An awareness guideline on consumer food safety in Suriname

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Abstract

The Nationaal Instituut voor Voedselveiligheid Suriname (NIVS) which is established in the context of general food safety and protecting consumers from dangers associated with all foods sold in Suriname, gives the opportunity to develop food safety rules, regulation and raise awareness on topics regarding food safety. One opportunity of this Institute is to create awareness among the consumers who are part of the food supply chain (known as the farm to fork continuum). Historical data show that Suriname is not excluded from foodborne illness. The goal of this project and report was to educate consumers in Suriname on food safety best practices. To the authors knowledge, no reports were found on consumers food safety behavior and knowledge in Suriname. Therefore, these guidelines were developed to educate consumers on food safety behavior, and also food safety best practices based on different international prior studies. These food safety best practices are described under several different topics related to consumer behavior and food handling.

Keywords: Food safety, consumer, Foodborne illness.

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Introduction

Background and Setting, Statement of the Problem, Significance of the Problem

Food safety includes all biological, chemical, and physical hazards that can make consumption of food products unsafe. These hazards can form a danger to human health if contaminated food is consumed. The Centers for Disease Control and Prevention (CDC) calls the path from food source to the point of final service the "farm to fork continuum" (CDC, 2017). Briefly, according to the US Centers for Disease Control and Prevention each point along the farm to fork contimum is described. The **source** is where the food item originates. This could be a farm where produce is grown, a sea from which fish are harvested, a dairy farm or beef cattle operation, and so on. It could also be freshwater aquaculture. **Processing/manufacturing** includes all the steps along the food continuum that prepare a food item for distribution. In the case of produce, this encompasses everything from washing produce, pasteurization, low acidity canning, to preparing for sale. **Distribution** includes everything from storage and warehousing, repacking, reprocessing, and transport to the next point in the continuum. Sometimes distribution involves multiple points. **Point of final service** includes every place where food is purchased and/or consumed, from delis, cafeterias, restaurants, grocery stores, and so on, to the consumer home (CDC, 2017). To ensure safe food, authorities have created voluntary and mandatory regulatory systems and programs to

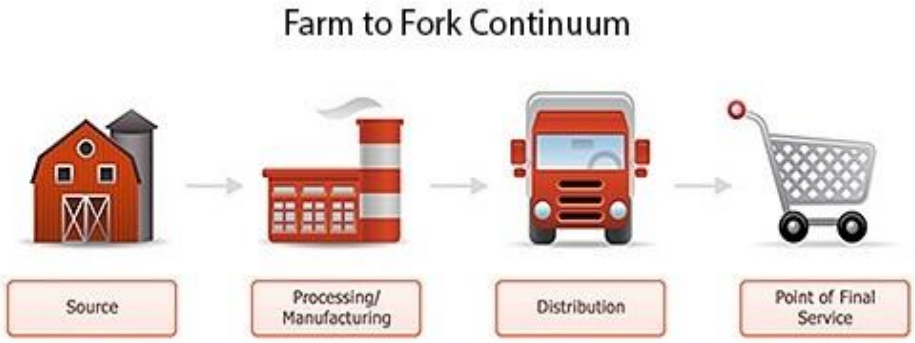

Figure 1: Farm to Fork continuum

Source: (CDC, 2017) Food Safety and the Environment

be implemented within the different points of the farm to fork continuum. There are quality management systems, such as Good Agricultural Practices, which are a collection of principles to apply during on-farm production and post-production activities, resulting in safe food and non-food agricultural products (FAO, 2016). Good Manufacturing Practices (GMPs) describe the methods, equipment, facilities, and controls for producing processed food at minimum sanitary conditions, and processing requirements, for producing safe food (FDA, 2004). Additionally, there are food safety standards to certify businesses, such as Food Safety System Certification 22000 (FSSC 22000), International Organization for Standardization 22000 (ISO 22000), and Hazard Analysis Critical Control Point (HACCP) (FDA, Adopted1997). For foodservice, there are also food safety training programs for employees, such as the US based ServSafe. The consumer is the last point within the farm to fork continuum, and there are no regulations on how consumers should handle or prepare food. When it comes to handling food, there are many mistakes that consumers may make that can lead to contamination of food resulting in foodborne illness, if consumed. Education of consumers is needed to help raise awareness and minimize food safety risks.

The problem stated is that food contamination can occur at home due to risky practices of the consumer, and there is a lack of guidelines for Suriname. Studies have shown consumers are unaware of food safety practices which can cause contamination and lead to foodborne illness. This unawareness is due to a lack of knowledge, and also the presumption that food products purchased should already be safe to consume. Statistics from the World Health Organization (WHO) show that annually there is a worldwide estimate of 600 million cases of foodborne illnesses of which an estimated 420,000 people die every year after eating contaminated food (WHO, 2020).

The Republic of Suriname is an independent country in South America, bordered by the Atlantic Ocean in the north, the countries French Guiana in the east, Guyana in the west, and Brazil in the south. The land area of Suriname is approximately 163,820 km² divided in 10 administrative districts with Paramaribo as the capital. The country has a population of approximately 0.6 million ("World Population Dashboard | United Nations Population Fund", 2021) people with diverse ethnicity and many languages spoken. Dutch is the official language but other languages are spoken are English, Sranantongo, and languages associated to ethnic groups. Suriname agriculture sector, one of the largest sectors, is formed by the production of vegetables, fruit, fisheries, animal husbandry (ruminants, poultry), timber, and non-timber products. Regarding food safety, there is a regulatory system for Suriname which has been divided under different institutions within different government Ministries, some with overlapping authority. The Ministries that have responsibilities concerning Food Safety in Suriname are the Ministry of Health, Ministry of Spatial Planning and the Environment, Ministry of Economic Affairs, Entrepreneurship and

Figure 2: Map of Suriname

Source: Jim Rittenhouse.

Technological Innovation, and the Ministry of Agriculture, Fisheries, and Animal husbandry (Bessy et al., 2013). The system has not been functioning adequately and some reasons are no clear authority among different institutions, outdated food safety legislation (from the year 1911), little or no coordination between institutions for food safety, limited food inspection capacity of locally processed food, limited support and guidance to the primary production and processing food sectors (Dijksteel et al., 2020). A positive development for the food safety regulatory system in Suriname is the establishment of the Nationaal Instituut voor Voedselveiligheid Suriname (NIVS). The law for establishing this institute was passed in December 2020, and is a very important milestone. The NIVS is established in the context of general food safety and protecting consumers from dangers associated with all foods sold in Suriname. NIVS aims to merge the important food safety institutions in Suriname to resolve the confusion of jurisdiction, and to work on an amended or new food law to replace that of 1911 (Dijksteel et al., 2020). There is no research found on consumer food safety knowledge, perception, and food handling practices at homes in Suriname at the time of this project report.

Purpose of the Project

The purpose of the project was to raise awareness of food safety best practices through a written guideline. Food customs in Suriname are based on ethnic and demographic factors. The preparation of different cuisines may differ, but most practices are the same. Consumer food safety risks in the interior part of Suriname may be different from the coastal plain where there is easier access to utilities for cleaning and temperature control of food products. This project addresses developing a food safety awareness guideline for consumers in Suriname living the coastal plain.

This guideline describes food safety measures or best practices after a food product has been purchased and brought into the home for preparation and consumption.

Project Objectives

1. Review consumer food safety practices and the food safety risks which can occur.

2. A written awareness guideline for food safety measures or best practices for consumers in the coastal plain of Suriname.

Definition of Keywords/Terms

Keywords and terms used within this report have the following definitions.

1. ***Cleaning:*** When different types of visible or invisible soil are removed from a surface.
2. ***Consumer:*** A person who buys goods or uses services (Oxford Learner's Dictionaries).
3. ***Contaminant:*** Any biological or chemical agent, foreign matter, or other substances not intentionally added to food that may compromise food safety or suitability (WHO, 2006).
4. ***Cross-contamination:*** The transfer of microorganisms from raw food into ready-to-eat food.
5. ***Danger zone:*** That is the temperature between 5°C and 60°C where microorganisms proliferate.
6. ***Farm to fork***: The path from food source to the point of final service.
7. ***Food safety:*** All measures to ensure that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (WHO, 2006).
8. ***Food:*** Any plant or animal product prepared or sold for human consumption. Includes drink and chewing substances and any ingredient, food additive, or other substance that

enters into or is used in the preparation of food. Does not include substances used as a drug or medicine (WHO, 2006).

9. ***Foodborne illness:*** A general term used to describe any disease or illness caused by eating contaminated food or drink. Traditionally referred to as "food poisoning" (WHO, 2006).
10. ***Hazard:*** Any biological, chemical (including radiological), or physical agent that has the potential to cause illness or injury (FDA, 2021).
11. ***Pathogen:*** Any disease-causing microorganism such as a bacterium, virus, or parasite. Often referred to as a "germ" or "bug" (WHO, 2006).
12. ***Risk:*** Is the severity and likelihood of harm resulting from exposure to a hazard (WHO, 2006).
13. ***Sanitizing:*** Means to adequately treat cleaned surfaces by a process that is effective in destroying vegetative cells of pathogens, and in substantially reducing numbers of other undesirable microorganisms, but without adversely affecting the product or its safety for the consumer (FDA, 2021).

Review of Literature

Food safety described by the World Health Organization is "all measures to ensure that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use" (WHO, 2006). The farm to fork continuum is the movement of food from the farm (production) to the fork (consumer consumption) (Scheule & Sneed, 2001). The different points within this movement are the source, processing/manufacturing, distribution, and point of final service. Contamination can occur anywhere within the farm to fork continuum. During production, harvesting, and transport, processing or packing, in distribution, at food service facilities, and even in the home. Each point has an important role in assuring safe food for consumption by avoiding food safety hazards that can cause contamination and lead to foodborne illness. Foodborne illness is a result of the consumption of food contaminated with foodborne hazards. There are different pathogens that contaminate and proliferate in food causing mild to severe illnesses. But food can also be contaminated by chemicals that result in foodborne illness. According to the WHO major foodborne illnesses are usually infectious or toxic in nature and caused by bacteria, viruses, parasites, or chemical substances entering the body through contaminated food or water (WHO, 2020). Foodborne pathogens can cause acute to chronic illnesses such as severe diarrhea or meningitis, which may lead to long-lasting disability and death. Pathogens can be bacteria, viruses, parasites, and prions. Chemical contamination can lead to acute poisoning or long-term diseases, such as cancer. There are foods that have natural chemicals which may cause foodborne illness, but the illness can also come from intentionally or unintentionally added chemicals (WHO, 2020). There has been an increase in reports of foodborne illnesses worldwide due to factors such as improved surveillance programs, an increasing number of elderly persons in the population, major deficiencies in personal hygiene practices, increase in food preparation outside the home, changes

in food preparation techniques, and changes in microbiology. Changes in microbiology indicate the presence of more virulent strains (e.g. *Salmonella* Enteritidis can now incorporate into uncracked "sterile" eggs); greater ability to grow at low temperatures such as *Y. enterocolitica* and *L. monocytogenes* (Collins, 2015). Scientific measures used to implicate the number of illnesses associated with food are data and statistics. The WHO reports that unsafe food containing harmful bacteria, viruses, parasites, or chemical substances, causes more than 200 diseases ranging from diarrhea to cancers with diarrhea being the most common illness resulting from the consumption of contaminated food (WHO, 2015a). A world estimation of 600 million foodborne illnesses are reported of which 420,000 die every year (WHO, 2015b). In the Caribbean, where Suriname is a part of the community, statistics show that each year, roughly 1 in 49 persons (approximately 142,000 persons) will acquire a foodborne illness due to possible consumption of contaminated food or drink (Cruickshank-Taylor, 2020). An estimated 1100 deaths as a result of foodborne illness were reported in Suriname between 1983 and 1995 ("Jaarlijk sterven", 2018). Data reported by the Bureau of Public Health is referred to the number of hospitalizations and mortality due to infectious gastroenteritis (Bessy etal., 2013). Data and statistical analysis are difficult to do on foodborne illnesses due to the unsystematic information flow of the regulatory system in Suriname, resulting in an inadequate data systems and a partial view of the existing foodborne illnesses. Laboratory testing of foodborne microorganisms related to food poisoning is primarily done at the Academic Hospital. The Central Laboratory of Public Health runs a small number of tests on chemical or microbiological contamination of food products in the country. Data from the years 2000 to 2011 shows a fluctuation in the number of hospitalizations and mortality (figure 3).

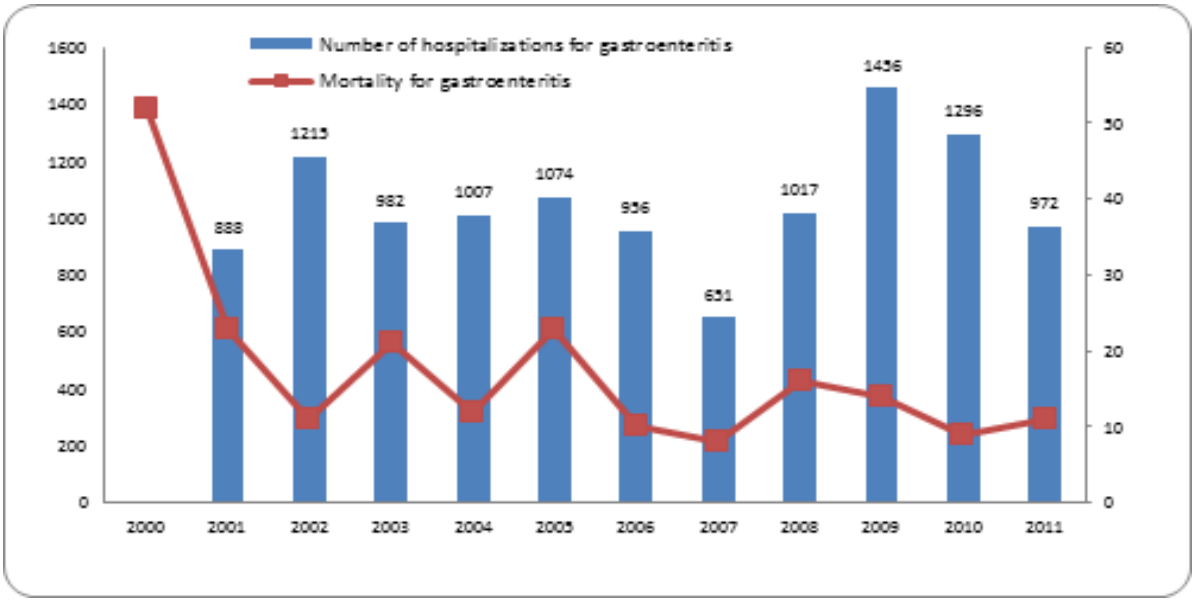

Figure 3: Number of hospitalizations and mortality data for the years 2000 to 2011

Ramadhin et col, 2012 as cited by (Bessy et.al., 2013).

Recent data is obtained from the Academic Hospital. This data is for a selection of foodborne bacteria tested on samples from patients who were referred by different physicians. The recorded perod is from August 1, 2020 until August 31, 2021. Table 1 indicates the bacterial species identified, the number of cases, the number of patients categorized in younger than 4 years, older than 50 years for they fall under consumers with a higher risk for foodborne illness. The table indicates the following information:

- The total amount of cases for the period August 1, 2020 until August 31, 2021 is 127 cases.
- the total amount of cases for people under the age of 4 years is more than those of 50 years and those between 4 and 50 years of age.
- the total number of cases for persons above 50 years old is less than those between 4 and 50 years of age.
- the pathogen with the highest number of cases is *Salmonella* group D with 28 cases total.

Table 1: Number of idetified foodborne pathogens from August 1, 2020 until August 31, 2021

Identified species	# cases	< 4 years	Between 4 and 50 years	>50 years
Campylobacter sp.	4	3	1	0
Salmonella not from group A-G	2	0	0	2
Salmonella group B	20	9	3	8
Salmonella group C	16	4	4	8
Salmonella group D	28	6	14	8
Salmonella group E	3	1	2	0
Salmonella group F	8	4	3	1
Salmonella group G	3	1	1	1
Shigella flexnerie	24	12	6	6
Shigella sonnei	19	12	7	0
Total	**127**	**52**	**41**	**34**

Overview of major foodborne pathogens

The World Health Organization has reported the major foodborne illnesses and the pathogens which cause them. Also stated by the World Health Organization is that foodborne illnesses are usually infectious or toxic and caused by foodborne pathogens (bacteria, viruses, parasites) or chemical substances entering the body through contaminated food or water. Foodborne pathogens can cause severe diarrhea or debilitating infections including meningitis while chemical contamination can lead to acute poisoning or long-term diseases, such as cancer. Foodborne illness may lead to long-lasting disability and death (WHO, 2020). The most common bacteria named by the WHO that cause foodborne illness are *Salmonella, Campylobacter,* Enterohaemorrhagic *Escherichia coli, Listeria monocytogenes,* and *Vibrio cholerae.* These bacteria can have severe and fatal outcomes. A brief summary of foodborne pathogens is listed in table 2. This information is obtained from the "Bad Bug Book" by Food and Drug Administration (2018b), "What You Need to Know about Foodborne Illnesses" from the Food and Drug Administration website, and an adapted table "Major Foodborne Pathogens Associated with Fresh Produce" by Williams (2020).

Table 2. Summary of major foodborne pathogens

	Microorganism	Name of illness	Time to Illness Onset	Symptoms	Duration of Illness	Sources
Bacteria	***Salmonella***	Salmonellosis	6 to 72 hours	Nausea, vomiting, abdominal cramps, diarrhea, fever, headache	4-7 days but may last 1-2 days longer depending on host, strain, and dose	Feces of livestock, wildlife, pets, and humans; contaminated water; eggs, raw meats and poultry; low moisture foods (*e.g.*, spices), etc.
	Escherichia coli (enterohemorrhagic)	*E. coli* infection "travelers' diarrhea"	3 to 4 days	Mild diarrhea to hemorrhagic colitis to hemolytic uremic syndrome	2-9 days; average of 8 days	Feces of ruminants, particularly cattle and sheep; raw or undercooked ground beef and beef

						products; contaminated water; raw milk
	Campylobacter jejuni	Campylobacteriosis	2 to 5 days	Fever, diarrhea, abdominal cramps, and vomiting. Watery or sticky stools that may contain blood	2-10 days	Raw or undercooked poultry; raw milk and raw-milk cheeses; contaminated water
	Vibrio cholerae	cholera infection	a few hours to 3 days	abdominal discomfort and diarrhea that may vary from mild and watery to acute, with rice-water stools and vomiting	usually goes away by itself in a few days	ingestion of contaminated water and ice; unwashed, contaminated food; and seafood.
	Listeria monocytogenes	Listeriosis	Gastroenteritis: a few hours to 3 days Invasive: 3 days to 3 months	Gastroenteritis: Mild to fever, muscle aches, nausea and vomiting, and, sometimes, diarrhea Invasive: malaise, headache, stiff neck, confusion, loss of balance, and convulsions, death	Days to weeks	Food workers, incoming air, raw materials, and food processing environments; post-processing contamination of food contact surfaces
Parasites	***Taenia species***	Taeniasis	2 to 4 months	diarrhea, nausea, pain, and change in appetite,	Adult worms can live for years in the intestine	insufficiently cooked pork and beef
	Cryptosporidium	Cryptosporidiosis.	7 to 10 days	Profuse, watery diarrhea, nausea, vomiting, cramping, and fever	2 to 14 days. May become chronic in immunocompromised individuals.	Contaminated water, infected food handlers, fecal matter (especially cattle); this organism is resistant to chlorine
	Giardia	Giardiasis	1 to 2 weeks	Malodorous diarrhea, malaise, abdominal cramps, flatulence, and weight loss	2 to 6 weeks. May become chronic in immunocompromised individuals.	Feces of humans and animals; contaminated water
Viruses	**Norovirus**	viral gastroenteritis, winter diarrhea, acute non- bacterial gastroenteritis, food poisoning, and food infection	12 to 48 hours	Explosive, projectile vomiting, watery, non-bloody diarrhea with abdominal	12 to 60 hours	Human feces and vomit, contaminated water and foods; up to 30% of infected people show no symptoms, but

				cramps, and nausea		excrete high levels of virus in their feces
	Hepatitis A	Hepatitis	15 to 50 days; Average: 30 days	Fever, anorexia, nausea, vomiting, diarrhea, myalgia, hepatitis, and, often, jaundice	1 to 2 weeks. May be prolonged or relapse for up to 6 months for some individuals.	Human feces, contaminated water and food
Chemicals	**Naturally occurring toxins**	include mycotoxins, marine biotoxins, cyanogenic glycosides,		Long-term exposure can affect the immune system and normal development, or cause cancer.		poisonous mushrooms, Staple foods like corn or cereals
	Persistent organic pollutants (POPs)	dioxins and polychlorinated biphenyls (PCBs)		reproductive and developmental problems, damage the immune system, interfere with hormones, and cause cancer		accumulate in the environment and the human body.
	Heavy metals	lead, cadmium, and mercury		neurological and kidney damage		heavy metals in food through pollution of air, water, and soil.

Consumer food safety perception and practices

Within society, there are different perspectives of food safety. The definition and meaning of food safety are perceived differently within the farm to fork continuum. “At the farm level, food safety is defined by the practices of the farmers and ranchers, whether in regard to chemical treatment of the soil or use of hormones in animal production. The food industry defines safe food by its specifications for raw materials and finished products in terms of pathogen reduction associated with processing technologies. Distributors, retailers, and restaurants define safe food by the expectations of their customers and the regulatory authorities” (Schmidt & Rodrick, 2003). Consumers their view on food safety may be different and depends on their perspective. Different answers were given by consumers when asked what food safety means to them (Schmidt & Rodrick, 2003):

- food handled properly, prepared hygienically, prepared using clean and sanitized surfaces, utensils, and dishes.
- food that retains vitamins and minerals but does not contain harmful chemicals such as pesticides.
- food that is within its shelf life, stored and distributed at proper temperatures.
- food that is not contaminated and does not make people ill.
- food with good (sealed) packages and labeled.
- food that is not spoiled (smell and taste).

The consumer's home is one of the primary locations where foodborne illness occurs. However, consumers do not consider foodborne illness to be related to food safety risks within their home kitchen due to different reasons. The first reason is that the majority of food eaten is prepared at home. This increases the risks of improper handling that can lead to foodborne illness. The second reason is the groups of people known to be at increased risk of foodborne illness (Byrd-Bredbenner et al, 2013). Healthy People 2020 mentions that these groups include children under the age of 4 which have shown the highest incidence of laboratory-confirmed infections from some foodborne pathogens, including *Campylobacter*, *Cryptosporidium*, *Salmonella*, Shiga toxin-producing *Escherichia coli* O157, *Shigella,* and *Yersinia*. Other people at risk are people older than age 50 and those with reduced immunity. They have a greater risk for hospitalizations and death from intestinal pathogens commonly transmitted through foods. A third reason is consumer's perception not to be susceptible to foodborne illness. They perceive the risk for foodborne illness is low or do not follow recommended food safety practices nor take enough precautions. A fourth reason may be that home kitchens are multipurpose areas used for much more than food preparation and food storage. This poses a risk for potential contamination and proliferation of

foodborne pathogens. Some of the pathogens that have been confirmed in home kitchens include Salmonella, pathogenic *Escherichia coli, S. aureus*, and *Campylobacter* (Byrd-Bredbenner et al, 2013).

Research on consumer food safety knowledge

Research studies and surveys with various methodologies prove the knowledge of consumer's behavior and practices with food products after they purchased them. The following paragraphs are a summary on consumer food safety knowledge and practices surveys from the "Food Safety Handbook" by Schmidt & Rodrick (2003), "From Farm to Fork: Critical Control Points for Food Safety" by Scheule & Sneed (2001), "Food Safety in Home Kitchens: A Synthesis of the Literature" by Byrd-Bredbenner et al. (2013), "Household consumer food safety study in Trinidad, West Indies" by Surujlal & Badrie (n.d.).

A national telephone survey (Altekruse et al.,1995) was done to estimate U.S. consumer knowledge about food safety. There were 1,620 participants of which one-third of those surveyed admitted to using unsafe food hygiene practices, such as not washing hands or preventing cross-contamination. Results also showed a disparity between the level of knowledge and corresponding safe hygiene practices. This suggested that decisions to practice safe food handling likely are based on various factors including knowledge, risk tolerance, and experience. (Altekruse et al.,1995 as cited by Schmidt & Rodrick, 2003).

The most common food handling mistakes made by consumers stated by Bryan (1988) include serving contaminated raw food; cooking, heating, or re-heating foods inadequately; obtaining food from unsafe sources; cooling food inappropriately; allowing too much of a time

lapse between preparing and serving food; and using poor hygiene practices in the handling of food (Bryan, 1988 as cited by Scheule & Sneed 2001).

The research report from McDowell (1998) shows results of on-site inspections of 106 households in 81 U.S. cities by professional auditors. The inspection was done on meal preparation, cleanup, temperatures, sanitation, the environment, and personal hygiene. The results showed that 96% of the households had at least one critical violation, most commonly for cross-contamination, improper handwashing, improper leftover cooling, improper chemical storage, insufficient cooking, refrigeration above 45°F (McDowell, 1998 as cited by Schmidt & Rodrick, 2003).

A research study was done by Jay et al. (1999) using video recording to study food handling practices in 40 home kitchens in Melbourne, Australia. Video monitoring was done for up to two weeks during 1997 and 1998. The results showed a significant variance between what people said they would do and what they practiced concerning food safety in the home. The most common unhygienic practices included infrequent and inadequate handwashing, inadequate cleaning of food contact surfaces, presence of pets in the kitchen, and cross-contamination between dirty and clean surfaces and food. (Jay et al., 1999 as cited by Schmidt & Rodrick, 2003).

The researchers Redmond, Griffith, and Riley researched in the United Kingdom on contamination of bottles used for feeding reconstituted powdered infant formula and implications for public health. They found baby bottles contaminated with *Staphylococcus aureus*. These baby bottles had been cleaned and disinfected in advance, creating an opportunity for pathogen proliferation (Byrd-Bredbenner et al., 2013).

A more recent study from Surujlal & Badrie (n.d.) was done within the homes of Trinidad. Interviews were done on 84 respondents about reporting of foodborne illness, handwashing

practices, purchase of foods, separation of raw, and cooked foods, cooking of foods, thawing and cooling of foods and consumption of raw eggs. The results showed that the majority of consumers had experienced some form of food- borne illness but only a small percentage sought medical treatment. The majority of respondents washed their hands with soap and water before preparation of meals, after using the toilet facilities, and after handling raw foods or contaminated objects. A few respondents purchased from unlicensed vendors. While labeling and expiry dates were important for more than half of the respondents. The minority did not apply good separation practices cooked or ready-to-eat foods from raw foods. Meat and vegetables were washed before serving or cooking by almost all respondents. And lastly less than half applied good chilling practices (Surujlal & Badrie, n.d.).

Byrd-Bredbenner et al. (2013) have summed up consumer practices to focus attention on.

- The multipurpose use of kitchen sinks for not only dishwashing, produce washing or handwashing.
- Lack of separation of dirty dishes stacked alongside clean dishes.
- Refrigerators which are commonly stored with raw unwashed vegetables, dripping raw meat, as well as cooked ready-to-eat foods.
- The use of cleaning products such as dishcloths and sponges that can quickly become heavily contaminated with a variety of microorganisms. Using these soiled cleaning products to wipe down kitchen areas also contributes to contamination. Research results mentioned by Byrd-Bredbenner et al. (2013) showed that of the 92% of consumers who use them, just 9% report changing dishcloths or sponges daily, 44% change them at least weekly, the remainder changes them less often, with 5% waiting until they fall apart.
- The improper use of kitchen utensils and cutting boards through insufficient cleaning.

- The reuse and multipurpose use of grocery bags which poses a food safety risk because the bags are considered a cross-contamination vehicle for microorganisms. Byrd-Bredbenner et al (2013) mentions one in three consumers using these bags for more than just groceries; bags are also used as gym bags, toy bags, and other uses. It is also concerning that large numbers of bacteria were found in grocery bags. This shows the lack of washing reusable grocery bags and poses a food safety risk due to the multipurpose use of the same bags.
- Unclean refrigerators are of concern mentioned in a study from Ireland also mentioned by Byrd-Bredbenner et al. (2013) showed that the pathogens *S. aureus, Salmonella enterica, E. coli, Listeria monocytogenes, and Yersinia enterocolitica* were found in more than 50 % of inspected refrigerators. Many refrigerators also showed temperatures exceeding the recommended 5°C (40°F) and lower due to being tightly packed and posing cross- contamination risks.
- The scope of consumer food safety goes beyond the home kitchen, for meals prepared at home are taken to work or school and even prepared for public events. Byrd-Bredbenner et al. (2013) explains that many workers eat lunch at their desks and only 38% cleaning their work area weekly, Only half of the workers report always washing their hands before lunch, and less than a quarter of workplace refrigerators are cleaned weekly. These practices also pose risk of foodborne illness. Workers have reported that they refrigerate their lunch, however some leave perishable foods foods at room temperature for more than two hours.
- The same consideration applies to lunches children take to school. Lunches brought to school create a "chill" food safety hazard due to lack of chilling lunches that are often stored at room temperature for several hours. Foods are exposed to the danger zone and pose risks causing foodborne illness. Lunch bags are often reused and cleaned by wiping with a dishcloth. Dishcloths can be a vehicle for cross-contamination.

Food Safety Best Practices Awareness Guideline

"Safe food saves lives" (Fung et al. 2018). Safe food means no consumption from foods that are contaminated and may pose health risks for consumers. Safe food is also very important for consumers in Suriname. There are no regulations for consumers, but a guideline to safer food is needed to make consumers aware of safe food practices. In Suriname, food customs may be ethnic bound and based on demographic factors. For example, products or tools used for different ethnic cuisines may differ, and also different ways in preparing food based on where people live. Access to utilities is easier in the coastal plain than in the interior. Transport and storage of food products in the interior also differ from the ways in the coastal plain. Because of these factors, the guideline is only prepared for consumers in the coastal plain. Awareness advice is given for the following topics: Purchase, Clean, Separate, Cook, Chill, Storage, Risky practices, and Power outage.

Purchase

The guidelines for purchase food safety practices are consulted from international literature "Shelf-Stable Food Safety" by Food Safety and Inspection Service (2015), "Food Product Dating" by Food Safety and Inspection Service (2019), and "Climate and Average Weather in Suriname" from the Weather and Climate website.

Foodservices, supermarkets, and other vendors of food in Suriname are required to be licensed and follow food safety regulations. Despite the license, consumers still need to be aware of certain food safety risks when purchasing food. Observation and food safety knowledge is needed when consumers purchase food products. The Public Health Department Suriname has written requirements for commercial businesses that sell food to consumers. All food businesses

are required to be registered at the Chamber of Commerce or at the district's office and inspected by the Department of Environment Inspectorate. However, if a food business is not registered, the inspection may not be done with the risk of making consumers ill due to food safety hazards**.**

Consumers need to observe the environment or surroundings from the establishment where they purchase food. Food safety risks can be seen by observation of cleanliness, storage, chilling practices, etc. Avoid purchasing food at unlicensed vendors for they are usually not inspected and pose food safety risks. Labels on products have different dates to indicate the quality and safety of the product. The Food Safety and Inspection Service advices to check the date printed on the labels. A "Sell-By" date tells the store how long to display the product for sale. A "Best if Used By (or Before)" date is recommended for best flavor or quality. A "Use-By" date is the last date recommended for the use of the product while at peak quality. A "Freeze-By" date indicates when a product should be frozen to maintain peak quality (FSIS, 2019). Temperature control is important during grocery shopping. Choose food products that presumably are not in the danger zone and pick up refrigerated and frozen foods last to avoid them from thawing. Separation of food products is important to avoid cross-contamination. Keep frozen or refrigerated foods separate; meat products in a separate bag to avoid their juices from leaking. Cleaning products should also be in separate bags to avoid contact. Chemicals on food can also cause food poisoning. Canned products which are heavily dented (at the seam), swollen or rusted should not be purchased according to Food Safety and Inspection Service. *Clostridium botulinum* causes food poisoning and can grow in canned food products. If a can containing food has a small dent but is otherwise in good shape, the food should be safe to eat (FSIS, 2015). Avoid purchasing fruit and vegetables with rotten parts, because bacteria can thrive in those parts. Use clean grocery bags. Grocery bags are not often washed and are a vehicle for contamination. Grocery shopping needs to be planned to avoid long

periods of food products at improper temperatures. The average daily temperature in Suriname lies between 21°C and 32°C ("Climate and average weather in Suriname", 2021). Driving around with food products can risk products being in the danger zone.

Clean

The following guidelines are created based on information from “When and How to Wash Your Hands” by Centers for Disease Control and Prevention (2021), “Dangerous Food Safety Mistakes” by Centers for Disease Control and Prevention (2020), “Dishwashing sponges and brushes: Consumer practices and bacterial growth and survival” from Møretrø et al. (2020), and “FIVE KEYS TO SAFER FOOD MANUAL” by World Health Organization (2006).

Microorganisms that cause foodborne illness can be transferred through contaminated hands, cloths, and utensils used within the home kitchen. Cleaning helps remove different types of soil e.g. food particles, grease, etc. After cleaning products can be sanitized to reduce the number of microorganisms or disinfected to kill microorganisms. Observations from households in Suriname regarding cleaning are washing meat with vinegar 12% diluted in water or with specific leaves and rinsed afterward. Also, (leafy) vegetables are put in (kitchen) saltwater for some time and rinsed afterward**.** Salt inhibits microorganisms.

Use safe water for cleaning and washing. Untreated water contains pathogens that can contribute to food contamination. The World Health Organization (2006) advices to wash your hands thoroughly and sufficiently before and after handling food, especially raw meat, before eating, often during food preparation, after using the restroom, after handling trash, after handling chemicals, and after playing with (pet) animals. Hands are one of the vehicles for food contamination with biological, physical, and chemical contaminants. Proper handwashing method

from the CDC is done by “wetting your hands with clean, running water (warm or cold), turning off the tap, and apply soap. Lather your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails. Scrub your hands for at least 20 seconds. If a timer is not available, singing the “Happy Birthday” song from beginning to end twice also works. Rinse your hands well under clean, running water. Dry your hands using a clean towel or air dry them”. (CDC, 2021). Use a paper towel for hand drying or replace cloth towels frequently because cloth towels can get soiled and form a contamination source. Keep areas clean from pests (rats, mice, birds, cockroaches, flies, and insects), pets, or other animals for they carry pathogens that can contaminate food and surfaces. Wash fruit and vegetables before cooking or eating raw. Fruits and vegetables may have germs on their peeling or skin. It’s easy to transfer those germs to the inside of fruits and vegetables when you cut or peel them. Wash all fruits and vegetables under running water even if you’re going to peel them. Use a clean vegetable brush to scrub firm fruits and vegetables like melons, avocados, and cucumbers (CDC, 2020). Clean appliances frequently. Appliances such as refrigerators, freezers, microwaves, blenders, choppers, etc. are frequently used and also pose as a source of contamination and need to be kept clean. Wash utensils and equipment used for raw meat, poultry, and seafood separately to avoid cross-contamination from sponges, washcloths or brushes used. Clean sponges and brushes with chlorine, dish-washing machine, or boiling. Use paper or single-use wipes for raw food spills. Use brushes rather than sponges for dishwashing (Møretrø et al. 2020). Don’t wash meat, chicken, turkey, or eggs. Cooking them thoroughly will kill harmful germs. Washing raw meat, chicken, turkey, or eggs can spread germs to your sink, countertops, and other surfaces in your kitchen. (CDC, 2020).

Separate

The concept of separation is to keep raw meat, poultry, and seafood separate from ready-to-eat foods. Separation avoids cross-contamination. The following guidelines are based on "Dangerous Food Safety Mistakes" by Centers for Disease Control and Prevention (2020), and "FIVE KEYS TO SAFER FOOD MANUAL" by World Health Organization (2006).

Separate raw meat, poultry, and seafood from other products while shopping (WHO, 2006). Using separate bags and separation in the shopping cart can reduce cross-contamination. Separate food products from chemicals because chemical products may leak onto food products. Use separate utensils and equipment for raw foods while cooking. Separate clean dishes and utensils from dirty ones. "One of major contamination sources is the improper use of utensils, mainly cutting boards. Use separate cutting boards for meat, vegetables, and fruit. Always use separate plates for raw meat and cooked meat. The same rule applies to chicken, turkey, and seafood. Germs from the raw meat can spread to the cooked meat" (CDC, 2020).

Chill

The CDC's "Dangerous Food Safety Mistakes" (2020) and the USDA website have written guidelines for best food safety chill practices. These guidelines are the basis for the following information.

Chilling focuses on temperature control of foods stored at cool temperatures. Proper cooling and freezing temperatures do not kill bacteria but limit microbial growth. Regarding temperature there is a danger zone. Use a thermometer for indication of the right temperature in coolers and freezers. Frozen foods should be thawed in the refrigerator. While foods are in the process of thawing in the refrigerator (40°F or less), they remain safe. After thawing, use ground

meats, poultry, and fish within one or two additional days, and use beef, pork, lamb or veal (roasts, steaks, or chops) within three to five days" (*AskUSDA*, n.d.). "Always marinate food in the refrigerator do not be thawed at room temperature. It can be thawed in the refrigerator, in cold water, or the microwave. Harmful germs can multiply very quickly at room temperature" (CDC, 2020).

Storage

Information on food safety storage practices used for this guideline is based on from Boyer & McKinney (n.d.), "Food Safety and Eating Out" by Centers for Disease Control and Prevention (2021) and the USDA website (*AskUSDA*, n.d.).

Optimal quality and safety depend on the proper handling of food products. This includes storage temperatures to avoid spoilage. Proper storage of food in containers, cabinets, freezers, and refrigerators can reduce contamination or microbial growth and contamination with chemical or physical hazards. Extending the shelf-life of food depends of the food products, packaging, temperature, and humidity. Spoilage will also occur in unsterilized food (Boyer & McKinney, n.d.). Check storage directions on labels; packed products usually have labels with storage instructions. Store raw meat, poultry, and seafood in leak-proof containers. Juices from raw meat, poultry, and seafood can leak onto other food products causing cross-contamination. Store raw meat, poultry, and seafood at the bottom of the freezer or refrigerator (when defrosting). Keep food products stored at the right temperature: "dairy between 34°F and 38°F, meats between 33°F and 36°F, eggs 33°F to 37°F, fresh vegetables and ripe fresh fruits between 35°F and 40°F" (Boyer & McKinney, n.d.). Do not store food too long in the refrigerator or freezer (appendix A). Throw out foods that are expired, and canned products that are heavily dented, swollen or rusted. **"**Practice

FIFO (First-In-First-Out) to ensure that food stored in the refrigerator, freezer, or pantry is consumed within the expiration dates" (Boyer & McKinney, n.d.). "When eating out Take care of your leftovers quickly. Refrigerate leftovers within 2 hours of eating out. If it is above 90°F outside, refrigerate leftovers within 1 hour. Eat leftovers within 3 to 4 days. Throw them out after that time" (CDC, 2021b). The custom is to remove food in a canned good and store them in a container to retain the flavor and keep food from drying out. The USDA recommends that opened canned goods be stored in the refrigerator and kept for four days if it is a low-acid canned good and seven days if it is a high-acid canned good (*AskUSDA*, n.d.).

Cook

The guidelines for cook food safety practices are consulted from international literature "Tips for Using Your Microwave Oven Safely" by Food and Drug Administration (2016), the USDA website (*AskUSDA*, n.d.)., and the Made Safe website on "How to Avoid Toxic Chemicals in Plastics".

The goal of cooking as a safety key is to kill harmful pathogens with proper heating. Cooking food to a temperature of 70°C ensures safe food for consumption. Food can be cooked with different appliances or techniques, but no matter the cooking method used, proper cooking temperatures are important. The danger zone also applies to cooking safe food.

Use safe water for preparing and cooking food and drinks. Untreated water contains pathogens that can contribute to food contamination. Use a thermometer to determine the readiness of cooked food. Visually checking the readiness of food preparation can often be misleading while a thermometer gives precise cooking temperatures. Use the right cooking temperatures (appendix B). Microwaves are also used to cook food in and the use of a thermometer is also important. It is

recommended to use glass, ceramic, and plastic containers labeled for microwave oven use (FDA, 2016). Some plastic containers are made from material that releases toxic chemicals when heated such as Phthalates, Bisphenol-A (BPA), and Polyvinyl chloride (PVC) (Made Safe, 2016). Keep cooked food at more than 60°C before serving because temperatures above 60 °C slow down or stop proliferation of microorganisms. Refrigerate cooked food within two hours to avoid the danger zone. Meat and poultry can be marinated before cooking. Marinated meat or poultry should be kept in the refrigerator for the time indicated on the recipe, and boil the used marinade if you want to brush it on the meat or poultry while it's grilling. Do not save the used marinade (*AskUSDA*, n.d.).

Risky Practices

Consumption of risky foods is one food safety risk that is not often mentioned. The information from "Dangerous Food Safety Mistakes" by Centers for Disease Control and Prevention (2020) was consulted for information regarding risky food practices.

Raw fish and vegetables pose a risk of contamination with foodborne pathogens. Be aware of foodborne risks associated with the practice of consuming raw vegetables. Improper cleaning of vegetables which will be consumed raw can cause infection with harmful pathogens present on these vegetables. Be aware of the foodborne risks associated with the practice of eating rare meats and poultry. Improper heating does not effectively inactivate or kill pathogens. Be aware of the foodborne risks associated with the practice of eating raw fish. Other risky food practices are eating raw cookie dough or batter containing raw eggs. "Flour and uncooked eggs may contain *Escherichia coli*, *Salmonella*, or other harmful bacteria" (CDC, 2020).

Power outage

Boyer & McKinney "Food Storage Guidelines For Consumers" was consulted for information on food safety practices regarding power outage. Power outage in Suriname commonly occurs and can last a few minutes, an hour, and sometimes even longer. Few homes may have a back- up generator, but for those who do not have one, food safety practices are recommended to avoid eating spoiled or unsafe food (appendix C).

Minimize opening the refrigerator or freezer because cooling will be lost. An option to keep products cool inside the refrigerator is using ice blocks. Perishable refrigerated foods should be discarded after 6 hours of not being cooled. If a freezer is fully loaded, the food products may last for approximately two days, but if the freezer is partially loaded, food products may last for only one day. Boyer & McKinney advise to check your food products once the power comes back. Freezer foods that still have ice crystals may be refrozen, except for ice cream and pizza for they can be linked to the growth of *Listeria monocytogenes*. A 24-hour period should be applied to foods that have completely thawed but are still cold. The 24-hour period is for cooking or refreezing the products. An option to keep products cool and frozen inside the freezer is using dry ice (Boyer & McKinney, n.d.).

Project Methodology and Design

Targeted Population

The target population for this project is consumers in the coastal plain of Suriname who purchases, prepare and consume foods within the home. Some facts may also apply to consumers in their work or school environment. The information will be disseminated through social media platforms which are frequently used by consumers in Suriname. The goal is also to setup training programs to train interested consumers in food safety best practices. Simple training ourses will be developed for education institutes to bring food safety awareness to students. Another way for dissemination is creating short films used as informercials through different media outlets. This information will also be made available to the government authorities in Suriname.

Methodology

This project was conducted by doing a research study on consumer food safety literature. Literature on international consumers behavior, food safety hazards, and best practices were analyzed and the information used for this report. A guideline is provided for best practices regarding food safety for Suriname consumers.

Summary of Outcomes, Discussions, and Recommendations

This report is an outcome of information based on research scholarly papers, published articles, and United States government and University (through University Cooperative Extension Services) food safety related websites. The information obtained from the literature search was used to create a guideline for best food safety practices for Suriname consumers. This report

addressed basic food safety practices for consumers in the coastal area of Suriname who have access to utilities and would be able to do accordingly. Publications on consumer food safety knowledge and practices were not found during this project in Suriname; as well as, minimal data received regarding foodborne illness in Suriname.

It is recommended that intensive research be done regarding consumer food safety in Suriname; in addition, to adapting some of the best practices for the interior portion of Suriname (as this guideline focused on the coastal plains portion). Doing very intensive research regarding food safety in Suriname is recommended for both the coastal plains and interior regions of Suriname on topics such as foodborne illness data analysis, consumer food safety practices through surveys, and consumer food safety knowledge or perceptions through surveys. This guideline may be adapted accordingly based on food safety research in Suriname.

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Appendices

Appendix A: Refrigerator & freezer storage chart

Food-Safety Refrigerator-Freezer

Double click for the attached PDF

Appendix B: Safe Minimum Cooking Temperatures Chart

Advice on Safe Minimum Cooking Temperatures

Food	Type	Internal Temperature (°F) / °C
Ground meat and meat mixtures	Beef, pork, veal, lamb	160 / 71
	Turkey, chicken	165/ 74
Fresh beef, veal, lamb	Steaks, roasts, chops **Rest time: 3 minutes**	145/ 63
Poultry	All Poultry (breasts, whole bird, legs, thighs, wings, ground poultry, giblets, and stuffing)	165/ 74
Pork and ham	Fresh pork, including fresh ham **Rest time: 3 minutes**	145/ 63
	Precooked ham (to reheat) **Note:** Reheat cooked hams packaged in USDA-inspected plants to 140°F	165/ 74
Eggs and egg dishes	Eggs	Cook until yolk and white are firm
	Egg dishes (such as frittata, quiche)	160/ 71
Leftovers and casseroles	Leftovers and casseroles	165/ 74
Seafood	Fish with fins	145 / 63 or cook until flesh is opaque and separates easily with a fork
	Shrimp, lobster, crab, and scallops	Cook until flesh is pearly or white, and opaque
	Clams, oysters, mussels	Cook until shells open during cooking

Adapted from Food Safety.gov. (2019, April 12). Safe Minimum Cooking Temperatures Chart

Appendix C: Frozen Food and Power Outages

Advice on Frozen food and Power outage

Food Type	Contains ice crystals and feels cold as if refrigerated	Thawed and held above 40°F for more than 2 hours
Meat, poultry, seafood – all types of cuts	Refreeze	Discard
stews, soups	Refreeze	Discard
Milk	Refreeze (some loss of texture)	Discard
Eggs (out of shell) and egg products	Refreeze	Discard
Ice cream, frozen yogurt	Discard	Discard
Cheese (soft and semi-soft)	Refreeze (some loss of texture)	Discard
Hard cheeses	Refreeze	Refreeze
Shredded cheeses	Refreeze	Discard
Cheesecake	Refreeze	Discard
Fruit juices (Home or commercially packaged)	Refreeze	Refreeze. Discard if mold, yeasty smell, or sliminess develops
Vegetables juices (Home or commercially packaged or blanched)	Refreeze	Discard after held above 40°F for 6 hours
Breads, rolls, muffins, cakes (without custard fillings)	Refreeze	Refreeze
Cakes, pies, pastries with custard or cheese filling	Refreeze	Discard
Pie crusts, commercial and homemade bread dough	Refreeze (some quality loss may occur)	Refreeze (quality loss is considerable)
Casseroles: pasta, rice-based	Refreeze	Discard
Flour, cornmeal, nuts	Refreeze	Refreeze
Breakfast items: waffles, pancakes, bagels	Refreeze	Refreeze
Frozen meal, entree, specialty item (pizza, sausage and biscuit, meat pie, convenience foods)	Refreeze	Discard

Adapted from Food Safety.gov. (2021, January 28). Frozen Food and Power Outages: When to Save It and When to Throw It Out