				
41aFC	A		5	1	0	6.19E+01	6.19E+00	7.92E-01
	B		7	0	0			
41bFC	A		0	0	0			<0.00
	B		0	0	0			
41aNC	A	14	5	0		1.48E+01	1.48E+00	1.69E-01
	B	12	0	0				
41bNC	A	0	0	0				<-1.00
	B	0	0	0				

42aFC	A		TNTC	61	9	6.59E+03	6.59E+02	2.82E+00
	B		TNTC	62	13			
42bFC	A			19	2	1.82E+02	1.82E+01	1.26E+00
	B			18	1	0		
42aNC	A	0	0	0				<-1.00
	B	0	0	0				
42bNC	A	1	0	0		1.00E+00	1.00E-01	-1.00E+00
	B	0	0	0				
43aFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		0	0	0			
43bFC	A		TNTC	24	3	3.05E+03	3.05E+02	2.48E+00
	B		TNTC	35	5			
43aNC	A	11	0	1		1.05E+01	1.05E+00	2.12E-02
	B	9	0	0				
43bNC	A	0	1	1		1.82E+01	1.82E+00	2.60E-01
	B	0	0	0				
44aFC	A		68	13	2	6.95E+02	6.95E+01	1.84E+00
	B		61	8	1			
44bFC	A		TNTC	TNTC	28	2.85E+04	2.85E+03	3.45E+00
	B		TNTC	TNTC	29			
44aNC	A	2	0	0		2.00E+00	2.00E-01	-6.99E-01
	B	2	0	0				
44bNC	A	0	0	0				<-1.00
	B	0	0	0				
45aFC	A		2	0	0	2.50E+01	2.50E+00	3.98E-01
	B		3	0	0			
45bFC	A		TNTC	70	7	7.09E+03	7.09E+02	2.85E+00
	B		TNTC	71	8			
45aNC	A	0	0	0				<-1.00
	B	0	0	0				
45bNC	A	0	0	0				<-1.00
	B	0	0	0				
46aFC	A		0	0	0			<0.00
	B		0	0	0			
46bFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		1	0	0			
46aNC	A	0	0	0				<-1.00
	B	0	0	0				
46bNC	A	0	0	0				<-1.00
	B	0	0	0				

Sample ID	Duplicate	TOTAL COLIFORMS				Result CFU/ml	CFU/g	Log (CFU/g)
		Colonies counts			10 ⁻³			
		10 ⁻⁰	10 ⁻¹	10 ⁻²				
1T	A	0	0	0				<1.0
	B	0	0	0				
1L	A	TNTC	TNTC	46	5.45E+03	4.91E+04	4.69E+00	
	B	TNTC	TNTC	63				
2T	A	TNTC	34	1	3.41E+02	3.07E+03	3.49E+00	
	B	TNTC	38	2				
2L	A	TNTC	TNTC	59	5.60E+03	5.04E+04	4.70E+00	
	B	TNTC	TNTC	53				
3T	A	94	14	1	1.01E+02	9.12E+02	2.96E+00	
	B	97	14	3				
3L	A	TNTC	TNTC	132	1.37E+04	1.23E+05	5.09E+00	
	B	TNTC	TNTC	142				
4T	A	TNTC	47	7	5.09E+02	4.58E+03	3.66E+00	
	B	TNTC	49	9				
4L	A	TNTC	TNTC	300	2.40E+04	2.16E+05	5.33E+00	
	B	TNTC	TNTC	180				
5T	A	TNTC	TNTC	260	2.40E+04	2.16E+05	5.33E+00	
	B	TNTC	TNTC	220				
5L	A	TNTC	TNTC	180	2.00E+04	1.80E+05	5.26E+00	
	B	TNTC	TNTC	220				
6T	A	TNTC	15	2	1.59E+02	1.43E+03	3.16E+00	
	B	TNTC	17	1				
6L	A	TNTC	TNTC	51	5.85E+03	5.27E+04	4.72E+00	
	B	TNTC	TNTC	66				
7T	A	TNTC	9	4	1.68E+02	1.51E+03	3.18E+00	
	B	TNTC	22	2				
8L	A	TNTC	TNTC	300	2.60E+04	2.34E+05	5.37E+00	
	B	TNTC	TNTC	220				
9L	A	TNTC	TNTC	81	8.50E+03	7.65E+04	4.88E+00	
	B	TNTC	TNTC	89				
10T	A	TNTC	TNTC	18	1.20E+03	1.08E+04	4.03E+00	
	B	TNTC	TNTC	6				
11T	A	TNTC	TNTC	17	1.60E+03	1.44E+04	4.16E+00	
	B	TNTC	TNTC	15				
12T	A	TNTC	TNTC	75	8.00E+03	7.20E+04	4.86E+00	
	B	TNTC	TNTC	85				
13T	A	TNTC	TNTC	25	2.25E+03	2.03E+04	4.31E+00	
	B	TNTC	TNTC	20				
14L	A	TNTC	TNTC	380	3.70E+04	3.33E+05	5.52E+00	
	B	TNTC	TNTC	360				
15T	A	8	0	0	1.05E+01	9.45E+01	1.98E+00	
	B	13	0	0				
16L	A	TNTC	TNTC	12	1.70E+04	1.53E+05	5.18E+00	
	B	TNTC	TNTC	22				
17T	A	1	0	0	1.00E+01	9.00E+01	1.95E+00	
	B	1	0	0				
17L	A	TNTC	TNTC	36	3.40E+04	3.06E+05	5.49E+00	
	B	TNTC	TNTC	32				
18T	A	50	5	0	4.00E+02	3.60E+03	3.56E+00	
	B	29	0	0				
18L	A	TNTC	56	10	6.05E+03	5.44E+04	4.74E+00	
	B	TNTC	56	11				
19L	A	TNTC	TNTC	43	4.50E+04	4.05E+05	5.61E+00	
	B	TNTC	TNTC	47				
20T	A	0	0	0			<1.9	
	B	0	0	0				
21L	A	57	10	2	6.38E+02	5.74E+03	3.76E+00	
	B	51	14	0				
22L	A	TNTC	43	7	5.00E+03	4.50E+04	4.65E+00	
	B	TNTC	55	5				
23L	A	TNTC	98	7	9.77E+03	8.80E+04	4.94E+00	
	B	TNTC	95	15				
24L	A	TNTC	TNTC	49	4.95E+04	4.46E+05	5.65E+00	
	B	TNTC	TNTC	50				
25T	A	TNTC	75	12	8.32E+03	7.49E+04	4.87E+00	
	B	TNTC	78	18				
26T	A	6	1	0	6.19E+01	5.57E+02	2.75E+00	
	B	6	0	0				
27T	A	TNTC	TNTC	37	3.85E+04	3.47E+05	5.54E+00	
	B	TNTC	TNTC	40				
27L	A	TNTC	12	1	1.45E+03	1.31E+04	4.12E+00	
	B	TNTC	16	3				
28T	A	TNTC	76	5	7.50E+03	6.75E+04	4.83E+00	
	B	TNTC	76	8				
28L	A	2	0	0	2.00E+01	1.80E+02	2.26E+00	
	B	0	0	0				
29T	A	63	4	1	5.62E+02	5.06E+03	3.70E+00	
	B	41	9	0				
30L	A	TNTC	TNTC	16	1.21E+04	1.09E+05	5.04E+00	
	B	TNTC	107	22				
31T	A	TNTC	17	4	1.91E+03	1.72E+04	4.24E+00	
	B	TNTC	20	1				
32T	A	129	14	1	1.28E+03	1.15E+04	4.06E+00	
	B	121	15	2				
33T	A	32	0	1	2.90E+02	2.61E+03	3.42E+00	
	B	25	3	0				
33L	A	TNTC	120	13	1.23E+04	1.10E+05	5.04E+00	
	B	TNTC	114	23				
34T	A	7	1	0	8.18E+01	7.36E+02	2.87E+00	
	B	9	1	0				
35T	A	126	13	1	1.30E+03	1.17E+04	4.07E+00	
	B	133	10	2				
36T	A	TNTC	33	2	2.86E+03	2.58E+04	4.41E+00	
	B	TNTC	25	3				
36L	A	TNTC	72	11	6.95E+03	6.26E+04	4.80E+00	
	B	TNTC	62	8				
37L	A	TNTC	TNTC	102	1.14E+05	1.02E+06	6.01E+00	
	B	TNTC	TNTC	125				
38T	A	37	2	0	3.32E+02	2.99E+03	3.48E+00	
	B	33	1	0				
38L	A	TNTC	TNTC	136	1.41E+05	1.27E+06	6.10E+00	
	B	TNTC	TNTC	146				
39T	A	5	1	0	5.83E+01	5.25E+02	2.72E+00	
	B	0	1	0				
40L	A	TNTC	34	6	4.64E+03	4.17E+04	4.62E+00	
	B	TNTC	53	9				
40T	A	96	11	0	9.59E+02	8.63E+03	3.94E+00	
	B	88	16	0				
41T	A	TNTC	TNTC	21	1.90E+04	1.71E+05	5.23E+00	
	B	TNTC	TNTC	17				
42T	A	16	0	0	1.65E+02	1.49E+03	3.17E+00	
	B	17	0	0				

42L	A		TNTC	TNTC	220	2.10E+05	1.89E+06	6.28E+00
	B		TNTC	TNTC	200			
43T	A		67	7	0	7.43E+02	6.69E+03	3.83E+00
	B		73	8	1			
44L	A		53	9	2	5.73E+02	5.15E+03	3.71E+00
	B		49	10	3			
45T	A		0	0	0			<1.9
	B		0	0	0			
46T	A		5	0	0	3.50E+01	3.15E+02	2.50E+00
	B		2	0	0			
1aFC	A		0	0	0	1.00E+01	1.00E+00	0.00E+00
	B		1	0	0			
1bFC	A		TNTC	TNTC	18	1.95E+04	1.95E+03	3.29E+00
	B		TNTC	TNTC	21			
1aNC	A		0	0	0			<0.00
	B		0	0	0			
1bNC	A		0	0	0			<0.00
	B		0	0	0			
2aFC	A		TNTC	37	11	5.05E+03	5.05E+02	2.70E+00
	B		TNTC	45	18			
2bFC	A		TNTC	57	12	6.41E+03	6.41E+02	2.81E+00
	B		TNTC	60	12			
2aNC	A		0	0	0			<0.00
	B		0	0	0			
2bNC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		0	0	0			
3aFC	A		TNTC	40	9	4.23E+03	4.23E+02	2.63E+00
	B		TNTC	38	6			
3bFC	A		TNTC	52	4	5.09E+03	5.09E+02	2.71E+00
	B		TNTC	49	7			
3aNC	A		0	0	0			<0.00
	B		0	0	0			
3bNC	A		8	1	0	5.24E+01	5.24E+00	7.19E-01
	B		2	0	0			
4aFC	A		TNTC	TNTC	36	3.50E+04	3.50E+03	3.54E+00
	B		TNTC	TNTC	34			
4bFC	A		TNTC	49	3	4.95E+03	4.95E+02	2.70E+00
	B		TNTC	44	13			
4aNC	A		0	0	0			<0.00
	B		0	0	0			
4bNC	A		0	0	0			<0.00
	B		0	0	0			
5aFC	A		TNTC	74	29	7.91E+03	7.91E+02	2.90E+00
	B		TNTC	53	18			
5bFC	A		TNTC	59	11	6.77E+03	6.77E+02	2.83E+00
	B		TNTC	67	12			
5aNC	A		0	0	0			<0.00
	B		0	0	0			
5bNC	A		0	0	0			<0.00
	B		0	0	0			
6aFC	A		TNTC	TNTC	36	3.65E+04	3.65E+03	3.56E+00
	B		TNTC	TNTC	37			
6bFC	A		8	1	0	1.36E+02	1.36E+01	1.13E+00
	B		18	3	0			
6aNC	A		50	2	1	4.95E+02	4.95E+01	1.69E+00
	B		48	3	0			
6bNC	A		2	0	0	3.00E+01	3.00E+00	4.77E-01
	B		4	0	0			
7aFC	A		2	0	0	3.50E+01	3.50E+00	5.44E-01
	B		5	0	0			
7bFC	A		TNTC	TNTC	42	4.80E+04	4.80E+03	3.68E+00
	B		TNTC	TNTC	54			
7aNC	A		6	1	0	5.71E+01	5.71E+00	7.57E-01
	B		5	0	0			
7bNC	A		0	0	0			<0.00
	B		0	0	0			
8aFC	A		TNTC	92	14	9.64E+03	9.64E+02	2.98E+00
	B		TNTC	91	15			
8bFC	A		TNTC	43	7	4.45E+03	4.45E+02	2.65E+00
	B		TNTC	47	1			
8aNC	A		TNTC	24	1	2.77E+03	2.77E+02	2.44E+00
	B		TNTC	31	5			
8bNC	A		0	0	0			<0.00
	B		0	0	0			
9aFC	A		42	22	3	5.27E+02	5.27E+01	1.72E+00
	B		36	12	1			
9bFC	A		TNTC	TNTC	34	3.50E+04	3.50E+03	3.54E+00
	B		TNTC	TNTC	36			
9aNC	A		0	0	0			<0.00
	B		0	0	0			
9bNC	A		3	0	0	2.50E+01	2.50E+00	3.98E-01
	B		2	0	0			
10aFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
	B		0	0	0			
10bFC	A		107	13	0	1.09E+03	1.09E+02	2.04E+00
	B		95	24	0			
10aNC	A		0	0	0			<0.00
	B		0	0	0			
10bNC	A		0	0	0			<0.00
	B		0	0	0			
11aFC	A		TNTC	TNTC	TNTC			>1.00
	B		TNTC	TNTC	TNTC			
11bFC	A		TNTC	TNTC	33	3.30E+03	3.30E+02	2.52E+00
	B		TNTC	TNTC	33			
11aNC	A		0	0	0			<-1.00
	B		0	0	0			
11bNC	A		1	0	0	1.00E+00	1.00E-01	-1.00E+00
	B		0	0	0			
12aFC	A		1	0	0	1.00E+00	1.00E-01	-1.00E+00
	B		0	0	0			
12bFC	A		1	0	0	1.00E+00	1.00E-01	-1.00E+00
	B		1	0	0			
12aNC	A		6	2	1	1.00E+01	1.00E+00	0.00E+00
	B		12	0	0			
12bNC	A		TNTC	79	13	7.86E+02	7.86E+01	1.90E+00
	B		TNTC	74	7			
13aFC	A		25	1	0	3.10E+01	3.10E+00	4.91E-01
	B		39	0	0			
13bFC	A		10	0	0	1.05E+01	1.05E+00	2.12E-02
	B		11	0	0			
13aNC	A		0	0	0			<-1.00
	B		0	0	0			
13bNC	A		0	0	0			<-1.00
	B		0	0	0			

42aFC	A		TNTC	27	9	3.05E+03	3.05E+02	2.48E+00
B			TNTC	30	1			
42bFC	A		12	2	0	1.36E+02	1.36E+01	1.13E+00
B			14	2	0			
42aNC	A	0	0	0				
B	0	0	0	0				
42bNC	A	0	0	0				
B	0	0	0	0				
43aFC	A		3	0	0	3.00E+01	3.00E+00	4.77E-01
B	0	0	0	0	0			
43bFC	A		69	15	1	8.14E+02	8.14E+01	1.91E+00
B			74	17	3			
43aNC	A	7	1	0		7.14E+00	7.14E-01	-1.46E-01
B	7	0	0	0				
43bNC	A	0	0	0				
B	0	0	0	0				
44aFC	A		63	3	0	6.23E+02	6.23E+01	1.79E+00
B			64	7	0			
44bFC	A		TNTC	TNTC	15	1.35E+04	1.35E+03	3.13E+00
B			TNTC	TNTC	12			
44aNC	A	0	0	0				
B	0	0	0	0				
44bNC	A	0	0	0				
B	0	0	0	0				
45aFC	A		0	0	0	6.36E+01	6.36E+00	8.04E-01
B			5	2	0			
45bFC	A		TNTC	55	3	5.55E+03	5.55E+02	2.74E+00
B			TNTC	60	4			
45aNC	A	1	0	0		1.00E+00	1.00E-01	-1.00E+00
B	0	0	0	0				
45bNC	A	0	0	0				
B	0	0	0	0				
46aFC	A		0	0	0			
B	0	0	0	0	0			
46bFC	A		1	0	0	1.00E+01	1.00E+00	0.00E+00
B			1	0	0			
46aNC	A	0	0	0				
B	0	0	0	0				
46bNC	A	0	0	0				
B	0	0	0	0				

E. COLI								
Sample ID	Duplicate	Colonies counts				Result		
		10^0	10^-1	10^-2	10^-3	CFU/ml	CFU/g	Log (CFU/g)
1T	A							
	B							
1L	A							
	B							
2T	A							
	B							
2L	A	6	1			9.55E+00	8.59E+01	1.93E+00
	B	7	7					
3T	A							
	B							
3L	A	2	1			2.73E+00	2.45E+01	1.39E+00
	B							
4T	A	3				2.00E+00	1.80E+01	1.26E+00
	B	1						
4L	A		1			1.00E+01	9.00E+01	1.95E+00
	B		1					
5T	A							
	B							
5L	A		2			2.00E+01	1.80E+02	2.26E+00
	B		2					
6T	A	2				2.00E+00	1.80E+01	1.26E+00
	B							
6L	A	1	1			1.82E+00	1.64E+01	1.21E+00
	B							
7T	A							
	B							
8L	A	7	6			9.55E+00	8.59E+01	1.93E+00
	B	4	4					
9L	A	7				8.50E+00	7.65E+01	1.88E+00
	B	10						
10T	A							
	B							
11T	A	2				1.50E+00	1.35E+01	1.13E+00
	B	1						
12T	A							
	B							
13T	A							
	B							
14L	A	1				1.50E+00	1.35E+01	1.13E+00
	B	2						
15T	A							
	B							
16L	A		4			3.50E+01	3.15E+02	2.50E+00
	B		3					
17T	A							
	B							
17L	A							
	B							
18T	A							
	B							
18L	A							
	B							
19L	A							
	B							
20T	A							
	B							
21L	A		1			1.00E+01	9.00E+01	1.95E+00
	B							
22L	A		1			2.00E+01	1.80E+02	2.26E+00
	B		3					
23L	A							
	B							
24L	A							
	B							
25T	A		3			2.50E+01	2.25E+02	2.35E+00
	B		2					
26T	A							
	B							
27T	A							
	B							
27L	A							
	B							
28T	A							
	B							
28L	A		1			1.00E+01	9.00E+01	1.95E+00
	B							
29T	A							
	B							
30L	A					1.00E+01	9.00E+01	1.95E+00
	B		1					
31T	A							
	B							
32T	A							
	B							
33T	A							
	B							
33L	A							
	B							
34T	A							
	B							
35T	A							
	B							
36T	A							
	B							
36L	A							
	B							
37L	A		4	1		4.76E+01	4.29E+02	2.63E+00
	B		5					
38T	A							
	B							
38L	A		3	1		3.64E+01	3.27E+02	2.51E+00
	B							
39T	A							
	B							
40L	A							
	B							
40T	A							
	B							
41T	A							
	B							
42T	A							
	B							

42L	A	3			2.00E+01	1.80E+02	2.26E+00
	B	1					
43T	A						
	B						
44L	A	1			1.00E+01	9.00E+01	1.95E+00
	B						
45T	A						
	B						
46T	A						
	B						
1aFC	A						
	B						
1bFC	A						
	B						
1aNC	A						
	B						
1bNC	A						
	B						
2aFC	A						
	B						
2bFC	A						
	B						
2aNC	A						
	B						
2bNC	A						
	B						
3aFC	A						
	B						
3bFC	A	1			1.50E+01	1.50E+00	1.76E-01
	B	2					
3aNC	A	2			2.00E+01	2.00E+00	3.01E-01
	B						
3bNC	A						
	B						
4aFC	A	1	3		4.55E+01	4.55E+00	6.58E-01
	B	4	2				
4bFC	A	1			1.00E+01	1.00E+00	0.00E+00
	B						
4aNC	A						
	B						
4bNC	A						
	B						
5aFC	A	1			1.82E+01	1.82E+00	2.60E-01
	B		1				
5bFC	A	1			1.00E+01	1.00E+00	0.00E+00
	B						
5aNC	A						
	B						
5bNC	A						
	B						
6aFC	A						
	B						
6bFC	A						
	B						
6aNC	A						
	B						
6bNC	A						
	B						
7aFC	A						
	B						
7bFC	A						
	B						
7aNC	A						
	B						
7bNC	A						
	B						
8aFC	A	14	0	0	1.62E+02	1.62E+01	1.21E+00
	B	16	4	0			
8bFC	A	3	1		4.55E+01	4.55E+00	6.58E-01
	B	5	1				
8aNC	A						
	B						
8bNC	A						
	B						
9aFC	A	2			2.50E+01	2.50E+00	3.98E-01
	B	3					
9bFC	A						
	B						
9aNC	A						
	B						
9bNC	A						
	B						
10aFC	A						
	B						
10bFC	A						
	B						
10aNC	A						
	B						
10bNC	A						
	B						
11aFC	A		5		3.50E+02	3.50E+01	1.54E+00
	B		2				
11bFC	A						
	B						
11aNC	A						
	B						
11bNC	A						
	B						
12aFC	A						
	B						
12bFC	A						
	B						
12aNC	A						
	B						
12bNC	A						
	B						
13aFC	A						
	B						
13bFC	A						
	B						
13aNC	A						
	B						
13bNC	A						
	B						

14aFC	A	4	3	1		7.62E+00	7.62E-01	-1.18E-01
	B	5	3	0				
14bFC	A	11	1			9.55E+00	9.55E-01	-2.02E-02
	B	7	2					
14aNC	A	1				1.50E+00	1.50E-01	-8.24E-01
	B	2						
14bNC	A							
	B							
15aFC	A							
	B							
15bFC	A							
	B							
15aNC	A							
	B							
15bNC	A							
	B							
16aFC	A		3			3.00E+02	3.00E+01	1.48E+00
	B							
16bFC	A							
	B							
16aNC	A							
	B							
16bNC	A							
	B							
17aFC	A							
	B							
17bFC	A							
	B							
17aNC	A							
	B							
17bNC	A							
	B							
18aFC	A							
	B							
18bFC	A							
	B							
18aNC	A							
	B							
18bNC	A							
	B							
19aFC	A							
	B							
19bFC	A							
	B							
19aNC	A							
	B							
19bNC	A	10				1.20E+01	1.20E+00	7.92E-02
	B	14						
20aFC	A							
	B							
20bFC	A							
	B							
20aNC	A	1				1.00E+00	1.00E-01	-1.00E+00
	B							
20bNC	A							
	B							
21aFC	A							
	B							
21bFC	A							
	B							
21aNC	A							
	B							
21bNC	A							
	B							
22aFC	A							
	B							
22bFC	A							
	B							
22aNC	A							
	B							
22bNC	A							
	B							
23aFC	A		2			2.00E+03	2.00E+02	2.30E+00
	B							
23bFC	A							
	B							
23aNC	A							
	B							
23bNC	A							
	B							
24aFC	A							
	B							
24bFC	A							
	B							
24aNC	A		1			1.00E+02	1.00E+01	1.00E+00
	B							
24bNC	A							
	B							
25aFC	A							
	B							
25bFC	A							
	B							
25aNC	A							
	B							
25bNC	A							
	B							
26aFC	A							
	B							
26bFC	A							
	B							
26aNC	A							
	B							
26bNC	A							
	B							
27aFC	A		1			1.00E+03	1.00E+02	2.00E+00
	B		1					
27bFC	A							
	B							
27aNC	A							
	B							
27bNC	A							
	B							

28aFC	A							
28bFC	B							
28aNC	A							
28bNC	B							
29aFC	A							
29bFC	B							
29aNC	A							
29bNC	B							
30aFC	A							
30bFC	B							
30aNC	A							
30bNC	B							
31aFC	A							
31bFC	B							
31aNC	A							
31bNC	B							
32aFC	A							
32bFC	B							
32aNC	A							
32bNC	B							
33aFC	A							
33bFC	B							
33aNC	A							
33bNC	B							
34aFC	A							
34bFC	B							
34aNC	A							
34bNC	B							
35aFC	A							
35bFC	B							
35aNC	A							
35bNC	B							
36aFC	A							
36bFC	B							
36aNC	A							
36bNC	B							
37aFC	A							
37bFC	B							
37aNC	A							
37bNC	B							
38aFC	A							
38bFC	B							
38aNC	A							
38bNC	B							
39aFC	A							
39bFC	B							
39aNC	A							
39bNC	B							
40aFC	A							
40bFC	B							
40aNC	A							
40bNC	B							
41aFC	A							
41bFC	B							
41aNC	A							
41bNC	B							

42aFC	A							
42bFC	B							
42aNC	A							
42bNC	B							
43aFC	A							
43bFC	B							
43aNC	A							
43bNC	B							
44aFC	A							
44bFC	B							
44aNC	A							
44bNC	B							
45aFC	A							
45bFC	B							
45aNC	A							
45bNC	B							
46aFC	A							
46bFC	B							
46aNC	A							
46bNC	B							

Salmonella results

sample ID	XLD		HE	
	TT	RV	TT	RV
1T				
1L	+		+	
1aFC				
1bFC				
1aNC				
1bNC				
2T				
2L			+	
2aFC				
2bFC			+	+
2aNC				
2bNC				
3T				
3L				
3aFC				
3bFC				
3aNC			+	+
3bNC				
4T			+	
4L				
4aFC				
4bFC				
4aNC				
4bNC				
5T				
5L				
5aFC				
5bFC				
5aNC				
5bNC				
6T				
6L			+	+
6aFC			+	
6bFC				
6aNC			+	
6bNC				
7T			+	
7L				
7aFC				+
7bFC			+	
7aNC				
7bNC			+	
8T			+	+
8L				
8aFC				
8bFC				
8aNC				
8bNC				
9T				
9L				
9aFC			+	
9bFC				
9aNC				
9bNC			+	
10T				+
10L				
10aFC				
10bFC				
10aNC				
10bNC				
11T				
11L				
11aFC				
11bFC				
11aNC				
11bNC				
12T			+	
12L			+	+
12aFC				
12bFC	+			
12aNC				
12bNC				
13T				
13L			+	+
13aFC	+		+	
13bFC			+	+
13aNC				
13bNC				
14T			+	+
14L				
14aFC			+	
14bFC				
14aNC				
14bNC				
15T				
15L			+	
15aFC			+	
15bFC			+	+
15aNC			+	
15bNC			+	+
16T			+	
16L				
16aFC			+	
16bFC				
16aNC				
16bNC				
17T			+	+
17L				
17aFC				
17bFC			+	
17aNC			+	
17bNC				
18T			+	
18L	+		+	
18aFC			+	
18bFC				
18aNC				
18bNC				

19T				
19L			+	
19aFC				
19bFC			+	
19aNC				
19bNC				
20T				
20L			+	
20aFC			+	+
20bFC				
20aNC				
20bNC				
21T			+	+
21L			+	+
21aFC				
21bFC	+		+	
21aNC				
21bNC				
22T			+	+
22L			+	+
22aFC				
22bFC	+		+	+
22aNC				
22bNC				
23T			+	+
23L				
23aFC			+	
23bFC				
23aNC				
23bNC			+	
24T				
24L			+	
24aFC				
24bFC				
24aNC				
24bNC			+	+
25T				
25L	+		+	
25aFC				
25bFC				+
25aNC			+	
25bNC			+	+
26T				
26L				+
26aFC				
26bFC				
26aNC				
26bNC				
27T				
27L				
27aFC				
27bFC				
27aNC				
27bNC				
28T			+	+
28L				
28aFC				
28bFC				+
28aNC			+	
28bNC				
29T				
29L				
29aFC				
29bFC			+	+
29aNC				
29bNC				
30T				
30L				
30aFC				
30bFC			+	+
30aNC				
30bNC				
31T			+	
31L				
31aFC				
31bFC				
31aNC				
31bNC				
32T				
32L				
32aFC				
32bFC			+	
32aNC				
32bNC				
33T				
33L			+	
33aFC			+	+
33bFC				
33aNC				
33bNC				
34T				
34L				
34aFC				
34bFC				
34aNC				
34bNC				
35T				
35L				
35aFC				+
35bFC			+	
35aNC				
35bNC				

36T				
36L			+	
36aFC				
36bFC				
36aNC				
36bNC				
37T				
37L				
37aFC			+	
37bFC				
37aNC				
37bNC				
38T				
38L				
38aFC				
38bFC				
38aNC				
38bNC				
39T			+	
39L				
39aFC				
39bFC				
39aNC				
39bNC				
40T			+	
40L				
40aFC				
40bFC				
40aNC				
40bNC				
43T				
43L				
43aFC				
43bFC			+	
43aNC	+			+
43bNC				
44T				
44L			+	+
44aFC				
44bFC				
44aNC				
44bNC				
45T				
45L				
45aFC				
45bFC				
45aNC				
45bNC				
46T				
46L			+	
46aFC				
46bFC				
46aNC				
46bNC				
47T				
47L				+
47aFC				
47bFC				
47aNC				
47bNC				
48T				
48L				
48aFC				
48bFC				
48aNC				
48bNC				
51T				
51L				
51aFC	+			+
51bFC	+	+	+	+
51aNC				
51bNC				
52T				
52L				
52aFC				
52bFC				
52aNC				
52bNC				
53T	+			
53L			+	+
53aFC				
53bFC	+		+	+
53aNC				
53bNC				
54T				
54L				
54aFC				
54bFC			+	
54aNC				
54bNC				

55T				
55L				
55aFC				
55bFC				
55aNC				
55bNC			+	
56T				
56L				
56aFC				
56bFC				
56aNC				
56bNC				
57T			+	
57L			+	+
57aFC				+
57bFC			+	
57aNC				
57bNC				
58T				+
58L				
58aFC			+	
58bFC			+	
58aNC				
58bNC				
59T				
59L			+	
59aFC				
59bFC				
59aNC				
59bNC				
60T				
60L				
60aFC				
60bFC			+	+
60aNC				
60bNC				
61T				+
61L				
61aFC				
61bFC			+	
61aNC				
61bNC				
62T				
62L				+
62aFC				+
62bFC				
62aNC				
62bNC				
63T				
63L				
63aFC				
63bFC				
63aNC				
63bNC				
64T				
64L				
64aFC				
64bFC				
64aNC				
64bNC				
65T				
65L				
65aFC				
65bFC				
65aNC				
65bNC				
66T				+
66L				
66aFC				
66bFC				+
66aNC				
66bNC				
67T				
67L				+
67aFC				+
67bFC			+	
67aNC				
67bNC				
68T				
68L				
68aFC				
68bFC				
68aNC				
68bNC				
69T				
69L				
69aFC				
69bFC			+	+
69aNC				
69bNC				

70T				
70L				
70aFC				
70bFC				
70aNC				
70bNC				
71T				
71L				
71aFC				
71bFC				
71aNC				
71bNC				
72T				
72L				
72aFC				
72bFC				+
72aNC				
72bNC				
73T				
73L				
73aFC				
73bFC				
73aNC				
73bNC			+	
74T				
74L				
74aFC				
74bFC				
74aNC				
74bNC				
75T				
75L				
75aFC			+	
75bFC				
75aNC				
75bNC				
76T				
76L				
76aFC				
76bFC				
76aNC				
76bNC				
77T				
77L				
77aFC				
77bFC				
77aNC				
77bNC				
78T				
78L				
78aFC				
78bFC				
78aNC				
78bNC				
79T				
79L				
79aFC				
79bFC				
79aNC				
79bNC				
80T				
80L				
80aFC				
80bFC				
80aNC				
80bNC				
81T				
81L				
81aFC				
81bFC	+		+	
81aNC				
81bNC				
82T				
82L				
82aFC	+		+	
82bFC	+		+	
82aNC			+	
82bNC			+	
83T				
83L				
83aFC				
83bFC				
83aNC				
83bNC				
84T				
84L				
84aFC				
84bFC			+	
84aNC				
84bNC				

85T				
85L				
85aFC				
85bFC	+			
85aNC				
85bNC				
86T				
86L				
86aFC			+	
86bFC	+		+	
86aNC				
86bNC				
87T				
87L				
87aFC	+		+	
87bFC			+	
87aNC				
87bNC				
88T				
88L				
88aFC	+			
88bFC				
88aNC				
88bNC				
89T				
89L	+	+	+	+
89aFC				
89bFC			+	
89aNC				
89bNC				
90T				
90L	+	+	+	+
90aFC				
90bFC	+		+	+
90aNC	+			
90bNC				
91T				
91L		+		+
91aFC				
91bFC	+		+	
91aNC				
91bNC				
92T				
92L				
92aFC			+	
92bFC	+		+	
92aNC				
92bNC				
93T				
93L				
93aFC				
93bFC				
93aNC				
93bNC				
94T				
94L				
94aFC				
94bFC				
94aNC				
94bNC				
95T				
95L				
95aFC	+		+	
95bFC				
95aNC				
95bNC				
96T			+	
96L				
96aFC				
96bFC				
96aNC				
96bNC				

Listeria monocytogenes results

sample ID	MOX			CHR			Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Reincubate d?	Blue?	Typical in CHR	
1T							
1L	R			R			
1aFC	R			R	Y		
1bFC	R			R			
1aNC	R			R	Y		
1bNC	R			R	Y		
2T	R	Y	N	R	Y	Y	2T_CHR
2L	R			R	Y		
2aFC	R			R	Y		
2bFC		Y	N	R	Y	Y	2bFC_CHR
2aNC		Y	+	R	Y	Y	2aNC_MOX 2aNC_CHR
2bNC	R			R	Y	Y	2bNC_CHR
3T	R			R			
3L	R			R			
3aFC	R			R			
3bFC				R			
3aNC		Y	+	R	Y		3aNC_MOX
3bNC	R			R	Y		
4T	R			R	Y	Y	4T_CHR
4L	R			R			
4aFC		Y	+	R	Y	Y	4aFC_MOX 4aFC_CHR
4bFC	R	Y	N	R			
4aNC	R	Y	N	R	Y	Y	
4bNC	R			R			
5T	R			R			
5L							
5aFC	R			R	Y		
5bFC	R	Y	N	R			
5aNC	R			R	Y		
5bNC	R			R	Y		
6T							
6L	R			R			
6aFC	R			R	Y		
6bFC	R	Y	+	R	Y		6bFC_MOX
6aNC	R			R			
6bNC	R			R			
7T	R			R			
7L							
7aFC	R			R	Y		
7bFC	R			R			
7aNC	R			R			
7bNC	R			R			

sample ID	MOX			CHR			Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Reincubate d?	Blue?	Typical in CHR	
8T	R			R			
8L							
8aFC	R			R	Y	Y	8aFC_CHR
8bFC	R			R	Y	Y	8bFC_CHR
8aNC	R	Y	N	R			
8bNC	R			R			
9T	R			R			
9L							
9aFC	R			R	Y		
9bFC	R			R			
9aNC	R			R			
9bNC	R			R	Y		
10T	R			R	Y		
10L	R			R			
10aFC	R			R	Y		
10bFC							
10aNC							
10bNC							
11T	R			R			
11L							
11aFC	R			R			
11bFC	R			R			
11aNC	R			R			
11bNC	R			R			
12T	R			R	Y		
12L	R			R			
12aFC	R	Y	+	R	Y		12aFC_MOX
12bFC	R			R			
12aNC		Y	+	R	Y		12aNC_MOX
12bNC	R	Y	N	R	Y		
13T							
13L	R			R			
13aFC	R			R	Y	Y	13aFC_CHR
13bFC	R			R	Y	Y	13bFC_CHR
13aNC	R			R	Y		
13bNC	R			R	Y		
14T	R	Y	+	R			14T_MOX
14L							
14aFC	R			R			
14bFC	R			R			
14aNC		Y	+	R			14aNC_MOX
14bNC	R			R			

sample ID	MOX colonies			CHROM				Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
15T								
15L	R			R				
15aFC	R			R				
15bFC	R			R	Y			
15aNC	R			R				
15bNC	R			R				
16T	R			R				
16L								
16aFC		Y	N		Y	Y	+	16aFC_CHR
16bFC		Y	N	R				
16aNC		Y	N	R	Y			
16bNC		Y	N	R	Y			
17T	R			R				
17L								
17aFC		Y	N	R	Y			
17bFC	R			R				
17aNC	R			R				
17bNC	R			R	Y			
18T	R			R				
18L	R			R				
18aFC	R			R				
18bFC		Y	N		Y	Y	+	18bFC_CHR
18aNC		Y	N	R				
18bNC	R			R				
19T	R			R				
19L	R			R				
19aFC	R			R	Y			
19bFC	R			R				
19aNC	R			R				
19bNC	R			R				
20T	R			R	Y	Y	+	20T_CHR
20L	R			R				
20aFC	R			R				
20bFC	R			R	Y			
20aNC		Y	N	R				
20bNC	R			R				
21T	R			R				
21L	R			R				
21aFC	R	Y	N	R	Y			
21bFC		Y	N	R				
21aNC		Y	+	R	Y			21aNC_MOX
21bNC		Y	+	R				21bNC_MOX

sample ID	MOX colonies			CHROM colonies				Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
22T	R			R				
22L	R			R				
22aFC	R			R				
22bFC		Y	N	R	Y			
22aNC	R			R				
22bNC	R			R				
23T	R				Y	Y	+	23T_CHR
23L	R			R				
23aFC	R			R				
23bFC		Y	N	R	Y			
23aNC		Y	N	R				
23bNC		Y	N	R	Y			
24T	R			R				
24L	R			R				
24aFC		Y	N	R				
24bFC		Y	N	R	Y			
24aNC		Y	N	R				
24bNC		Y	N		Y	Y	+	24bNC_CHR
25T	R			R				
25L	R			R				
25aFC		Y	+	R				25aFC_MOX
25bFC	R			R				
25aNC	R			R				
25bNC	R			R				
26T	R			R	Y	Y	+	26T_CHR
26L	R			R	Y	Y	N	
26aFC	R			R	Y	Y	N	
26bFC		Y	N	R	Y	Y	N	
26aNC		Y	N	R	Y	Y	+	26aNC_CHR
26bNC		Y	+	R	Y	Y	+	26bNC_MOX 26bNC_CHR
27T	R			R				
27L								
27aFC	R	Y	N	R				
27bFC		Y	N	R	Y	Y	+	27bFC_CHR
27aNC		Y	N	R				
27bNC		Y	N	R				
28T	R			R				
28L	R			R	Y			
28aFC		Y	N	R	Y	Y	N	
28bFC		Y	N	R	Y	Y	+	28bFC_CHR
28aNC	R			R	Y	Y	+	28aNC_CHR
28bNC	R	Y	N	R	Y	Y	N	

sample ID	MOX colonies			Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE					
29T	R			R				
29L	R			R	Y			
29aFC	R			R	Y			
29bFC		Y	N	R	Y			
29aNC		Y	N	R	Y	Y	N	
29bNC	R			R				
30T	R	Y	N	R				
30L								
30aFC	R			R	Y	Y	N	
30bFC	R	Y	N	R	Y	Y	N	
30aNC		Y	N		Y	Y	+	30aNC_CHR
30bNC	R			R	Y	Y	N	
31T	R			R				
31L	R			R	Y			
31aFC		Y	N	R	Y	Y	+	31aFC_CHR
31bFC		Y	N		Y	Y	+	31bFC_CHR
31aNC	R				Y	Y	N	
31bNC	R	Y	+	R	Y			31bNC_MOX
32T	R			R				
32L	R	Y	N	R	Y			
32aFC		Y	N	R	Y			
32bFC	R				Y	Y	N	
32aNC		Y	N		Y	Y	N	
32bNC		Y	N		Y	Y	N	
33T	R			R				
33L	R			R	Y			
33aFC	R			R	Y	Y	N	
33bFC		Y	N	R	Y	Y	+	33bFC_CHR
33aNC	R			R				
33bNC	R			R	Y	Y	N	
34T	R			R	Y			
34L								
34aFC		Y	N	R	Y			
34bFC	R				Y	Y	N	
34aNC		Y	N	R				
34bNC	R				Y	Y	+	34bNC_CHR
35T								
35L	R			R	Y			
35aFC	R	Y	+	R	Y			35aFC_MOX
35bFC	R			R	Y	Y	N	
35aNC	R			R	Y	Y	+	35aNC_CHR
35bNC	R			R	Y	Y	N	

sample ID	MOX colonies			CHROM colonies				Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
36T	R			R	Y			
36L	R			R	Y			
36aFC		Y	N	R				
36bFC	R			R	Y			
36aNC	R				Y	Y	+	36aNC_CHR
36bNC		Y	N		Y	Y	N	
37T	R			R				
37L	R			R				
37aFC	R			R	Y			
37bFC	R			R	Y			
37aNC	R			R	Y	Y	N	
37bNC	R			R	Y			
38T	R			R	Y			
38L		Y	N	R	Y			
38aFC		Y	N	R	Y	Y	+	38aFC_CHR
38bFC		Y	N	R	Y	Y	+	38bFC_CHR
38aNC		Y	N		Y	Y	+	38aNC_CHR
38bNC	R			R	Y	Y	N	
39T		N			Y	N		
39L								
39aFC	R			R	Y			
39bFC	R			R	Y	Y	N	
39aNC	R	Y	N	R				
39bNC	R			R	Y	Y	+	39bNC_CHR
40T	R			R				
40L	R			R	Y	Y	+	40L_CHR
40aFC	R	Y	N		Y	Y	+	40aFC_CHR
40bFC	R			R				
40aNC	R			R	Y	Y	N	
40bNC	R				Y	Y	+	40bNC_CHR
41T								
41L								
41aFC								
41bFC								
41aNC								
41bNC								
42T								
42L								
42aFC								
42bFC								
42aNC								
42bNC								

sample ID	MOX colonies			Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE					
43T	R			R				
43L	R			R	Y			
43aFC	R			R				
43bFC	R	Y	N	R	Y	Y	N	
43aNC		Y	N	R	Y	Y	N	
43bNC		Y	N	R				
44T	R			R	Y			
44L	R				Y	Y	+	44L_CHR
44aFC	R			R	Y			
44bFC	R			R				
44aNC	R			R	Y	Y	+	44aNC_CHR
44bNC	R			R	Y			
45T	R			R				
45L	R			R	Y	Y	+	45L_CHR
45aFC		Y	+	R	Y	Y	+	45aFC_MOX 45aFC_CHR
45bFC	R	Y	N		Y	Y	+	45bFC_CHR
45aNC	R			R				
45bNC		Y	N		Y	Y	+	45bNC_CHR
46T	R			R				
46L	R			R				
46aFC	R				Y	Y	+	46aFC_CHR
46bFC	R			R	Y			
46aNC	R			R				
46bNC	R			R	Y	Y	+	46bNC_CHR
47T	R			R				
47L	R			R	Y			
47aFC	R				Y	Y	N	
47bFC	R			R				
47aNC		Y	N	R				
47bNC		Y	N	R				
48T	R			R				
48L	R			R	Y			
48aFC	R			R				
48bFC	R			R				
48aNC	R				Y	Y	N	
48bNC	R			R	Y	Y	N	

sample ID	MOX			CHR					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
51T									
51L				✓	-	-	✓	✓	51L_CHR
51aFC				✓	-	-	✓	✓	51aFC_CHR
51bFC	✓	✓	✓						
51aNC	✓	✓	✓						51aNC_MOX
51bNC				✓	-	-	✓	✓	
52T					✓	✓	✓	✓	
52L	✓	✓	✓	✓	-	-	✓	✓	52L_MOX
52aFC				✓	-	-	✓	✓	52aFC_CHR
52bFC				✓	-	-	✓	✓	
52aNC				✓	-	-	✓	✓	
52bNC				✓	-	-	✓	✓	
53T									
53L									
53aFC	✓	✓	✓	✓	-	-	✓	✓	
53bFC				✓	-	-	✓	✓	53bFC_CHR
53aNC				✓	-	-	✓	✓	
53bNC				✓	-	-	✓	✓	
54T				✓	-	-	✓	✓	
54L									
54aFC				✓	-	-	✓	✓	54aFC_CHR
54bFC				✓	-	-	✓	✓	54bFC_CHR
54aNC	-	✓	✓	✓	-	-	✓	✓	54aNC_MOX
54bNC				✓	-	-	✓	✓	
55T									
55L				✓	-	-	✓	✓	
55aFC									
55bFC				✓	-	-	✓	✓	
55aNC	-	✓							
55bNC	-	✓							
56T				✓	-	-	✓	✓	
56L									
56aFC	-	✓	✓	✓	-	-	✓	✓	
56bFC	-	✓	✓	✓	-	-	✓	✓	
56aNC					✓	✓	✓	✓	
56bNC				✓	-	-	✓	✓	
57T				✓	-	-	✓	✓	57T_CHR
57L				✓	-	-	✓	✓	
57aFC	✓	✓	✓	✓	-	-	✓	✓	
57bFC				✓	-	-	✓	✓	
57aNC	-	✓	✓	✓	-	-	✓	✓	57aNC_MOX
57bNC	-	✓	✓	✓	-	-	✓	✓	

sample ID	MOX			CHR					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
58T				✓	-	-	✓	✓	
58L				✓	-	-	✓	✓	
58aFC									
58bFC				✓	-	-	✓	✓	
58aNC	✓	✓	✓						58aNC_MOX
58bNC					✓	✓	✓	✓	
59T									
59L									
59aFC					✓	✓	✓	✓	
59bFC	-	✓	✓	✓	-	-	✓	✓	59bFC_MOX
59aNC	✓	✓	✓	✓	-	-	✓	✓	59aNC_CHR
59bNC									
60T									
60L				✓	-	-	✓	✓	
60aFC				✓	-	-	✓	✓	
60bFC				✓	-	-	✓	✓	60bFC_CHR
60aNC					✓	✓	✓	✓	
60bNC					✓	✓	✓	✓	
61T	✓	✓	✓	✓	-	-	✓	✓	
61L									
61aFC	✓	✓	✓						
61bFC				✓	-	-	✓	✓	
61aNC									
61bNC									
62T									
62L									
62aFC				✓	-	-	✓	✓	
62bFC				✓	-	-	✓	✓	
62aNC				✓	-	-	✓	✓	
62bNC				✓	-	-	✓	-	
63T				✓	-	-	✓	✓	
63L									
63aFC									
63bFC									
63aNC				✓	-	-	✓	✓	
63bNC				✓	-	-	✓	✓	
64T									
64L									
64aFC									
64bFC									
64aNC				✓	-	-	✓	✓	
64bNC									

sample ID	MOX colonies			CHROM					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
65T									
65L									
65aFC					✓	✓	✓	✓	
65bFC	✓	✓	✓	✓	-	-	✓	✓	
65aNC									
65bNC				✓	-	-	✓	-	
66T				✓	-	-	✓	-	
66L									
66aFC	-	✓	✓	✓	-	-	✓	✓	
66bFC				✓	-	-	✓	✓	
66aNC				✓	-	-	✓	✓	
66bNC									
67T									
67L				✓	-	-	✓	✓	
67aFC				✓	-	-	✓	✓	
67bFC				✓	-	-	✓	✓	
67aNC									
67bNC				✓	-	-	✓	✓	67bNC_CHR
68T									
68L									
68aFC									
68bFC	-	✓	✓						
68aNC				✓	-	-	✓	✓	
68bNC	-	✓	✓	✓	-	-	✓	✓	
69T									
69L									
69aFC				✓	-	-	✓	-	
69bFC				✓	-	-	✓	✓	
69aNC									
69bNC				✓	-	-	✓	✓	
70T				✓	-	-	✓	✓	
70L				✓	-	-	✓	✓	
70aFC				✓	-	-	✓	✓	
70bFC									
70aNC				✓	-	-	✓	✓	
70bNC				✓	-	-	✓	✓	
71T									
71L				✓	-	-	✓	✓	
71aFC				✓	-	-	✓	✓	
71bFC									
71aNC									
71bNC									

sample ID	MOX colonies			CHROM colonies					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
72T									
72L				✓	-	-	✓	✓	
72aFC									
72bFC				✓	-	-	✓	✓	
72aNC					✓	✓	✓	✓	
72bNC	-	✓	✓						
73T				✓			✓	✓	
73L									
73aFC	-	✓	✓						73aFC_MOX
73bFC									
73aNC									
73bNC				✓	-	-	✓	✓	
74T									
74L									
74aFC									
74bFC				✓	-	-	✓	✓	
74aNC	-	✓	✓	✓	-	-	✓	-	
74bNC				✓	-	-	✓	-	
75T				✓	-	-	✓	-	
75L									
75aFC									
75bFC	-	✓	✓	✓	-	-	✓	-	
75aNC	-	✓	✓	✓	-	-	✓	✓	
75bNC	-	✓	✓	✓	-	-	✓	✓	
76T									
76L									
76aFC									
76bFC				✓	-	-	✓	✓	
76aNC				✓	-	-	✓	✓	
76bNC				✓	-	-	✓	✓	
77T									
77L				✓	-	-	✓	✓	
77aFC					✓	✓	✓	✓	
77bFC	✓	✓	✓	✓	-	-	✓	✓	
77aNC				✓	-	-	✓	✓	
77bNC	✓	✓	✓	✓	-	-	✓	✓	
78T				✓	-	-	✓	✓	
78L									
78aFC									
78bFC	-	✓	✓	✓	-	-	✓	✓	
78aNC				✓	-	-	✓	✓	
78bNC									

sample ID	MOX colonies								Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
79T									
79L									
79aFC				✓	-	-	✓	✓	
79bFC				✓	-	-	✓	✓	
79aNC				✓	-	-	✓	✓	
79bNC				✓	-	-	✓	✓	79bNC_CHR
80T									
80L									
80aFC	-	✓	✓						
80bFC				✓	-	-	✓	✓	
80aNC									
80bNC	-	✓	✓	✓	-	-	✓	✓	
81T									
81L	-	✓	✓	✓	-	-	✓	✓	
81aFC	✓	✓	✓	✓	-	-	✓	-	
81bFC				✓	-	-	✓	✓	
81aNC									
81bNC	✓	✓	✓	✓	-	-	✓	✓	
82T									
82L	✓	✓	✓	✓	-	-	✓	✓	
82aFC				✓	-	-	✓	✓	
82bFC				✓	-	-	✓	✓	
82aNC				✓	-	-	✓	✓	
82bNC				✓	-	-	✓	✓	
83T					✓	✓	✓	✓	
83L									
83aFC									
83bFC									
83aNC	✓	✓	✓	✓	-	-	✓	✓	
83bNC									
84T				✓	-	-	✓	✓	
84L	✓	✓	✓	✓	-	-	✓	✓	
84aFC									
84bFC									
84aNC				✓	-	-	✓	✓	
84bNC									
85T									
85L				✓	-	-	✓	✓	85L_CHR
85aFC	✓	✓	✓						
85bFC	✓	✓	-	✓	-	-	✓	✓	
85aNC					✓	✓	✓	✓	
85bNC					✓	✓	✓	✓	

sample ID	MOX colonies			CHROM colonies					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
86T									
86L				✓	-	-	✓	✓	
86aFC									
86bFC									
86aNC					✓	✓	✓	✓	
86bNC					✓	✓	✓	✓	
87T									
87L									
87aFC				✓	-	-	✓	✓	
87bFC				✓	-	-	✓	✓	
87aNC					✓	✓	✓	✓	
87bNC				✓	-	-	✓	✓	
88T									
88L									
88aFC					✓	✓	✓	✓	
88bFC									
88aNC					✓	✓	✓	✓	
88bNC					✓	✓	✓	✓	
89T				✓	-	-	✓	-	
89L	✓	✓	✓						
89aFC				✓	-	-	✓	✓	
89bFC	-	✓	✓	✓	-	-	✓	✓	
89aNC									
89bNC	✓	✓	✓	✓	-	-	✓	✓	
90T	✓	✓	✓						
90L									
90aFC	-	✓	✓		✓	✓	✓	✓	
90bFC				✓	-	-	✓	✓	
90aNC				✓	-	-	✓	✓	
90bNC				✓	-	-	✓	✓	
91T				✓	-	-	✓	✓	
91L	✓	✓	✓						
91aFC				✓	-	-	✓	✓	
91bFC	✓	✓	✓		✓	✓	✓	✓	
91aNC									
91bNC									
92T	✓	✓	✓						
92L				✓	-	-	✓	✓	
92aFC									
92bFC	✓	✓	✓						
92aNC					✓	✓	✓	✓	
92bNC									

sample ID	MOX colonies			CHROM colonies					Cryovial ID
	Reincubate d?	Typical in MOX	Typical in TSAYE	Blue?	Reincubate d?	Blue?	Typical in CHR	Typical in TSAYE	
93T	-	✓	-						
93L									
93aFC	-	✓	✓	✓	-	-	✓	✓	
93bFC									
93aNC									
93bNC									
94T				✓	-	-	✓	✓	
94L									
94aFC	✓	✓	✓	✓	-	-	✓	✓	
94bFC	✓	✓	✓						
94aNC					✓	✓	✓	✓	
94bNC									
95T									
95L	-	✓	✓	✓	-	-	✓	✓	
95aFC									
95bFC				✓	-	-	✓	✓	
95aNC	✓	✓	✓	✓	-	-	✓	✓	
95bNC									
96T				✓	-	-	✓	✓	
96L									
96aFC				✓	-	-	✓	✓	
96bFC				✓	-	-	✓	✓	
96aNC				✓	-	-	✓	✓	
96bNC				✓	-	-	✓	✓	

Appendix C - Raw data collected through the COM-B questionnaire

Fecha	Acuerdo de consentimiento	¿Ha obtenido la certificación HACCP?	En caso afirmativo, ¿Qué entidad/organización le otorgó su certificación de HACCP?	En caso afirmativo, ¿Cuándo obtuvo su certificación de HACCP?	1. Estoy muy familiarizado con los estándares y requisitos de HACCP.	2. Conozco las razones por las que los productores/procesadores de alimentos adoptan el sistema HACCP.	3. Sé cuánto tiempo se requiere para adoptar los estándares y requisitos de HACCP en una productora/procesadora de alimentos.	4. Conozco los costos en que se incurren para adoptar los estándares y requisitos de HACCP en una producción/procesadora de alimentos.	5. La mayoría de los reguladores/productores/procesadores en mi zona han obtenido la certificación HACCP.	6. La mayoría de los reguladores/productores/procesadores en mi zona creen que es importante obtener la certificación HACCP.	7. Otros reguladores/productores/procesadores en mi zona hablan con frecuencia sobre los beneficios de obtener la certificación HACCP.	8. Los funcionarios del gobierno me animan a obtener la certificación HACCP para mi productora/procesadora de alimentos.	9. Tengo el dinero que se requiere para implementar los estándares de HACCP en mi productora/procesadora de alimentos.	10. Tengo el tiempo que se requiere para implementar los estándares de HACCP en mi producción/procesadora de alimentos.	11. Tengo suficientes trabajadores o mano de obra para la producción/el procesamiento de alimentos según los estándares de HACCP.	12. Sé dónde podría aprender más acerca de los estándares de HACCP.	13. Sé dónde hay asistencia financiera disponible para ayudarme a obtener la certificación HACCP.	14. Otros reguladores/productores/procesadores similares a mí, piensan que debería obtener la certificación HACCP.	15. Las personas que compran los productos alimenticios de mi productora/procesadora de alimentos esperan que yo obtenga la certificación HACCP.
4/27/2023 8:46	Acepto	No			De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo
4/27/2023 11:05	Acepto	No			De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	En desacuerdo	De acuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	En desacuerdo	En desacuerdo	De acuerdo
9/19/2023 6:35	Acepto	No			De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo
10/31/2023 10:14	Acepto	No			De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
11/1/2023 5:45	Acepto	No			De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	En desacuerdo	Ligeramente de acuerdo	En desacuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo
11/3/2023 5:13	Acepto	No			De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	En desacuerdo	Totalmente en desacuerdo	En desacuerdo	En desacuerdo	De acuerdo	Totalmente en desacuerdo	En desacuerdo	En desacuerdo
1/30/2024 11:36	Acepto	No			De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
1/30/2024 11:36	Acepto	No			De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
1/30/2024 12:06	Acepto	No			De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo
11/1/2023 4:18	Acepto	No			Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
1/30/2024 13:00	Acepto	No			Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo
10/31/2023 11:09	Acepto	No			Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	En desacuerdo	En desacuerdo	En desacuerdo	Ligeramente de acuerdo	En desacuerdo	En desacuerdo	En desacuerdo	Ligeramente de acuerdo	En desacuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo
4/28/2023 9:22	Acepto	No			Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	En desacuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
1/30/2024 11:31	Acepto	No			Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo
1/31/2024 3:21	Acepto	No			Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo

16. Sería difícil para mí producir/procesar mis productos alimenticios según los estándares de HACCP.	17. Producir/procesar según los estándares de HACCP mejoraría la calidad de mis productos.	18. Planeo obtener la certificación de HACCP en los próximos 12 meses.	19. Sería muy beneficioso para mí productora/pr ocesadora si yo obtuviera la certificación de HACCP.	20. Obtener la certificación de HACCP mejoraría la reputación de mi productora/pr ocesadora.	21. Produciría/pr ocesaría según los estándares de HACCP si con esto mejorara la calidad de mis productos alimenticios.	22. Obtendría la certificación HACCP si esto hiciera que mis productos fueran más populares entre las personas que los compran.	23. La inocuidad de mis productos afecta mi reputación como regulador/pro ductor/proces ador.	24. Obtendría la certificación de HACCP si esto hiciera que ganara más dinero.	25. Podría evitar que las personas se enfermen si produjera/pro cesara productos alimenticios según los estándares de HACCP.	26. Si obtuviera la certificación de HACCP, mi productora/pr ocesadora podría vender mis productos alimenticios a más exportadores.	27. Produciría/pr ocesaría según los estándares de HACCP si esto mejorara la inocuidad de mis productos alimenticios.	28. La inocuidad de los productos alimenticios de mi productora/pr ocesadora son un motivo de orgullo para mí.	29. Obtendría la certificación de HACCP para mi productora/pr ocesadora si esto significara que puedo vender mis productos alimenticios a nuevos compradores.	30. Mi productora/pr ocesadora ganaría más dinero si obtuviera la certificación HACCP.	31. La calidad de los productos alimenticios de mi productora/pr ocesadora es un motivo de orgullo para mí.	32. Sería fácil para mí obtener la certificación de HACCP para mi productora/pr ocesadora. MR5	Género	Edad	Productos que regula/produce/proc esa
En desacuerdo	Ligeramente en desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Femenino	35-44 años	Granos, cereales frutas y hortalizas
De acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Femenino	25-34 años	Animal, vegetal
Ligeramente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Femenino	45-54 años	Somos laboratorio de ensayo
Ligeramente en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Masculino	55-64 años	ninguna, soy controlador
De acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Femenino	35-44 años	trabajo en un laboratorio
En desacuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	En desacuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Femenino	45-54 años	No somos productores de productos alimenticios
Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Masculino	35-44 años	Carne bovina enfiada y congelada
Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Masculino	35-44 años	Carne Bovina enfiada y congelada
De acuerdo	De acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Masculino	45-54 años	Carne
Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Masculino	35-44 años	SÉSAMO, TARTAGO, CHIA, SOJA, TRIGO, MAÍZ, POROTO, LOCOTE, TOMATE, ETC
Ligeramente en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Masculino	35-44 años	Carne vacuna
Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Femenino	25-34 años	Vegetales
Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Femenino	45-54 años	Productos alimenticios procesados
Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Masculino	25-34 años	Carne vacuna deshuesada enfiada y congelada...
Ni de acuerdo ni en desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente en desacuerdo	De acuerdo	Ligeramente en desacuerdo	De acuerdo	De acuerdo	Ligeramente en desacuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	De acuerdo	Ligeramente de acuerdo	Femenino	35-44 años	Carne bovina, menudencias bovina y sub productos no comestible

Fecha	Acuerdo de consentimiento	¿Ha obtenido la certificación HACCP?	En caso afirmativo, ¿Qué entidad/orgанизación le otorgó su certificación de HACCP?	En caso afirmativo, ¿Cuándo obtuvo su certificación de HACCP?	1. Estoy muy familiarizado con los estándares y requisitos de HACCP.	2. Conozco las razones por las que los productores/procesadores de alimentos adoptan el sistema HACCP.	3. Sé cuánto tiempo se requiere para adoptar los estándares y requisitos de HACCP en una productora/procesadora de alimentos.	4. Conozco los costos en que se incurren para adoptar los estándares y requisitos de HACCP en una producción/procesadora de alimentos.	5. La mayoría de los reguladores/procesadores en mi zona han obtenido la certificación HACCP.	6. La mayoría de los reguladores/procesadores en mi zona creen que es importante obtener la certificación HACCP.	7. Otros reguladores/procesadores en mi zona hablan con frecuencia sobre los beneficios de obtener la certificación HACCP.	8. Los funcionarios del gobierno me animan a obtener la certificación HACCP para mi productora/procesadora de alimentos.	9. Tengo el dinero que se requiere para implementar los estándares de HACCP en mi productora/procesadora de alimentos.	10. Tengo el tiempo que se requiere para implementar los estándares de HACCP en mi producción/procesadora de alimentos.	11. Tengo suficientes trabajadores o mano de obra para la producción/el procesamiento de alimentos según los estándares de HACCP.	12. Sé dónde podría aprender más acerca de los estándares de HACCP.	13. Sé dónde hay asistencia financiera disponible para ayudarme a obtener la certificación HACCP.	14. Otros reguladores/procesadores similares a mi, piensan que debería obtener la certificación HACCP.	15. Las personas que compran los productos alimenticios de mi productora/procesadora de alimentos esperan que yo obtenga la certificación HACCP.
4/27/2023 8:56	Acepto	Si	Kansas state university	2022	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	En desacuerdo	En desacuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Ligeramente en desacuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo
5/16/2023 6:42	Acepto	Si	FSNS	28 al 30 DE JUNIO 2022	De acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	En desacuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
9/6/2023 4:42	Acepto	Si	KSU	MARZO 2023	De acuerdo	De acuerdo	De acuerdo	De acuerdo	En desacuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
9/6/2023 8:29	Acepto	Si	Proyecto T-FAST- UNIVERSIDAD DE KANSAS	14, 15 y 16 de marzo del 2023	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo
9/18/2023 8:52	Acepto	Si	kansas state university	marzo 2023	De acuerdo	Totalmente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo
9/19/2023 17:52	Acepto	Si	FSNS	Marzo 14-16, 2023	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo
11/1/2023 4:55	Acepto	Si	Food Safety Net Services - Proyecto t-Fast	Ya obtuve en el año 2022	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo
1/30/2024 12:45	Acepto	Si	FSNS A CERTIFIED GROUP COMPANY	Junio 2022	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo
1/30/2024 13:31	Acepto	Si	Universidad	2023	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo
9/19/2023 16:14	Acepto	Si	Kansas State University	Marzo 2023	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	En desacuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	Ligeramente de acuerdo	En desacuerdo	De acuerdo	De acuerdo	Ligeramente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	Ligeramente en desacuerdo
9/25/2023 6:10	Acepto	Si	T-Fast	Abril 2022	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	Ligeramente en desacuerdo	En desacuerdo	En desacuerdo	Ligeramente de acuerdo	En desacuerdo	Totalmente en desacuerdo	En desacuerdo	Ligeramente de acuerdo	En desacuerdo	Ligeramente en desacuerdo	En desacuerdo
4/27/2023 9:06	Acepto	Si	FSNS	Junio 28-30, 2022	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo
5/2/2023 15:45	Acepto	Si	Quality Internacional , T-Fast	en el año 2021, 2022	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo
9/5/2023 19:55	Acepto	Si	KSU	Marzo 2023	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	En desacuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
9/6/2023 5:21	Acepto	Si	Kansas State University	Marzo 2023	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	En desacuerdo	De acuerdo	En desacuerdo	Totalmente de acuerdo	En desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo

16. Sería difícil para mí producir/ procesar mis productos alimenticios según los estándares de HACCP.	17. Producir/ procesar según los estándares de HACCP mejoraría la calidad de mis productos.	18. Planeo obtener la certificación de HACCP en los próximos 12 meses.	19. Sería muy beneficioso para mi productora/ procesadora si yo obtuviera la certificación de HACCP.	20. Obtener la certificación de HACCP mejoraría la reputación de mi productora/ procesadora.	21. Produciría/ procesaría según los estándares de HACCP si con esto mejorara la calidad de mis productos alimenticios.	22. Obtendría la certificación HACCP si esto hiciera que mis productos fueran más populares entre las personas que los compran.	23. La inocuidad de mis productos afecta mi reputación como regulador/ productor/ procesador.	24. Obtendría la certificación de HACCP si esto hiciera que ganara más dinero.	25. Podría evitar que las personas se enfermen si produjera/ procesara productos alimenticios según los estándares de HACCP.	26. Si obtuviera la certificación de HACCP, mi productora/ procesadora podría vender mis productos alimenticios a más exportadores.	27. Produciría/ procesaría según los estándares de HACCP si esto mejorara la inocuidad de mis productos alimenticios.	28. La inocuidad de los productos alimenticios de mi productora/ procesadora son un motivo de orgullo para mí.	29. Obtendría la certificación de HACCP para mi productora/ procesadora si esto significara que puedo vender mis productos alimenticios a nuevos compradores.	30. Mi productora/ procesadora ganaría más dinero si obtuviera la certificación HACCP.	31. La calidad de los productos alimenticios de mi productora/ procesadora es un motivo de orgullo para mí.	32. Sería fácil para mí obtener la certificación de HACCP para mi productora/ procesadora. MRS	Género	Edad	Productos que regula/produce/ procesa
En desacuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	Femenino	35-44 años	Derivados de hortalizas
Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	Totalmente en desacuerdo	En desacuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	En desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Femenino	35-44 años	PRODUCTOS ALIMENTICIOS PROCESADOS
Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Masculino	55-64 años	SERVICIOS DE ASISTENCIA TECNICA
Ligeramente en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Femenino	55-64 años	SECTOR AGRARIO
Ni de acuerdo ni en desacuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Femenino	55-64 años	Regulación de la carne porcina productor y sub productos
Ligeramente en desacuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente en desacuerdo	Femenino	25-34 años	Productos Lácteos
De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Femenino	25-34 años	La entidad donde actualmente trabajo es el SENACSA y regula todo los productos y sub productos de origen animal.
Totalmente en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	En desacuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Femenino	45-54 años	Productos y sub productos de carne bovina
En desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Masculino	35-44 años	Carne bovina
Ligeramente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	En desacuerdo	Femenino	25-34 años	--
De acuerdo	Totalmente de acuerdo	En desacuerdo	De acuerdo	Ligeramente de acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	En desacuerdo	Femenino	25-34 años	No produzco
Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Masculino	45-54 años	En mi caso soy funcionario del Senacsa, ente regulador de Alimentos inocuos en frigoríficos
De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente en desacuerdo	En desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	En desacuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Masculino	35-44 años	Planta Frigorifica
Ligeramente en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Femenino	35-44 años	Alimentos origen animal, vegetal, mineral
En desacuerdo	Totalmente de acuerdo	En desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Femenino	25-34 años	Vegetales y Semillas

Fecha	Acuerdo de consentimiento	¿Ha obtenido la certificación HACCP?	En caso afirmativo, ¿Qué entidad/organización le otorgó su certificación de HACCP?	En caso afirmativo, ¿Cuándo obtuvo su certificación de HACCP?	1. Estoy muy familiarizado con los estándares y requisitos de HACCP.	2. Conozco las razones por las que los productores/procesadores de alimentos adoptan el sistema HACCP.	3. Sé cuánto tiempo se requiere para adoptar los estándares y requisitos de HACCP en una productora/procesadora de alimentos.	4. Conozco los costos en que se incurren para adoptar los estándares y requisitos de HACCP en una producción/procesadora de alimentos.	5. La mayoría de los reguladores/procesadores en mi zona han obtenido la certificación HACCP.	6. La mayoría de los reguladores/procesadores en mi zona creen que es importante obtener la certificación HACCP.	7. Otros reguladores/procesadores en mi zona hablan con frecuencia sobre los beneficios de obtener la certificación HACCP.	8. Los funcionarios del gobierno me animan a obtener la certificación HACCP para mi productora/procesadora de alimentos.	9. Tengo el dinero que se requiere para implementar los estándares de HACCP en mi productora/procesadora de alimentos.	10. Tengo el tiempo que se requiere para implementar los estándares de HACCP en mi producción/procesadora de alimentos.	11. Tengo suficientes trabajadores o mano de obra para la producción/el procesamiento de alimentos según los estándares de HACCP.	12. Sé dónde podría aprender más acerca de los estándares de HACCP.	13. Sé dónde hay asistencia financiera disponible para ayudarme a obtener la certificación HACCP.	14. Otros reguladores/procesadores similares a mi, piensan que debería obtener la certificación HACCP.	15. Las personas que compran los productos alimenticios de mi productora/procesadora de alimentos esperan que yo obtenga la certificación HACCP.
9/6/2023 11:15	Acepto	Si	kansas State University	Marzo 2023	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Ligeramente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	En desacuerdo	Totalmente de acuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	Ni de acuerdo ni en desacuerdo
9/13/2023 14:11	Acepto	Si	senacsa	ya cuento	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo
9/18/2023 8:47	Acepto	Si	Tfast	abril/2023	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Ligeramente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo
1/30/2024 11:31	Acepto	Si	Senacsa	Año 2024	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo
1/30/2024 11:57	Acepto	Si	FSNS	Aprobado	Totalmente de acuerdo	Totalmente en desacuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente en desacuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo
1/30/2024 12:25	Acepto	Si	Quality	2022	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo
1/31/2024 2:57	Acepto	Si	Senacsa	2023	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo
1/31/2024 3:30	Acepto	Si	Haccp consulting group LLC	25/11/2020	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	En desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo

16. Sería difícil para mí producir/procesar mis productos alimenticios según los estándares de HACCP.	17. Producir/procesar según los estándares de HACCP mejoraría la calidad de mis productos.	18. Planeo obtener la certificación de HACCP en los próximos 12 meses.	19. Sería muy beneficioso para mi productora/pr ocesadora si yo obtuviera la certificación de HACCP.	20. Obtener la certificación de HACCP mejoraría la reputación de mi productora/pr ocesadora.	21. Produciría/pr ocesaría según los estándares de HACCP si con esto mejorara la calidad de mis productos alimenticios.	22. Obtendría la certificación HACCP si esto hiciera que mis productos fueran más populares entre las personas que los compran.	23. La inocuidad de mis productos afecta mi reputación como regulador/pro ductor/proces ador.	24. Obtendría la certificación de HACCP si esto hiciera que ganara más dinero.	25. Podría evitar que las personas se enfermen si produjera/pro cesara productos alimenticios según los estándares de HACCP.	26. Si obtuviera la certificación de HACCP, mi productora/pr ocesadora podría vender mis productos alimenticios a más exportadores.	27. Produciría/pr ocesaría según los estándares de HACCP si esto mejorara la inocuidad de mis productos alimenticios.	28. La inocuidad de los productos alimenticios de mi productora/pr ocesadora son un motivo de orgullo para mí.	29. Obtendría la certificación de HACCP para mi productora/proces adora si esto significara que puedo vender mis productos alimenticios a nuevos compradores.	30. Mi productora/pr ocesadora ganaría más dinero si obtuviera la certificación HACCP.	31. La calidad de los productos alimenticios de mi productora/pr ocesadora es un motivo de orgullo para mí.	32. Sería fácil para mí obtener la certificación de HACCP para mi productora/pr ocesadora. MR5	Género	Edad	Productos que regula/produce/procesa
Ligeramente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente en desacuerdo	Masculino	45-54 años	Regulacion: Productos Alimenticios Envasados
Ligeramente en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Ligeramente en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Masculino	35-44 años	productos y subproductos de origen animal
Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Masculino	35-44 años	Productos y sub productos de origen animal
Totalmente de acuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Ligeramente de acuerdo	Masculino	35-44 años	Carne bovina enfriada y congelada
Totalmente en desacuerdo	Totalmente de acuerdo	Ni de acuerdo ni en desacuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Masculino	45-54 años	Carne vacuna y Sub productos
De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Masculino	35-44 años	Productos carnicos
De acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Ligeramente en desacuerdo	De acuerdo	Ligeramente de acuerdo	Totalmente de acuerdo	Totalmente de acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	En desacuerdo	Masculino	55-64 años	Productos y sub productos de origen animal
Ligeramente en desacuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Totalmente de acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	De acuerdo	Ni de acuerdo ni en desacuerdo	Masculino	45-54 años	Faena y desposte de carne bovina