SNI

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Indonesian National Standard

Maximum limit of microbial contamination in food

ICS 67.220.20

National Standardization Agency

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Preface

Standards for Maximum Limits of Microbial Contamination in Food are prepared and formulated by the Technical Committee 67-02 for Food Additives and Contaminants. This standard has been discussed in a technical meeting, and was finally formulated at a national consensus meeting in Bogor on January 16, 2008 which was attended by representatives of producers, consumers, associations, universities, and relevant government agencies as an effort to improve food safety considering that microbes are the cause of food poisoning. Food spoilage and food-borne diseases are the most dangerous for human consumption.

This standard is prepared by taking into account: 1. Law No. 23 of 1992 on Health 2. Law No. 7 of 1996 concerning Food.
3. Law Number 8 of 1999 concerning Consumer Protection 4. Government Regulation Number 28 of 2004 concerning Food Safety, Quality and Nutrition.
5. Decree of the Director General of Drug and Food Control No. 03726/B/ SK/VII/1989 on the Maximum Limit of Microbial Contamination in Food.

This standard has gone through the process of polling on July 15, 2008 to October 15, 2008 and voting on May 20, 2009 until August 20, 2009 with the final result of RASNI.

Maximum limit of microbial contamination in food

1 Scope

This standard establishes terms and definitions, requirements for microbial contamination in food, and maximum limits for microbial contamination in food.

2 Terms and definitions

2.1
food is
anything that comes from biological and water sources, both processed and unprocessed, which is intended as food or drink for human consumption, including food additives, food raw materials, and other materials used in the process of preparation, processing and or the manufacture of food or drink

2.2
food categories
food grouping based on the type of food

2.3
contamination
chemical, physical, biological substances whose presence in food to a certain extent can pose a risk to health

2.4
Microbes are also called microorganisms or
microorganisms , simple living things formed from one or several cells that can only be seen with the help of a special instrument (microscope) including viruses, bacteria, micro algae, protozoa, yeasts and molds

2.5
microbial
contamination of microbes whose presence in food to a certain extent can pose a risk to health

2.6
types of microbial
contamination , the type and or number of microbes whose presence in food at certain limits can pose a risk to health

2.7
the maximum
limit is quantitatively expressed as the maximum number of microbes allowed to be present in food expressed in numbers or number of colonies per unit weight or volume, and qualitatively expressed as negative per unit weight or certain volume

2.8
visually
visible microbial growth colonies on solid and semi-solid culture media

2.9

Most Probable Number (APM) also known as *The Most Probable Number* (MPN)
the approximate number (per ml / per gram or per 100 ml / per 100 grams) of the microbes present in the sample, based on their presence in the replica aliquots prepared by decimal dilution

2.10

Total Plate Count (ALT) is also known as *Total Plate Count* (TPC)
the number of mesophilic aerobic microbes per gram or per milliliter of sample determined by standard methods

2.11

bacteria
are single-celled microbes that have a cell wall, reproduce by dividing, and have four main shapes, namely cocci (spherical), bacilli (like rods), commas and spirals

2.12

microbial
molds consist of more than one cell in the form of fine threads called hyphae, a collection of hyphae called mycelium, reproduce by spores

2.13

Yeasts are also called
single-celled microbial yeasts that are oval in shape and reproduce through the formation of buds or ascospores, but do not form mycelium.

3 Requirements for microbial contamination in food

3.1 The maximum limit of microbial contamination in food is stated in Article 4.

3.2 The microbial contamination as referred to in 3.1 has been assessed for safety and is listed in Appendix A.

3.3 If Enterobacteriaceae testing shows negative results per 10 grams in food category 13.1 advanced formula, and negative per 2 x 1 gram in food category 01.0 Milk products and their analogues and food category 13.2 Food for babies and children in the growing period; then coliform testing is not required.

4 Maximum limit of microbial contamination in food

Table 1 - Maximum limit of microbial contamination in food

No. in food	Food Category	Types of microbial contamination	Maximum limit
01.0	Milk products and their analogues, except those included in category 02.0		
01.1	Milk and milk-based drinks		

Table 1 (continued)

no.kat food	Food Category	Types of microbial contamination	Maximum
	Fresh milk (unpasteurized milk) for further processing (milk of cows, horses, goats and other livestock)	ALT (30 °C, 72 jam)	**limit** 1 x 106
		coliform	colonies/ml 2 x 101 colonies/ml
		APM *Escherichia coli*	< 3/ml
		Salmonella sp.	negative /25ml
		Staphylococcus aureus ALT	1 x 102 colonies/ml
	Fresh milk (unpasteurized milk) for direct consumption, (cow, horse, goat and buffalo milk)	(30 °C, 72 hours)	5 x 104 colonies/ml
		coliform	2 x 101 colonies/ml
		Escherichia coli APM < 3/ml *Salmonella*	
		sp. negative /25 ml 1 x 102 colonies/ml	*Staphylococcus*
		monocytogenes negative/25 ml *Campylobacter sp*	*aureus Listeria*
		negative/25 ml 5 x 104 colonies/ml ALT (30 °C, 72	
		hours)	
	Pasteurized milk (unsalted or flavored)		
		APM Coliform 10/ml APM *Escherichia*	
		coli < 3/ml *Salmonella sp.* negative /25	ml 1 x
		102 colonies/ml *Staphylococcus aureus*	*Listeria*
		negative /25 ml ALT (30 °C, 72 hours)	*monocytogenes* < 10 colonies/
		0.1 ml after 15 days incubation	
	Sterile milk and UHT milk (fresh or flavored)		
01.2	Fermented milk and dairy products resulting from negative enzyme hydrolysis (unsalted)		
	Fermented milk (yogurt)	APM Coliform 10/ml plain or flavored	
	Salmonella sp. negative /25 ml *Listeria monocytogenes* negative /25 ml		
01.3	Condensed milk and its analogues (fresh)		
	Evaporated milk and evaporated skim milk	ALT (30 °C, 72 jam)	1 x 102 colonies/ml
		APM Coliform	10/ml negative / 25
		Salmonella sp.	ml 1 x 102 colonies/
		Staphylococcus aureus ALT	ml 1 x 104 colonies/
	Sweetened condensed milk and sweetened condensed skim milk (plain or flavored)	(30 °C, 72 hours)	g 10/g negative / 25
		APM Coliform	g 1 x 102 colonies/
		Salmonella sp.	g 2 x 102 colonies/
		Staphylococcus aureus Mold	g 5 x 104 colonies/
		and yeast ALT (30 °C, 72	g 10/g negative/25
	Vegetable creamer powder	hours)	g 1 x 102 colonies/g
		APM Coliform	
		Salmonella sp.	
		Staphylococcus aureus	

Table 1 (continued)

No. food kat 01.4	Food Category	Types of microbial contamination	Maximum limit
	Cream (unsalted) and the like		
	Pasteurized cream	ALT (30 °C, 72 h) colony/g APM Coliform	5 x 104 10/g
		Salmonella sp. negative/ 25 g *Staphylococcus aureus*	1 x 102 colonies/g
		Listeria monocytogenes negative/25 g Milk powder	and milk powder
		and analogue powder (unsalted)	
01.5			
	Powdered milk and skim milk	ALT (30 °C, 72 hours) powdered	5 x104 colonies /g
	APM Coliform *Salmonella sp.*		10/g negative / 25
			g 1 x 102 colonies/
		Staphylococcus aureus ALT	g 2 x 105 colonies/
	Buttermilk powder	(30 °C, 72 hours)	g 10 colonies/g
		APM Coliform	negative/25 g
		Salmonella sp.	
01.6	Cheese and cheese analog		
	Cheese (all types)	APM *Escherichia coli* 10/g *Salmonella*	
		sp. negative/ 25 g 1 x 102 colonies/g *Staphylococcus*	
		monocytogenes negative /25 g Dairy-based dessert *aureus Listeria*	
		(eg pudding, flavored yogurt or yogurt with fruit) 5 x	
01.7	104 colonies /g ALT ice cream (30 °C, 72 o'clock)		
		Coliform APM < 3/g *Salmonella sp.*	
		negative/25 g 1 x 102 colonies/g *Staphylococcus*	
		monocytogenes negative/25 g 1 x 104 colonies/g *aureus Listeria*	
		ALT (30 °C, 72 h)	
	Cooked pudding, cold and frozen		
		Coliform APM < 3/g *Salmonella sp.*	
		negative / 25 g 1 x 102 colonies/g *Staphylococcus*	
		and whey products, except whey cheese 01.8 Whey	*aureus* Whey
powder APM Coliform *Salmonella sp.*			
			< 3/g
			negative/25 g
	Ice cream flour	ALT (30 °C, 72 jam)	5 x 104 colonies /g
		APM Coliform	< 3/g negative/25 g
		Salmonella sp.	1 x 101 colonies/g
		Staphylococcus aureus	
02.0	Fats, oils and oil emulsions		
	Butter	ALT (30 °C, 72 hours) 1 x 101 colonies/g	1 x 105 colonies/g
		negative/25 g 1 x 102 colonies/g *Staphylococcus*	*Salmonella sp.*
		aureus Listeria monocytogenes negative/25 g	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Margarine, butter fat	ALT (30 °C, 72 hours)	1 x 105 colonies/g
		APM Coliform 10/g APM *Escherichia*	
		coli < 3/g *Salmonella sp.* negative/25 g	
		Staphylococcus aureus 1 x 102 colonies/	
03.0	Edible *ice,* including *sherbet* and *sorbet*		
	Ice cubes, wax ice, ALT flavored ice (30 °C, 72 hours)		1 x 104 colonies/g
		Coliform APM < 3/g *Salmonella sp.*	
		negative/25 g	
04.0	Fruits and vegetables (including mushrooms, tubers, legumes including soybeans and aloe), seaweed, whole grains		
04.1	Fruit		
04.1.1	Fresh fruit	APM *Escherichia coli*	< 20/g
		Salmonella sp.	negative/25 g
04.1.2 Processed fruit Dried			
	fruit (raisins, sale bananas, mangoes, etc.)	ALT (30 °C, 72 jam)	1 x 105 colonies/g
		APM Coliform	< 3/g 5 x 101
		mold/yeast	colonies/g 1 x 105
	Wet fruit candy	ALT (30 °C, 72 jam)	colonies/g 10/g
		APM Coliform	
		APM Escherichia coli < 3/g 1 x 102	
		Mold and yeast 1 x 105	colonies/g
	Candied dried fruit	ALT (30 °C, 72 jam) colonies/g	
		APM Coliform 10/year	
		APM *Escherichia coli* < 3/g 5 x 101	
		102 colonies/g	colonies/g or 1 x
	Canned fruit	ALT (30 °C, 72 jam)	
		APM Coliform < 3 /year	
		Staphylococcus aureus negative/g negative/g	
		Clostridium perfringens 1 x	
	Jam, fruit jelly and marmalade	ALT (30 °C, 72 jam) 104 colonies/g	
		APM Coliform < 3/year	
		Staphylococcus aureus 1 x 102 colonies/g < 1 x 101	
		Clostridium sp 1	colonies/g
		Mold and yeast 1x102 colonies/g	
	Agar jelly	ALT (30 °C, 72 jam) colonies/g	
		APM Coliform < 3/g 1 x 102 colonies/g	
		Staphylococcus aureus	1 x 102 colonies/g
		Kapang and khamir	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Liquid coconut milk, coconut paste, coconut cream	ALT (30 °C, 72 hours)	1 x 106 colonies/g
		Coliform APM < 3/g *Salmonella sp.*	
		negative/25 g 1 x 102 colonies/g *Staphylococcus*	
		colonies/g ALT (30 °C, 72 h)	*aureus* 1 x 106
	Dry grated coconut		
		APM Coliform 100/g APM *Escherichia*	
		coli < 3/g *Salmonella sp.* negative/25 g 1	x 102
		colonies/g Molds and yeasts 1 x 104 colonies/g	
			ALT (30 °C, 72 h)
	Nata in packaging		
		APM Coliform < 3/g 1 x 102 colonies/g	
		1 x 104 colonies/g ALT (30 °C, 72 hours)	Molds and yeasts
	Lempok and its fruit-based analogues		
		APM Coliform 20 /g APM *Escherichia*	
		coli < 3/g *Salmonella sp.* negative/25 g	1x
		101 colonies/g *Staphylococcus aureus*	102 colonies/
		1 x 104 colonies/g ALT (30 °C, 72 hours)	g Molds and yeasts
	Fruit based chips		
		APM *Escherichia coli* < 3/g 1 x 102	
		Staphylococcus aureus 5 x 101 colonies/g	colonies/g Mold
		(including mushrooms, roots, tubers and aloe vera),	Vegetables
04.2	seaweed, beans and legumes and seeds Vegetables , nuts and fresh seeds Vegetables for APM *Escherichia coli* < 3/g fresh direct consumption *Salmonella sp.* negative/25 g Vegetables,		
04.2.1	seaweed, legumes and processed grains 5 x105 colonies/g Frozen vegetables ALT (30 °C, 72 h)		
	5 x102 colonies/g Coliform < 3/g *Salmonella sp.* negative/25 g 1 x 102 colonies/g 1 x 105 colonies/g Molds 1 x 102 colonies/g		
04.2.2			
		APM *Escherichia coli*	
		Salmonella sp.	
		ALT mold	
	Dried vegetables	(30 °C, 72 hours)	
		coliform	
		APM *Escherichia coli*	
		Salmonella sp.	
		APM	
	Pickled and salted vegetables	Coliform Mold	
		Salmonella sp.	
	Vegetables in cans	ALT (30 °C, 72 jam)	
		APM Coliform	
		Staphylococcus aureus	
		Clostridium perfringens	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Grains and nuts- APM *Escherichia coli* nuts (cashews,		10/g
	molds, soybeans, green beans, seeds, beans, chips	Peanut	1 x 104 colonies/g
	Cocoa beans	APM *Escherichia coli*	10/g
		Salmonella sp.	negative/25 g
		ALT mold	1 x 104 colonies/g
	Vegetable based chips, tubers and nuts (gadung, cassava, sweet potato, potato, mushroom)	(30 °C, 72 hours)	1 x 104 colonies/g
		APM *Escherichia coli*	< 3/g 1 x 102
		Staphylococcus aureus Mold	colonies/g 5 x 101
			colonies/g 1 x 104
	Vegetable based cakes, tubers and nuts (gadung, cassava, sweet potato, potato, mushroom)	ALT (30 °C, 72 jam)	colonies/g < 3/g
		APM Coliform	
		Staphylococcus aureus 1 x 102 colonies/g 1 x 102	
		Kapang and khamir	colonies/g
05.0	*Confectionery*		
05.1	Cocoa and chocolate products including imitation chocolate and chocolate substitutes		
	Cocoa powder, cocoa mass APM	ALT (30 °C, 72 h)	3 x 104 colonies/g
		Escherichia coli < 3/g negative/25 g	
		x 102 colonies/g Mold and yeast	*Salmonella sp.* 1 x 104 colonies/
		hours)	g ALT (30 °C, 72
	Chocolate and cocoa products		
		Escherichia coli APM < 3/g negative/25	
		Salmonella sp.	g 1 x 102
		Kapang and khamir	colonies/g
05.2	*Confectionery* includes hard and soft candy, nougat, etc., excluding food products categories 05.1, 05.3 and 05.4 Hard confectionery ALT (30 °C, 72 hours)		
			5 x 102 colonies/g
		APM Coliform	20 /g APM
		Escherichia coli < 3/g *Salmonella sp.* negative/25 g	*Staphylococcus*
		aureus 1 x 102 colonies/g 2 x 102 and yeasts Molds	colonies/g 7 x 102
		colonies/g ALT (30 °C, 72 hours)	
	Soft confectionery not jelly		
		APM Coliform 20 /g APM *Escherichia*	
		coli < 3/g negative/25 g	
		Salmonella sp.	
		Staphylococcus aureus 1 x 102 colonies/g 2 x 102	
		and yeasts	colonies/g Molds

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Soft candy jelly	ALT (30 °C, 72 jam)	5 x 104 colonies/g
		APM Koliform	20/g < 3/g negative/
		APM *Escherichia coli*	25 g 1 x 102
		Salmonella sp.	colonies/g 2 x 102
		Staphylococcus aureus	colonies/g 5 x 103
		Mold and yeast ALT (30	colonies/g 20/g <
05.3	Sugarless rubber, confectionery confectionery	°C, 72 hours)	3/g negative/25 g
		APM Koliform	1 x 102 colonies /
		APM *Escherichia coli*	g 2 x 102 colonies/
		Salmonella sp.	g
		Staphylococcus aureus	
		Mold and yeast	
06.0	Cereals and cereal products which are derivative products of cereal seeds, roots and tubers, nuts, legumes and pith (inside of plant stems), other than bakery products in food category 07.0 Grains whole, broken, or flaky, including rice		
06.1		ALT (30 °C, 72 jam)	1 x 106 colonies/
		APM *Escherichia coli*	g 10/g 1 x 104
		when	colonies/g
06.2	Flours and starches		
	Tapioca flour, hunkwee flour, mung bean flour, cassava flour, sago flour, arrowroot flour, corn flour, wheat flour, rice flour, ready-to-use flour for cakes, palm flour	ALT (30 °C, 72 jam)	1 x 106 colonies/
		APM *Escherichia coli*	g 10/ g < 1 x 104
		Bacillus cereus	colonies/g 1 x 104
		when	colonies/g
	Banana flour	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		APM Escherichia coli	10/g negative/25
		Salmonella sp	g negative/g 1 x
		Staphylococcus aureus	104 colonies/g 2 x
		Bacillus cereus	102 colonies/g
		Kapang and khamir	
06.3	Cereals for breakfast, including *rolled oats*		
	Cereals for breakfast without milk	ALT (30 °C, 72 jam)	1 x 104 colonies/
		APM Escherichia coli	g < 3/g 5 x 101
		when	colonies/g

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Cereal milk powder	ALT (30 °C, 72 jam)	5 x 104 colonies/g
		APM Coliform 100 /year	
		APM *Escherichia coli* < 3/g	
		Salmonella sp negative/25 g	
		Staphylococcus aureus negative/g 1 x 102	
		Bacillus cereus 5	colony/g
		when x 101 colonies/g	
06.4	Pasta and noodles and similar products (eg *rice paper,* rice vermicelli/vermicelli), soybean paste and soy noodles		
	Vermicelli, spaghetti, dry noodles, says, mi instan, macaroni, pasta cereal final product that still needs further processing	ALT (30 °C, 72 jam)	1 x 106 colonies/
		APM *Escherichia coli* dry	g 10/g
		Staphylococcus aureus 1 x 103 colonies/g 1 x 103	
		Bacillus cereus 1	colonies/g
		when x 104 colonies/g 1 x 106 colonies/	
	Wet noodles, raw pasta	ALT (30 °C, 72 jam)	g 10/g negative/
		APM *Escherichia coli*	25 g
		Salmonella sp	
		Staphylococcus aureus 1 x 103 colonies/g 1 x 103	
		Bacillus cereus 1	colonies/g
		Mold 1 x x 104 colonies/g	
06.6	Seasoned flour	ALT (30 °C, 72 jam) 1 x 106 colonies/g	
		APM *Escherichia coli* < 3/g 1 x 104	
		Bacillus cereus 2	colonies/g
		Kapang and khamir 1 x 104 colonies/g	
06.7	Rice cake		
	Dodol, wingko, yangko based on glutinous rice flour and diamonds	ALT (30 °C, 72 jam)	1 x 104 colonies/
		APM Coliform	g 20/g
		APM *Escherichia coli* < 3/g	
		Salmonella sp negative/25 g	
		Staphylococcus aureus 10 colonies/g 1 x 102	
		Bacillus cereus 2	colonies/g
		Kapang and khamir 1 x 102 colonies/g	
06.8	Soy products		
	Taco	Coliform APM 10/g *Escherichia coli*	
		APM negative/g *Salmonella sp* negative/	25 g 1 x
		103 colonies/g *Bacillus cereus* < 10 colonies	10 colonies /
		Salmonella sp. negative/25 g 5 x 101 colonies/g	APM coliform 10/g
			ALT (30 °C, 72 h)
	Tempeh Processed Products		
	Soybean juice		
		APM Coliform 20/ml APM *Escherichia*	
		coli < 3 /ml *Salmonella sp* negative/2	5 ml
		Staphylococcus aureus 1 x 102 colonies/	ml 1 x 103
		colonies/ml 5 x 101 colonies/ml	
		Bacillus cereus	
		when	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Green Bean Bakpia	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		APM Escherichia coli	< 3/g 1 x 102
		Bacillus cereus	colonies/g 1 x 102
		when	colonies/g
07.0	Bakery products		
07.1	Bread and bakery products, plain and premixes (including breadcrumbs)	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		APM *Escherichia coli*	10/g negative/25
		Salmonella sp.	g 1 x 102 colonies/
		Bacillus cereus	g 1 x 104 colonies/
		Mold and yeast ALT (30	g 1 x 104 colonies/
07.2	Special bakery products (sweet, salty, savory)	°C, 72 hours)	g 20 /g < 3/g
		APM Coliform	negative/25 g 1 x
		APM *Escherichia coli*	102 colonies/g 1 x
		Salmonella sp.	102 colonies/g 2 x
		Staphylococcus aureus	102 colonies/g
		Bacillus cereus Mold and	
		yeast	
08.0	Meat and meat products, including poultry and game meat		
08.1	Raw meat, poultry and game meat		
08.1.1	Fresh, frozen chicken (carcass and boneless) and minced	ALT (30 °C, 72 jam)	1 x 106 colonies/
		coliform	g 1 x 102 colonies/
		Escherichia coli	g 1 x 101 colonies/
		Salmonella sp.	g negative/25 g 1
		Staphylococcus aureus	x 102 colonies/g
		Campylobacter sp ALT (30	negative/25 g 1 x
08.1.1	Fresh, frozen meat (carcass and boneless) and minced meat	°C, 72 jam)	106 colonies/g 1 x
		coliform	102 colonies/g 1 x
		Escherichia coli Salmonella sp. negative/25 g 1 x	101 colonies/g
		colonies/g *Staphylococcus aureus*	102 *Campylobacter sp*
		products, poultry and game meat, whole cut meat	negative/25 g
		jerky, smoked meats, heat treated	Processed meat
08.2			
		ALT (30 °C, 72 jam)	1 x 105 colonies/
		APM Escherichia coli	g < 3/g negative/
		Salmonella sp.	25 g 1 x 102
		Staphylococcus aureus	colonies/g 1 x 103
		Bacillus cereus	colonies/g

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Dried meat products (including shredded); skin crackers, lung crackers, chicken intestine chips	ALT (30 °C, 72 jam)	1 x 105 colonies/g
		APM *Escherichia coli*	< 3/g *Salmonella*
		sp. negative/25 g *Staphylococcus aureus* 1 x 102 colonies/g	
08.3	Processed meat products, poultry meat and game meat, mashed		
	Processed meat and processed chicken (meatballs, sausages, nuggets, burgers)	ALT (30 °C, 72 hours)	1 x 105 colonies/g
		APM Coliform 10/g *APM Escherichia coli*	
		< 3/g *Salmonella sp* negative/25 g	
		Staphylococcus aureus 1 x 102 colonies/g	1 x 102
		colonies/g *Clostridium perfringens* 1 x 104 colonies/g	
		jam);	ALT (30 °C, 72
	Cooked sausage (not canned, ready to eat)		
		Coliform APM < 3/g *Salmonella sp.*	
		negative/25 g *Staphylococcus aureus* 1 x 102 colonies/	
		g *Clostridium perfringens* 10 colonies/g *Listeria*	
		monocytogenes negative/25 g 1 x 102 colonies/g	ALT (30 °C, 72
		Clostridium perfringens negative/g	
	Corned beef in cans, sausages in cans		
09.0	Fish and fishery products including molluscs, crustaceans and echinoderms		
09.1	Fresh fish and fishery products, including molluscs, crustaceans and fresh fish echinoderms		
09.1.1		ALT (30 °C, 72 jam)	5 x 105 colonies/g
		APM *Escherichia coli*	< 3/g *Salmonella*
		sp. negative/25 g *Vibrio cholerae* negative/25 g *Vibrio*	*parahaemolyticus*
		negative/25 g 5 x 105 colonies/g ALT (30 °C, 72 jam) .	
09.1.2	Mollusk, crustacean this echinodermata segar		
		APM *Escherichia coli* < 3/g *Salmonella*	
		sp negative/25 g *Vibrio cholerae* negative/25 g *Vibrio*	
		parahaemolyticus negative/25 g Fish and other	fishery products
		including molluscs, crustaceans and echinoderms	
09.2	that have undergone processing Fish, fish fillets and ALT products (30 ° C, 72 hours) fisheries include molluscs, APM *Escherichia coli* crustaceans and echinoderms *Salmonella*		
09.2.1	*sp.* frozen *Vibrio cholerae* Fish, fish fillets and *Escherichia coli* (30 °C, 72 hours) crustacean echinoderms		5 x 105 colonies/g
	Salmonella sp echinoderms coated with *Vibrio cholerae* frozen flour		< 3/g negative/25
			g negative/25 g 5
			x 105 colonies/g <
09.2.2			3/g negative/25 g
			negative/25 g

Table 1 (continued)

No. food cat 09.2.3	Food Category	Type of microbial contamination	Maximum limit
	Crushed and frozen fish including molluscs, crustaceans and echinoderms	ALT (30 °C, 72 jam)	5 x 105 colonies/g
		APM Escherichia coli < 3/g	
		Salmonella sp negative/25 g	
		Vibrio cholerae negative/25 g	5 x 105 colonies/g
09.2.4	Fish and fishery products including molluscs, crustaceans and echinoderms that are steamed or boiled and/or fried	ALT (30 °C, 72 jam)	
		APM *Escherichia coli* < 3/g	
		Salmonella sp negative/25 g	1 x 103 colonies/g
		Staphylococcus aureus	
		Vibrio cholera	negatif/25 g
09.2.5	Fish and fishery products including molluscs, crustaceans and echinoderms smoked, dried, fermented with or without salt		
	Fish and fishery products including molluscs, crustaceans and echinoderms smoked with or without salt	ALT (30 °C, 72 jam)	5 x 105 colonies/g
		APM *Escherichia coli*	< 3/g negative/25
		Salmonella sp	g 1 x 103 colonies/
		Staphylococcus aureus	g < 1 x 102
		when	colonies/g 1 x 105
	Fish and fishery products including molluscs, crustaceans and echinoderms dried with or without salt	ALT (30 °C, 72 jam)	colonies/g < 3/g
		APM *Escherichia coli*	negative/25 g
		Salmonella sp	negative/25 g
		Vibrio cholera	
	Fish and fishery products including molluscs, crustaceans and echinoderms fermented with or without salt	APM *Escherichia coli*	< 3/g
		Salmonella sp	negative/25 g
		Staphylococcus aureus	1 x 103 colonies/
		Vibrio cholera	g negative/25 g
09.4	Preserved fish and fishery products, including canned or fermented fish and fishery products, including molluscs, crustaceans and echinoderms	Thermophilic aerobic ALT (30 °C, 72 hours)	< 1 x 101 colonies/g
		ALT anaerob (30 °C, 72 jam)	< 1 x 101 colonies/g
		Clostridium sp	negative/g
10.0	Eggs and egg products		
10.1	Fresh eggs	g ALT (30 °C, 72 hours) 1 x 102 colonies/g	1 x 105 Coliform/
		g *Escherichia coli Salmonella sp.* negative/25 g	1 x 101 colonies/
		including traditional preserved eggs	Products including
		alkaline, salted and canned Salted eggs	negative/25 g
10.3	< 1 x 101 colonies/g *Staphylococcus aureus* 1 x 104 colonies/g ALT (30 °C, 72 hours)		
10.4	Egg based desserts (eg custard)		
		Coliform APM < 3/g *Salmonella sp.*	
		negative/25 g *Staphylococcus aureus*	negative/g

Table 1 (continued)

No. food cat 11.0	Food Category	Type of microbial contamination	Maximum limit
	Sweeteners, including honey		
	Crystal sugar, powdered sugar, syrup sugar (from sugar cane, stevia, maltose, dextrose, palm sugar, coconut)	ALT (30 °C, 72 jam)	3 x 103 colonies/g
		APM Coliform	< 3/g 1 x 102
		mold and yeast	colonies/g < 5 x
	Honey	EVERYTHING	103 colonies/g
		APM Coliform < 3/g < 1 x 101 colony/g	
			mold and yeast
12.0	Salt, spices, soups, sauces, salads, protein products		
12.2	Herbs, spices, seasonings and condiments (eg instant noodle seasoning)		
	Herbs and spices	ALT (30 °C, 72 hours) 1	1 x 106 colonies/g
		Coliform	x 102 colonies/g
		APM *Escherichia coli* < 3/g negative/25 g 1 x 104	
		Salmonella sp	colonies/g 1 x
		Bacillus cereus	103 colonies/g 2 x
		Clostridium perfringens	104 colonies/g 1 x
		Kapang and khamir	106 colonies/g 1 x
	Instant noodle seasoning	ALT (30 °C, 72 jam)	102 colonies/g < 3/
		coliform	g 1 x 104 colonies/
		APM *Escherichia coli*	g 1 x 104 colonies/
		mold/yeast	g 1x 102 colonies/
	Other condiments and condiments	ALT (30 °C, 72 jam)	g < 3/g negative/
		coliform	25 g 1 x 102
		APM *Escherichia coli*	colonies/g 1 x 102
		Salmonella sp	colonies/g 2 x 102
		Bacillus cereus	colonies/g 1 x 104
		Clostridium perfringens	colonies/g 1 x 102
		Kapang and khamir	colonies/g
12.4	Mustard	ALT (30 °C, 72 jam)	
		when	
12.5	Soup and broth		
	Soup and broth in cans	ALL aerobic (30 °C, 72 jam)	< 1 x 101 colonies/g
		ALT anaerob (30 °C, 72 jam)	< 1 x 101 colonies/g
		Clostridium sp negative/g 1 x 105 colonies/g	
	Powdered instant soup (including powdered instant cream soup)	ALT (30 °C, 72 jam)	
		APM Coliform 20/year	
		APM *Escherichia coli* < 3/g	
		Salmonella sp negative/25 g	
		Staphylococcus aureus 1 x 103 colonies/g 1 x 102	
		Clostridium perfringens 1 x	colonies/g
		Kapang and khamir 102 colonies/g	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Beef-flavored seasoning, chicken-flavored seasoning	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		APM Coliform	< 3/g 2 x 102
		Kapang and khamir	colonies/g
12.6	Sauces and similar products		
	Emulsion sauce (eg mayonnaise, salad dressing)	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		APM Coliform	10/g negative/25 g
		Salmonella sp.	1 x 102 colonies/g
		Staphylococcus aureus APM	< 3/g 5 x 101
	Chili shrimp paste	Koliform	colonies/g < 3/g 5
		when	x 101 colonies/g
	Soy sauce, fish sauce, APM coliform soy sauce, coconut		
	water, oyster sauce, mold		
	Tomato sauce, chili sauce and other non-emulsified sauces	ALT (30 °C, 72 jam)	1X 104 colonies/g
		APM Coliform	100/g 1 x 102
		Staphylococcus aureus Mold	colonies/g 5 x 101
		Spread products for APM	colonies/g < 3/g
12.7	Coliform salads (e.g. macaroni salad, potato salad) and sandwiches,		
	excluding chocolate and nut-based spreads belonging to food categories 04.2.2.5 and 05.1.3 Yeast and similar products Yeast	*Staphylococcus aureus* 5 x 102 colonies/g	
12.8			
		APM *Escherichia coli*	< 3/g
		Salmonella sp.	negative/25 g
13.0	Food products for special nutritional needs		
13.1	Infant formulas, follow-up formulas and formulas for certain medical purposes for infants		
13.1	Infant formulas and formulas for special medical purposes for infants	ALT (30 °C, 72 jam)	1 x 104 colonies/g
		Enterobacteriaceae	Negative/10 g
		Enterobacter sakazakii	Negative/10 g [†]
		Salmonella sp.	negative/25 g
		Staphylococcus aureus	1 x 101 colonies/g
		Bacillus cereus ALT (30 °C,	1 x 102 colonies/g
	Advanced Formula Milk	72 hours)	1 x 104 colonies/g
		APM Coliform	< 3/g negative/25
		Salmonella sp.	g 1 x 101 colonies/
		Staphylococcus aureus	g 1 x 102 colonies/
		Bacillus cereus	g

[2] The number of samples (n) = 10, the maximum number of samples that do not meet the requirements (c) = Number of samples (n) = 30

Table 1 (continued)

No. food kat 13.2	Food Category	Type of microbial contamination	Maximum limit
	Complementary foods for babies and young children		
	Biscuits for babies and toddlers, Biscuits	ALT (30 °C, 72 jam)	1 x 104 colonies/
		APM Coliform	g < 20/g APM
		Negative *Escherichia coli* / g *Salmonella sp.*	negative/25 g
		Staphylococcus aureus 1 x 102 colonies/g	colonies/g 1 x 102
		(30 °C, 72 h)	
	MPASI ready to eat		
		Coliform APM < 3/g *Escherichia coli*	
		APM negative/g negative/25 g negative/	g 1 x 104
		Salmonella sp.	colonies/g <
		Staphylococcus aureus	20/g negative/
	Instant MPASI powder	ALT (30 °C, 72 hours)	g negative/25 g
		APM Coliform	
		APM *Escherichia coli*	
		Salmonella sp.	
		Staphylococcus aureus 1 x 102	colonies/g
13.3	Special Diet Foods For Health Purposes, Including Infants and Children (Except Food Category 13.1) Products		
	Special Diet Food For Health Needs, Coliform APM Included for Infants and Children (Except Food Category 13.1) Products in the form of Milk for Infants Special Diet Foods for Health Purposes, Including Infants and Children (Except for Food Category 13.1) Products in the form of Biscuits	ALT (30 °C, 72 hours)	1 x 104 colonies/
			g < 3/g *Salmonella*
		sp. negative/25 g *Staphylococcus aureus* 1 x 102	colonies/g 1 x 102
		colonies/g 1 x 104 colonies/g < 20/g negative/g	
		Bacillus cereus	*Salmonella sp.*
	Special Diet Foods for Health Needs, Including Infants and Children (Except Food Category 13.1) Ready-to-cook form Special Diet Foods for Health Purposes, Including Infants and Children (Except Food Category 13.1) products in ready-to-eat form	ALT (30 °C, 72 jam)	negative/25 g
		APM Coliform	*Staphylococcus*
		APM *Escherichia coli*	*aureus* 1 x 102
		colonies/g 1 x 105 colonies/g ALT (30 °C, 72 hours)	1 x 102 / g APM
		Coliform negative/g negative/25 g	
		APM *Escherichia coli*	
		Salmonella sp.	
		Staphylococcus aureus 1 x 102	colonies/g 1 x 102
		(30 °C, 72 hours)	colonies/g ALT
		Coliform APM < 3/g negative/g negative/	
		APM *Escherichia coli*	25 g
		Salmonella sp.	negative/g
		Staphylococcus aureus	

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Special Diet Foods For Health Needs, Including Infants and Children (Except for Food Category 13.1) in the form of instant powder Diet Food for Slimming and Weight Loss	ALT (30 °C, 72 jam)	1 x 104 colonies/
		APM Coliform	g < 20/g negative/
		APM *Escherichia coli*	g negative/25 g 1
		Salmonella sp.	x 102 colonies/g
		Staphylococcus aureus	5 x104 colonies /
		ALT (30 °C, 72 hours)	g 102 /g negative
		APM Coliform	*Salmonella sp.*
		E. coli	negative / 25 g 1
		x 102 colonies/g *Staphylococcus aureus*	*Listeria monocytogenes*
			negative/25 g
13.5	Dietary Foods (e.g. Food Supplements for Diet) that are not included in products from categories 13.1, 13.2, 13.3, 13.4 and 13.6 5 x104 colonies /g Drinks for pregnant women ALT		
	or breastfeeding mothers 102 /g APM Coliform / 25 g 1 x 102 colonies/g *Salmonella sp.*		
	Listeria monocytogenes negative/25 g 1 x 105 colonies/ml ALT (30 °C, 72 h)		
	Special drinks for pregnant women and/or breastfeeding mothers in liquid form (pasteurized)		
		APM Coliform 10/ml negative negative /	
		E. coli	25 g 1
		Salmonella sp.	x 102 colonies/
		Staphylococcus aureus	ml
		Listeria monocytogenes negative/25 ml ALT (30	
	Special drinks for pregnant women and/or breastfeeding mothers in liquid form (sterile or UHT)	°C, 72 hours)	0
14.0	Beverages, excluding dairy products Drinking		
14.1.1	water 14.1.1.2 Bottled drinking water		
		Initial ALT (30 °C, 72 hours) 1 x	102 colonies/ml 1 x
		final ALT (30 °C, 72 hours)	105 colonies/ml
		APM Coliform	< 2/100 ml
		Salmonella sp.	negative/100 ml
		Pseudomonas aeruginosa	0 colonies/ml

Table 1 (continued)

No. food cat	Food Category	Type of microbial contamination	Maximum limit
14.1.2	Fruit juice and vegetable juice		
	juice	ALT (30 °C, 72 jam)	1x 104 colonies/
		coliform	ml 2 x 101 colonies/ml
		APM *Escherichia coli* < 3/ml	
		Salmonella sp. negative/25 ml	*Staphylococcus*
		aureus negative/ml 1 x 102 colonies/ml	and yeast Mold
		water-based drinks, including sports or electrolyte	14.1.4 Flavored
drinks and	particulate drinks Carbonated drinks (soda water, lemonade etc.)		
		ALT (30 °C, 72 jam)	1 x 102 koloni/ml
		coliform	1 koloni/100 ml
		Salmonella sp.	negative/100 ml
		Staphylococcus aureus	negative / ml 1 x
		Mold and yeast ALT (30	102 colonies/ml 1
	Isotonic drink	°C, 72 hours)	x 102 colonies/ml
		coliform	1 koloni/100 ml
		Salmonella sp.	negative/100 ml
		ALT molds and yeasts	1 x 102 colonies/ml
	Syrup	(30 °C, 72 hours)	5 x 102 colonies/ml
		APM Koliform	20/ml < 3/ml
		APM *Escherichia coli*	negative/25ml
		Salmonella sp.	negative/ml 1 x 102
		Staphylococcus aureus	colonies/ml 3 x 103
		Mold and yeast ALT (30	colonies/g < 3/g 1
	Powdered drinks (flavored or unflavored, traditional, etc.)	°C, 72 hours)	x 102 colonies/ g 4
		APM Coliform	x 102 colonies/ml
		Mold and Yeast	ALT (30 °C, 72
	Squash drink		hours)
		APM Coliform 20/ml *Salmonella sp.*	
		negative/25 ml 1 x 102 colonies/ml	Mold and
		colonies/ml ALT (30 °C, 72 hours)	yeast 2 x 102
	Non Carbonated Drinks Flavorful		
		APM Coliform 20/ml *Salmonella* sp	
		negative/25 ml *Staphylococcusaureus* 0	
		colony/ml *Vibrio* sp negative/ml 1 x 102	
		colonies/ml Mold and Yeast	
14.1.5	Coffee, substituted coffee, tea, herbal infusions, and hot cereal and grain drinks, except chocolate		
	Dry tea in packaging	ALT (30 °C, 72 jam)	3 x 103 colonies/g
		APM Coliform	< 3/g 5 x 102
		when	colonies/g 3 x 103
	Dip tea	ALT (30 °C, 72 jam)	colonies/g 5 x 102 colonies/
		when	g

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
	Packaged tea drinks	ALT (30 °C, 72 jam)	1 x 102 colonies/ml
		APM Coliform	< 2/100 ml
		APM *Escherichia coli*	negative/100 ml
		Salmonella sp.	negative/100 ml
	Packaged ground coffee	ALT (30 °C, 72 jam)	1 x 106 colonies/g 1 x 104
		ALT	colonies/g < 3 x
	Coffee bags, instant coffee	mold (30 °C,72 hours)	102 colonies/g 5 x 101
		ALT	colonies/g 5 x 105
	Mixed coffee, packaged milk sugar coffee	mold (30 °C, 72 hours)	colonies/g 20/g
		APM Coliform	negative/25 g 1 x 102
		Salmonella sp	colonies /25 g 1 x
		Staphylococcus aureus	102 colonies/g 1 x 102
		Kapang and khamir	colonies/ml
	Packaged coffee drinks	ALT (30 °C, 72 jam)	
		APM Coliform	< 2/100 ml
		Clostridium perfringens	negative/100 ml
		Salmonella sp.	negative/100 ml
14.2	Alcoholic beverages, including alcohol-free or low-alcohol similar drinks		
	Grapes, fruit grapes	ALT (30 °C, 72 jam)	2 x 102 colonies/ml
		APM koliform	20/ml < 3/ml
		APM *Escherichia coli*	negative/25 ml
		Salmonella sp.	negative/ml 1 x 102
		Staphylococcus aureus	colonies/ml
		Mold and yeast	
15.0	Ready-to-eat snacks		
15.1	Snack - based on potatoes, cereals, flour or starch (from tubers, beans and legumes) 1 x 104 colonies/g		
	Extrudate snacks	ALT (30 °C, 72 jam)	
		APM *Escherichia coli* < 3/g	
		Salmonella sp negative/25 g	
		Staphylococcus aureus 1 x 102 colonies/g	
15.2	Processed nuts, including coated nuts and mixed nuts 1 x 104 colonies/g		
	Dried beans, nuts onion beans, nuts, bali beans, peanut mold	ALT (30 °C, 72 h) sucro,	
		Escherichia coli APM < 3/g 5 x 102	
		Shake	colonies/g egg

Table 1 (continued)

No. in food	Food Category	Type of microbial contamination	Maximum limit
16.0	Mixed (composite) foods – foods that cannot be grouped into categories 01-15		
	Packaged pasteurized food and beverages (other than categories 01-15)	ALT (30 °C, 72 jam)	1 x 104 colonies/g or ml < 3/g or /ml
		APM Coliform	negative/25 g or
		Pathogenic microbes (according to the main raw material)	negative/25 ml
	Sterilized food and drink in aseptic packaging (other than categories regularly 01-15)	ALT (30 °C, 72 jam)	< 10 colonies/0.1 ml or < 10 colonies/ 0.1 g

Appendix A
(informative)
Microbial contamination safety study

A.1 *Total Plate Count*

A.1.1 Description

The Total Plate Number (ALT) indicates the number of microbes in a product. In some countries it is declared as *Aerobic Plate Count* (APC) or *Standard Plate Count* (SPC) or *Aerobic Microbial Count* (AMC).

A.1.2 Peace study

ALT is generally not associated with food safety hazards but is sometimes useful for indicating quality, shelf-life/half-life, contamination and hygienic status during the production process. ALT for food products in cans is expressed in ALT aerobic and ALT anaerobic. Anaerobic ALT is intended to indicate post-canning contamination.

A.1.3 Food analysis

The plating medium (energy source) used in ALT testing can affect the number and types of bacteria isolated due to differences in nutrient and salt requirements of each microbe. For fish products and their preparations, the incubation temperature of 25 °C produces a greater number of bacteria than the incubation temperature of 35°C.

A.2 *Bacillus cereus*

A.2.1 Description

Bacillus cereus is a rod-shaped bacterium that has spores and is Gram-positive, its cells are large compared to other rods and grow facultatively aerobically. To distinguish *Bacillus cereus* from other *Bacillus ,* morphological and biochemical characteristics were used. Distinction can be made by looking at the motility *(B. cereus*
most motile), toxin crystal formation *(B. thuringiensis),* hemolytic activity *(B. cereus* and other *Bacillus* have -hemolytic activity while *B. anthracis* is generally non-hemolytic).

A.2.2 Peace Studies

B. cereus can cause two types of illness, namely diarrhea and vomiting. Symptoms of diarrheal disease are similar to those caused by *Clostridium perfringens;* namely watery bowel movements, stomach cramps and pain 6 -15 hours after consuming contaminated food; accompanied by nausea, but rarely vomiting. Meanwhile, symptoms of vomiting are usually marked by nausea occurring 0.5 to 6 hours after consuming contaminated food, and usually lasting less than 24 hours; sometimes accompanied by abdominal cramps and diarrhea. Some strains of *B. subtilis* and *B. licheniformis* can also induce vomiting because they can produce a heat-stable toxin similar to that of *B. cereus.* The infectious dose of *B. cereus* is > 105 /g.

If the amount of *B. cereus* in the food is greater than 106 colonies/g, it indicates that the *B. cereus* is active and can pose a health risk.

To confirm that *B. cereus* is the cause of a *foodborne outbreak* , it is necessary to: (1) isolate the same serotype strain from the suspected food and the patient's faeces or vomit, (2) isolate a large number of *B. cereus* serotypes known to cause *foodborne* disease from the suspected or suspected food. from the patient's faeces or vomit, or (3) isolate *B. cereus* from the suspected food and determine its enterotoxicity by serological (diarrheal toxin) or biological (diarrhea and vomiting) tests. The timing of the onset of vomiting, combined with some evidence of food, is sufficient to diagnose this type of food poisoning.

Although there are no specific complications related to the toxins that cause diarrhea and vomiting produced by *B. cereus,* from some observations there are other clinical manifestations of invasion or contamination ; These include *bovine mastitis,* severe pyogenic and systemic infections, gangrene, *septic meningitis,* cellulite, panophthalmitis, lung abscess, infant mortality, and endocarditis.

B. cereus is found in nature (soil, dust, water) and in food. In addition, these microbes are widely found in raw materials commonly used in the food industry. In food, the concentration is 103 colonies/g or less; but mostly less than 102 colonies/g.

Types of food that are susceptible to contamination by *B. cereus* include meat, milk, vegetables, and fish. Cases of food poisoning due to *B. cereus* with symptoms of vomiting caused by food products made from rice, foods containing starch (pasta), potatoes and cheese. Food combinations such as sauces, puddings, soups, *casseroles,* pastries, and lettuce are often involved in food poisoning *outbreaks .*

Because the bacterium *B. cereus* is common and widespread, preventing contamination of its spores in food is nearly impossible. In order to inhibit spore germination and prevent vegetative cell propagation, one of the effective control and prevention methods is to cook food, eat it immediately after cooking or store it in the refrigerator if it is not ready to be eaten. Evaporation under pressure, roasting, frying and complete combustion can damage spores and cells. At temperatures below 100 °C some *Bacillus* spores can survive.

A.2.3 Food analysis

Various methods have been recommended to reduce, quantify and confirm the presence of *B. cereus* in food. Serological methods have also been developed to detect suspected enterotoxins from isolates of *B. cereus* (the cause of diarrhea) present in suspected foods. Recent investigations suggest that vomiting-causing toxins can be detected through test animals (cats, monkeys) or through cell culture.

Laboratory indications:

• Hemolytic (sheep blood agar) • Motile • Hydrolysis of cells + • Fermentation of salicin, glucose and maltose • Catalase +

A.3 *Campylobacter*

A.3.1 Description:

Campylobacter jejuni is a bent rod-shaped bacterium, gram-negative, microaerophilic (can live and grow optimally in an environment with O2 levels of 3% - 5% and CO2 levels of 2% - 10%), relatively susceptible and sensitive to environmental stress (such as high levels of 21% oxygen, drying, heating, disinfectant, acidic conditions) and can move because it has polar flagella.

C. jejuni is often found in healthy livestock such as cattle, chickens, birds and even flies. It is also found in non-chlorinated water sources such as pond and river water. Since the pathogenic mechanism of *C. jejuni* is still being studied, it is difficult to distinguish between nonpathogenic and pathogenic strains. However, from research, isolates of food products from chicken contain a lot of pathogenic *C. jejuni .*

A.3.2 Peace Studies

C. jejuni is now recognized as an important enteric pathogen. Prior to 1972, this bacterium was the main pathogen causing miscarriage and enteritis in cattle and goats.
Surveys in recent years have shown *C. jejuni* to be the leading cause of diarrheal disease in the United States (based on analysis of stool samples). These bacteria cause more disease than *Shigella* and *Salmonella.*

Campylobacteriosis or gastroenteritis or Campylobacter enteritis is the name of the disease caused by *C. jejuni.* Infection with *C. jejuni* causes diarrhea that is mucoid and sometimes contains blood and fecal leukocytes. Other symptoms that often accompany it are fever, abdominal pain, nausea, headache and muscle aches. Symptoms of infection generally occur 2 days - 5 days after the contaminated food or drink is ingested. Pain is felt for 7 days - 10 days; but the possibility of relapse can occur again (25% of cases).
Most infections go away on their own.

The infection dose of *C. jejuni* tends to be small. The number of 400 cells - 500 bacterial cells can cause disease in some individuals, but some individuals require a larger number of cells. Bloody diarrhea is caused by the invasive nature of Campylobacter which can enter the lining of the small intestine and will release toxins that damage the intestinal mucosa.

Complications that can occur are reactive arthritis, hemolytic uremic syndrome, which can be followed by septicemia. The mortality ratio for *C. jejuni* infection was 0.1%; means in 1000 cases there is 1 death. Fatal conditions generally occur in cancer patients or in debilitated patients. There are 20 cases of septic abortion due to *C. jejuni* that have been reported.
Other rare complications include inflammation of the lining of the brain (meningitis), recurrent inflammation of the colon (relapse colitis), inflammation of the gallbladder (cholecystitis) and *Guillain-Barre syndrome;*

C. jejuni is generally present in large amounts in the feces of individuals with diarrhea and is often found in raw chicken meat. Surveys show that 20% - 100% of retail chickens are contaminated with this bacteria. This is not surprising because many healthy chickens contain these bacteria in the gut. These bacteria are also present in healthy cows, house flies, raw milk and unchlorinated water. Proper cooking of chicken, pasteurized milk, and chlorinated drinking water can kill these bacteria.

Anyone can be infected with *C. jejuni,* but children under 5 years and adults (15 years - 29 years) are more susceptible to infection than other age groups. Treatment

with erythromycin can reduce the time of bacterial infection because it will cause the infected individual to release the bacteria from the body through the feces.

A.3.3 Food analysis

Isolating *C. jejuni* from food is difficult because its numbers are so low. To isolate it, a broth containing antibiotics is needed and a medium containing a special antibiotic and an environment with an oxygen content of 5%. For isolation it takes a few days to a week. Biochemical tests can also be used to analyze Campylobacter from other types of bacteria.

Laboratory indications:

- Hydrolyzed hippurate
- Motile • Catalase + •
  Nitrate +

A.4 *Clostridium perfringens*

A.4.1 Description

Clostridium perfringens is an invasive bacterial pathogen that is rod-shaped, non-motile, Gram-positive and anaerobic, and has spores that are relatively stable to heat. The vegetative cells will be damaged by heating at 60 °C; but at this temperature some spores are still able to survive. At temperatures between 20 °C and 55 °C the spores can become vegetative cells and produce toxins. Toxins include exotoxins that cause necrosis in surrounding tissues, for example in intestinal tissue.
In addition there are also enterotoxins that can cause severe diarrhea.

There are 5 serotypes of *C. perfringens ,* namely serotypes A, B, C, D, E. In humans, serotypes A and C cause disease.

A.4.2 Peace Studies

Food poisoning caused by *C. perfringens* is relatively mild. Cells as many as 105 colonies/g allow food poisoning to occur. In general, this bacterial disease can occur if the number of cells that enter the body is very large.

The general characteristic of perfringens poisoning is characterized by symptoms of stomach cramps, diarrhea and gas formation that occur 8 - 22 hours after consuming food containing large numbers of *C. perfringens* vegetative cells which are capable of producing heat-resistant toxins. The disease usually lasts for 24 hours but in some debilitated or elderly individuals, symptoms persist for 1 week or 2 weeks. Death and/or complications are very rare.

C. perfringens serotype A causes gas gangrene *(myonecrosis)* and food poisoning.
In food poisoning, the toxin stimulates the enzyme adenylate cyclase in the intestinal wall, which results in an increase in the concentration of cAMP so that hypersecretion of water and chloride occurs in the intestine and inhibits sodium reabsorption, resulting in diarrhea that can last 1 day - 3 days.

C. perfringens serotype C causes jejunitis, usually from eating pork.
Symptoms are bloody diarrhea, abdominal pain and vomiting. In children it is usually fatal.

This more serious but rare disease has come to be known as necrotizing enteritis or *Pig-bell disease.* Deaths that occur are caused by infection and intestinal necrosis as well as due to septicemia.

Toxins produced in the digestive tract (or in test tubes) occur due to sporulation. Poisoning due to *C. perfringens* can be identified through a diagnosis made by detecting the toxin in the patient's feces. Bacteriological confirmation can also be done by finding a large number of causative bacteria in the food consumed or in the patient's feces.

These bacteria are widely distributed in nature, especially found in soil, water, food, dust, spices and in the intestines of humans, animals, and human or animal feces. Spores can survive in soil, sediment, and areas polluted by animal or human feces. Some food ingredients may contain these spores or bacteria.

In many cases, the cause of *C. perfringens* poisoning is due to errors in cooking food. A small number of vegetative cells remain after cooking and multiply during food storage, resulting in food contamination.

Meat, meat products, meat broth, dairy products, pasta, flour, poultry and vegetables that have been in contact with soil, dust and faecal matter are the foods most commonly contaminated by *C. perfringens.* In raw meat a number of vegetative cells of *C. perfringens* found in muscle tissue and also in the liver.

C. Perfringens poisoning often occurs in school canteens, hospitals, prisons, parties that use catering services. Caters usually prepare food several hours before serving which allows food to be contaminated.

When cooking poultry and meat (soups, stews, sauces, gravy, *casseroles)* the temperature of the food being cooked should be maintained at or above 60 °C or when cold at or below 4 °C.
Large portions of food take longer to cool to 4 °C so large portions of food should be divided into smaller portions for storage.
Before serving, food should be reheated (at least 70 °C) before serving. *Clostridium perfringens* is called the *"food service germ"* because it often causes disease from food that is served in large quantities and for a long time at room temperature.

Administration of penicillin G antibiotics (to kill vegetative cells), administration of antitoxin and *hyperbaric* oxygen can be tried to treat food poisoning due to *C. perfringens.*

A.4.3 Food analysis

Standard bacterial culture procedures are used to detect microbes in contaminated food and in patient feces. Serological testing is used to detect enterotoxins in the patient's feces and to test the ability of the strain to produce toxins. Gram staining is a good method for identifying *Clostridium. Clostridium* showed optimum growth when placed on blood agar and incubated at human body temperature.

Laboratory Indications

- Not motile •
- Location of the spores is not in the middle (non-terminal spore) • Non aerotolerant • Double zone hemolysis

A.5 Koliform

A.5.1 Description

Coliform bacteria group consists of several genera of bacteria that belong to the family *Enterobacteriaceae.* These bacteria are rod-shaped, do not form spores, are Gram negative, ferment lactose within 24 hours at 44.5 °C, and can live with or without oxygen. This bacterium is an indicator microbe. Its presence indicates the presence of other pathogenic bacteria because pathogenic bacteria are usually present in small numbers making it difficult to monitor them directly.

A.5.2 Peace Studies

Coliforms are generally not pathogenic. However, if coliforms are found in rivers, it is assumed that the water has been contaminated with feces. Water containing high amounts of coliforms can cause diseases such as typhoid, hepatitis, gastroenteritis, dysentery and ear infections with symptoms such as fever, nausea, or stomach cramps caused by pathogens that enter the body through the mouth, nose, ears, or broken skin.

These bacteria live in soil, water and the digestive system of animals and are present in considerable numbers in the feces and digestive tract of humans and other warm-blooded animals, and can enter body fluids through human and animal feces.

Coliforms, like other bacteria, can be destroyed by boiling water or treating with chlorine. Washing with soap after contact with contaminated water can also prevent infection.

A.5.3 Food analysis

To determine the number of bacteria in the sample, it can be done by culturing and counting the colonies of these coliform bacteria. In addition, the APM (Most Possible Number) method is also used. If the APM test found a number of bacteria, it indicates the level of contamination.

A.6 *E. coli*

A.6.1 Description

E. coli is a short rod-shaped bacterium (cococobacilli), Gram negative, size 0.4 m – 0.7 m x 1.4 m, and some strains have capsules. There are pathogenic and non-pathogenic *E. coli* strains. Non-pathogenic *E. coli* is found in the large intestine of humans as normal flora and plays a role in food digestion by producing vitamin K from undigested material in the large intestine.

A.6.2 Peace Studies

Pathogenic strains of *E.coli* can cause severe cases of diarrhea in all age groups through the endotoxin it produces.

E. coli associated with the type of intestinal disease (diarrhea) in humans, namely:

- Enteropathogenic *E. coli :* causes diarrhea, especially in infants and children in developing countries.

- Enterotoxigenic *E.coli* causes *Secretory Diarrhea* as in cholera. These bacterial strains secrete LT (thermolabile) or ST (thermostable) toxins. The toxin is released when the bacteria adhere to the epithelial cells of the intestinal mucosa.
- Enteroinvasive *E. coli* causes diarrheal diseases such as dysentery caused by *Shigella.*
- *E. coli* serotype O157:H7 causes hemorrhagic colitis (bloody diarrhea).

E. coli can also cause urinary tract infections as well as other diseases such as pneumonia, meningitis and *traveler's diarrhea.* Although *E.coli* infection can be treated with antibiotics, it can cause patients to go into shock and even lead to death because more toxins are produced when the bacteria die.

The infection dose for *E.coli* serotype O157:H7 is low, between 101 /g – 102 /g; this dose causes disease in toddlers, the elderly and people with low immunity.
E. coli isolated from infection are usually sensitive to antimicrobial drugs used for Gram-negative microbes. Foods that are usually contaminated with *E.coli* are undercooked hamburgers and other fast food and cheese made from unpasteurized milk. Good sanitation, cooking beef to 65 °C, reheating food and storing food in the refrigerator at 4 °C or less; is a way to control *E. Coli.*

A.6.3 Food analysis

Laboratory indications: • Lysine + • Citrate – Indol + • Acetate + • Lactose +

A.7 Mold and Yeast

A.7.1 Description

Mold is a single-celled microbe in the form of fine threads called hyphae, a collection of hyphae called mycelium, reproduces by spores or divides. Yeast, also known as yeast, is a single-celled microbe that is oval in shape and reproduces itself through the formation of buds or ascospores, but does not form mycelium threads.

Most molds and yeasts are aerobic (require free oxygen for growth), acid/base requirements for growth are very wide ranging from pH 2 to above pH 9. The temperature range (10 °C - 35 °C) is also wide, and some species are capable of grow below or above this range. Yeast moisture requirements are relatively low; many species can grow at water activity (aw) 0.85 or less, although molds usually require higher water activity.

Some strains produce mycotoxins such as aflatoxin in beans and ochratoxin in coffee and chocolate.

A.7.2 Peace Studies

Molds and yeasts can cause damage to foodstuffs and some can cause allergic reactions and infections especially in immunocompromised populations, such as the elderly, HIV-infected individuals and people undergoing chemotherapy or antibiotic treatment.

Like bacteria, molds can cause diseases which are divided into two groups, namely, infection by molds (mycoses) and poisoning (mycotoxicosis). Mycotoxicosis is caused by ingestion of toxic metabolic products (toxins) from molds that are not damaged by food processing.

Poisoning is usually caused by repeated consumption of mycotoxins over a period of time. Incorrect processing or fermentation methods can result in unwanted contamination. The molds that produce mycotoxins are mainly *Aspergillus, Penicillium* and *Fusarium species.*

Molds and yeasts cause varying degrees of food spoilage and decomposition.
They can attack and grow on almost any type of food; attack crops such as rice, beans, chickpeas, and fruits on farms before harvest and during storage. Also grown in processed foods and food mixes.

A.7.3 Food analysis

Indications of fungal and yeast invasion in food depend on the type of food, the microbes involved, and the level of invasion. Slightly spoiled, severely spoiled, or fully decomposed contaminated food, characterized by stains of various sizes and colors, musty odor, white cotton mycelium, or mold with colored spores and abnormal taste, smell and odor. Sometimes, food appears to be free of molds, but during testing, certain types of mold or yeast are found in contaminated food. Food contamination by molds and yeasts can result in substantial economic losses to producers, processors and consumers.

A.8 *Listeria monocytogenes*

A.8.1 Description

Listeria monocytogenes is a short rod-shaped bacterium, Gram positive, forming a short chain consisting of 3 cells - 5 cells, measuring 0.4-0.5 x 0.5-2.0 nm, motile (has flagella), microaerophilic (Optimum growth when incubated under conditions of low O2 levels and 5% - 10% CO2 levels). *L. monocytogenes* grows well on blood agar and tryptose agar. The optimum growth temperature is 37 °C, but these bacteria are still able to grow at a temperature of 2.5 °C – 3 °C. Listeria can grow in cold temperatures and can also grow in containers with low oxygen levels or in environments without oxygen.

A.8.2 Peace Studies

Listeriosis is the name of the disease caused by *L. monocytogenes.* This disease is rare but the consequences are very fatal. In humans, listeriosis is a diffuse abscess or granuloma. Abnormalities are found in the liver, spleen, adrenal glands, respiratory tract, digestive tract, central nervous system and skin. The fetus can become infected transplacentally via the umbilical vein and cause septicemia.

Symptoms of listeriosis in adults include fever, chills, headache, backache, abdominal pain and diarrhea. In newborns, respiratory problems, refusal to drink, and vomiting.

The most typical infection by *L. monocytogenes* is a genital tract infection in pregnant women which can cause infection in the unborn child. In addition, complications of listeriosis can cause meningitis or meningioencephalitis which damages the tissue around the brain and septicemia or poisoning in the blood. Clinically, meningitis due to *L. monocytogenes* is indistinguishable from meningitis due to other bacteria. Listeriosis also causes blood poisoning *(septicemia),* cervical or intrauterine infections in pregnant women, which can result in spontaneous abortion (second/ third trimester) or stillbirth. Gastrointestinal symptoms such as nausea, vomiting, and diarrhea indicate serious listeriosis. Gastrointestinal symptoms are epidemiologically associated with the use of antacids or cimetidine. The timing of serious listeriosis relapses is unknown but is estimated to be a few days to three weeks. The timing of gastrointestinal symptoms is unknown but is estimated to be more than 12 hours.

Symptoms in infants infected with *L. monocytogenes* appear in the 1st to 4th week after birth, and are similar to the early symptoms of meningitis caused by other bacteria. Listeriosis prepartum will cause miscarriage, premature birth, *stillbirth,* or death some time after birth. Her mother usually shows symptoms of illness, or very mild symptoms resembling influenza and persistent fever

The minimum infectious dose of *L. monocytogenes* is estimated at 102 /g, but this depends on the strain and sensitivity of the victim. In the case of raw milk or milk that is supposedly pasteurized, for sensitive people, even less than 1000 bacteria can cause disease. *L. Monocytogenes.* Its presence in phagocytic cells allows these bacteria to enter the brain and into the fetus through the placenta.
The pathogenesis of *L. monocytogenes* is centered on its ability to survive and multiply in host cell phagocytes. The mortality rate for meningitis by *Listeria* is 70%; blood poisoning *(septicemia)* 50%, and perinatal/neonatal infections greater than 80%. Infection during pregnancy usually has no effect on the mother (survival). Listeriosis can be diagnosed by culturing bacteria from blood, cerebrospinal fluid, or watery feces in certain media.

The target population is pregnant women/perinatal and neonatal infections - fetuses; people who are immunocompromised with corticosteroids, anticancer drugs, *graft suppression therapy,* AIDS; cancer patients especially leukemia; diabetics, cirrhosis, asthma, and ulcerative colitis patients; seniors; normal and healthy people.

L. monocytogenes is ubiquitous in nature. However, it is commonly found in the intestinal tract of humans and animals, in soil, and also in foods such as raw milk, presumed pasteurized liquid milk, cheese (especially *soft-ripened types),* ice cream, raw vegetables, raw fermented meat sausages, poultry raw and cooked, raw meat (all kinds), raw fish and *smoked fish.* Its ability to grow at temperatures as low as 3 °C allows it to reproduce in refrigerated food.

To avoid infection by *L. Monocytogenes,* avoid consuming cheese and raw milk made from unpasteurized milk. Pregnant women and other groups who are at high risk of infection are advised to pay attention to labels on food packaging and observe production and expiration dates, reheating completely for frozen or refrigerated poultry and meat.

Treatment with penicillin or ampicillin parenterally has been successful.
Trimethoprim-Sulfamethoxazole is effective in patients allergic to penicillin. In the fetus, listeriosis can be prevented by treatment of the mother. Prevention should be done, among others, by removing reservoir animals, pasteurizing milk and preventing contact with infected animals or their products.

A.8.3 Food analysis

Laboratory diagnosis can be made by isolating bacteria from cervical/vaginal mucus, lochia, umbilical cord blood, meconium, blood and cerebrospinal fluid.
Gram stain is very useful to determine the possibility of *L. monocytogenes infection.* Specimens should be stored for at least 4 weeks to 3 months or 6 months at 4 °C. If further isolation is not successful, the specimens stored in the refrigerator must be replanted after 6 weeks and even after 3 months. Usually 6 weeks of storage at 4 °C is sufficient for growth of *L. monocytogenes.* This growth at low temperatures can be attributed to the psychrophilic nature of the bacteria. This inoculation is useful for differentiating *L. monocytogenes* from other morphologically similar Gram-positive bacteria such as *Corynebacteria, Erispelothrix* and Streptococci.

Laboratory indications:

- catalase +
- mobile at room temperature grows
- at 4 °C. beta-hemolytic bile esculin
- hydrolysis.
-

A.9 *Salmonella* spp

A.9.1 Description

Salmonella is a rod-shaped bacterium with a size of 1 m - 3.5 m x 0.5 m – 0.8 m, motile, except for *S. gallinarum* and *S. pullorum* nonmotile, non-sporing and Gram negative.

Salmonella is ubiquitous, and is known as a *zoonotic agent.* These bacteria grow in aerobic and facultative anaerobic conditions at a temperature of 15 °C - 41 °C (growth temperature C) and a growth pH of 6 - 8, but at a temperature of *Salmonella* is in the 56 °C and at an optimal temperature of 37 °C will die. In water can last for 4 weeks. The main habitat of

There are many types of *Salmonella* that cause *foodborne disease .* One of them is *Salmonella* Typhimurium. Another strain found was *Salmonella* Enteritidis, which was found in contaminated immature eggs. These bacteria are easily damaged by heat.

A.9.2 Peace Studies

More than 50,000 cases of food poisoning in the United States annually are caused by *Salmonella.* Cases of poisoning caused by this bacterium usually occur when humans ingest food containing significant amounts of *Salmonella .* Number of *Salmonella*
which can cause Salmonellosis is between 107 cells/g - 109 cells/g. In the USA, S. Typhimurium and S. Enteritidis are the cause of salmonellosis.

The spread of these microbes is usually through meat and eggs that are not cooked. Chicken and poultry products are the main breeding grounds for *Salmonella* . If food contaminated with *Salmonella* is ingested, it can cause intestinal infections followed by diarrhea, nausea, chills and headaches. There are 2200 types of *Salmonella* grouped based on their surface antigens. These bacteria can cause serious complications in immunosuppressed individuals such as HIV/AIDS patients.

While many *Salmonella* are carried by animals, *S.* Typhii is distinctive in that it is only carried by humans. These intracellular bacteria can cause *enteric fever* , which is characterized by fever, diarrhea, and inflammation of the infected organs. Besides *S.* Typhii, *S.*
Paratyphii A, B, and C also cause fever in humans that resembles typhus.
Various organs may become infected and cause injury to these organs. *S.*
Dublin has a 15% risk of death rate when septicemia occurs in the elderly, *S.*
Enteritidis showed a mortality rate of 3.6% in infected hospitals, deaths mainly occurring in the elderly.

Blood poisoning due to *Salmonella* is associated with infection in each organ system. Other forms of salmonellosis usually produce milder symptoms.

Acute symptoms are characterized by nausea, vomiting, abdominal cramps, terminal diarrhea, fever, and headache. Chronic consequences are symptoms of gout (arthritis) occur 3 weeks - 4 weeks after the attack of acute symptoms. Incubation time between 6 hours - 48 hours. The infectious dose is at least 15 cells - 20 cells; depending on the health and age of the host, and the differences in strain among members of the genus.

Duration of acute symptoms is at least 1 day to 2 days or may be longer, depending on host factors, absorbed dose, and strain characteristics.
The disease is caused by the penetration of *Salmonella* at the site of inflammation, namely from the intestinal cavity into the epithelium of the small intestine. Diagnosis of disease in humans can be done through serological identification of cultures isolated from feces. *Salmonella* infections can be treated with ciprofloxacin or ceftriaxone.

Salmonella is a normal microflora in some animals, especially pigs and poultry.
Sources of these microbes include water, soil, insects, factory environments, kitchens, animal feces, raw meat, raw poultry, and raw seafood, etc. Foods that are usually contaminated with *Salmonella* include raw meat and processed products, poultry, eggs, milk and dairy products, fish, shrimp, frog legs, yeast, coconut, *salad dressings* and sauces, *cake mixes,* toppings and desserts containing cream, dry gelatin. , peanut butter, cocoa and chocolate. These bacteria can survive for a long time in food.

Various species of *Salmonella* were isolated from the outer shell of eggs. Currently infected with *S. enteritidis* exacerbated by the presence of these microbes in the egg yolk. Foods other than eggs have also caused the spread of diseases caused by *S. enteritidis.*

To prevent infection can be done by thoroughly cooking all poultry, poultry products, eggs, meat, meat products including ground meat and fish.
Do not drink unpasteurized milk. Wash hands thoroughly before and after handling raw meat, egg and poultry products. Use clean utensils and surfaces to prepare the above ingredients. Wash utensils, boards and cutting surfaces thoroughly with hot soapy water and rinse before preparing other foods.

A.9.3 Food analysis

Analytical methods have been developed for various foods contaminated with *Salmonella.*
In addition to the conventional culture method which takes 5 days for presumptive results, there are also several rapid methods that require only 2 days.

Laboratory indications:

- Listen +
- Hydrogen sulfide + -/+
- TSI reaction (with gas) indole +
-
- Citrate +
- ONPG –
- Malonat –

A.10 *Staphylococcus aureus*

A.10.1 Description

Staphylococcus aureus is a spherical bacterium in pairs or groups like grapes with a diameter between 0.8 microns -1.0 microns, non-motile, non-sporing and gram-positive. However, sometimes they are Gram negative, namely in bacteria that have been phagocytosed or in old, nearly dead cultures. Staphylococcal bacteria are often found as normal microflora on the skin and mucous membranes of humans.

Can be a cause of infection in both humans and animals. This type of bacteria can produce enterotoxins that cause food contamination and cause poisoning in humans. These bacteria can be isolated from clinical materials, *carriers,* food and the environment.

Clinically, staphylococci are the most important genus of the family Micrococcaceae.
This genus is divided into two major groups: *aureus* and *non-aureus. S. aureus* is known to cause soft tissue infections, such as *toxic shock syndrome* (TSS) and *scalded skin syndrome* (SSS), which can be identified from staphylococcal species that give positive results on coagulase tests. Some strains are capable of producing a highly heat-stable toxin protein that can cause disease in humans.

These bacteria grow well at human body temperature and also in food stored at room temperature and produce toxins at that temperature. This toxin is called an enterotoxin because it can cause gastroenteritis or inflammation of the lining of the intestinal tract.

Staphylococci are present in air, dust, sewage, water, milk, food, tableware, the environment, humans and animals. These bacteria grow well in foods that are high in protein, high in sugar and salt. Humans and animals are the main growth sites. Staphylococci are present in the nasal passages and esophagus and in the skin and hair of 50% or more of healthy individuals. The risk is higher for those who have frequent contact with sick individuals or in contact with the hospital environment. Although food processors are a major source of food contamination, equipment and the environment can also be sources of *S. aureus contamination.*

A.10.2 Peace Studies

There are two forms of food poisoning caused by staphylococci, namely staphyloenterotoxicosis and staphyloenterotoxemia. This condition is caused by enterotoxins produced by

some strains *of S. aureus.* The enterotoxin *S. aureus* causes short-term food poisoning with severe cramping and vomiting. In addition, these microbes also secrete leukocidin, a toxin that destroys white blood cells and accelerates the formation of pus in wounds and acne. *S. aureus* was found to be the cause of several diseases such as pneumonia, meningitis, blisters, arthritis and osteomyelitis (chronic bone infection).

Infectious toxin dose of less than 1.0 g in contaminated food will cause symptoms of staphylococcal intoxication. The level of this toxin is reached when the *S. aureus* population exceeds 100,000/g.

Symptoms of staphylococcal food poisoning are usually rapid and in some cases acute, depending on the individual's susceptibility to the toxin, the minimum number of enterotoxin-producing bacterial cells, the amount of contaminated food eaten, the amount of toxin in the food ingested, and the general health of the victim. The most common symptoms are nausea, vomiting, stomach cramps and lethargy. In some individuals these symptoms do not always occur. In severe cases, headaches, muscle spasms, and transient changes in blood pressure and pulse rate occur.

Most *S. aureus* is resistant to penicillin, but vancomycin and nafcillin are known to be the most effective drugs against this strain of bacteria. Most *S. aureus* is resistant to penicillin, but vancomycin and nafcillin are known to be the most effective drugs against this strain of bacteria. The healing process, in general, takes two days, but for complete healing it takes three days and sometimes longer in severe cases. Death from staphylococcal food poisoning is very rare, cases of death usually occur in the elderly, infants, and the weak.

In the diagnosis of food-borne staphylococcal disease, it is advisable to conduct interviews with victims and collect and research epidemiological data. Food evidence should be collected and tested for staphylococci. The presence of large numbers of enterooxygen staphylococci is evidence that food contains toxins. The best tests are to link the disease to a particular food or by detecting the toxin in a food sample.

In foods that are processed by pasteurization and heating, diagnosis through direct microscopic observation of the food is very helpful. Proper cooking can destroy *Staphylococcus aureus bacteria,* but the toxin is very resistant to heating, refrigeration, and freezing. A number of serological methods for determining the enterotoxigenicity of *S. aureus* isolated from food as well as methods for the detection and separation of the toxin in food have been developed and used to support disease diagnosis.

Foods that are frequently contaminated by staphylococci include meat and meat products, eggs and poultry, tuna, chicken, potatoes, macaroni, bakery products such as cream-filled pastries, cream pies and chocolate *eclairs ,* sandwiches, and milk and dairy products. In milk, the number of staphylococci as much as 107 colonies/g will produce enterotoxins.

Everyone can contract this bacterial toxicity; However, the intensity of the symptoms varies. Hand washing with proper technique, cleaning equipment and cleaning food preparation surfaces is necessary to prevent the entry of bacteria into food, especially food that is not heated before preparation such as lettuce. Food should be refrigerated until consumed and not left at room temperature for more than two hours.

A.10.3 Food analysis

To detect staphylococcal enterotoxins in food samples in cases of food poisoning, the toxin must be separated from the food components and concentrated before being identified by specific precipitation using antiserum (antienterotoxin). Two principles were employed: (1) selective adsorption of enterotoxins from food extracts into ion exchange resins and (2) use of chemical and physical procedures to selectively remove food components from extracts, thereby leaving enterotoxins in solution.

The use of this technique and the concentration of the resulting product can be used to detect small amounts of enterotoxins in foods.

Currently, rapid methods based on monoclonal antibodies have been developed (eg, ELISA, *Reverse Passive Latex Agglutination),* which are being evaluated for their accuracy in detecting enterotoxins in food. This rapid method can detect approximately 1.0 nanogram of the toxin/g of food.

Laboratory indications:

- anaerobic glucose fermentation by producing acid.
- Catalase +
- Nitrate +
- Coagulase +

A.11 *Vibrio cholerae*

A.11.1 Description

Vibrio cholerae is a comma-shaped bacterium, measuring 2 m - 4 m, very motile because it has monotrichous flagella, does not form spores, in old cultures it is straight rod-shaped, Gram negative. Colonies are convex *(convex),* round, smooth, opaque and appear granular, aerobic or facultatively anaerobic, optimum temperature 37 °C (18 °C - 37 °C), optimum pH 8.5 - 9.5, grows well in media containing mineral salts and asparagine as carbon and nitrogen sources.

A.11.2 Peace Studies

Under normal circumstances it is only pathogenic to humans. *Vibrio cholerae* causes cholera, which is characterized by severe diarrhea with a color like rice water. This diarrhea causes 60% of people with cholera to die from dehydration. After these cholera microbes enter the body, they descend into the intestinal tract, attach to the epithelium and release an exotoxin called collagen. Collagen stimulates hypersecretion of water and chloride and inhibits sodium absorption. As a result of losing a lot of fluids and electrolytes, dehydration, acidosis, shock and death occur. Histologically the intestinal tissue remained normal. Incubation period 6 hours - 5 days, symptoms of nausea, vomiting, diarrhea and abdominal cramps. Watery stools such as rice water consist of mucus, epithelial cells and large amounts of vibrio germs.

The infectious dose that can cause disease in healthy people is 107 colonies/g.
Taking antacids will reduce the dose of infection.

Cholera can be determined only by isolation of the causative microbe from the faeces of an infected individual. *V. cholerae* is usually abundant in rivers and coastal and marine waters, namely in shellfish, oysters and other *seafood* with cell numbers below 103 colonies/g.
Anyone can get the infection, especially in individuals with underdeveloped or low immunity, who have low levels of stomach acid, or individuals who are malnourished.

Bacteria can be destroyed by cooking seafood completely. Prevention of recontamination of cooked seafood is through the use of clean equipment. Do not eat raw seafood including oysters and sushi. Drink treated water, especially when visiting a foreign country.

The principle of treatment is rehydration with fluids and electrolytes. Simultaneous administration of doxycycline can kill microbes.

A.11.3 Food analysis

The most convincing laboratory identification of V. cholerae is by culturing the specimen on specific media. It could also be with a laboratory diagnosis using samples of feces or vomit from the patient.

Laboratory indications:

- Oxidase +
- Catalase +
- Indo +
- Lysine decarboxylase +
- Ornitin deaminase +

A.12 *Vibrio parahaemolyticus*

A.12.1 Description

The genus Vibrio is a comma-shaped bacterium, has a monotrichous flagellum, is Gram negative, is motile, and is aerobic. *Vibrio cholerae* and *Vibrio parahaemolyticus* are the main species found in rivers, coastal and marine waters, namely fish, oysters, shellfish and other *seafood* .

The characteristics, structure and coloration for identification are the same as those of other Vibrio species.
The fermentation does not produce gas. The optimum pH of culture is 7.6 – 9.0.

A.12.2 Peace Studies

Vibrio parahaemolyticus causes gastroenteritis with diarrhea, abdominal cramps, nausea, vomiting, headache, fever and chills. The disease is generally mild, although some cases require hospitalization. The duration of the disease is on average 2.5 days. The incubation period is 4 hours - 96 hours with an average of 15 hours after ingestion of this microbe. Disease is caused by microbes attaching to the small intestine of the host and releasing toxins of which the type is still unknown.

Infectious dose > 106 microbes can cause disease; the number of infectious doses is markedly decreased by concomitant antacid consumption (or estimated by buffering foods). The diagnosis of gastroenteritis caused by these microbes can be made by means of microbial culture from the feces of sick individuals.

Infection by these microbes is caused by consuming fish and shellfish that are not cooked perfectly, or cooked but re-contaminated. The number of cells contained in *seafood* is usually below 103/g. All individuals who consume raw or incompletely cooked fish and shellfish are susceptible to infection by these organisms. Bacteria can be damaged if seafood is cooked perfectly. Prevention of re-contamination of cooked seafood is by using clean equipment. Don't eat

raw seafood including oysters and sushi. Drink water that has been treated especially when visiting a foreign country.

The disease usually resolves on its own and only lasts 3 days. In severe cases, it is necessary to rehydrate and add electrolytes. Antibiotics: chloramphenicol, kanamycin, tetracycline and cephalothin.

A.12.3 Food analysis

The method used to isolate these microbes from food is the same as the method used to isolate microbes from the feces of patients. Since many food isolates are non-pathogenic, the pathogenicity of all food isolates must be demonstrated. Laboratory diagnosis is made by examining the patient's stool and rectal swab.

Laboratory indications:

- Oxidase +
- Catalase +
- Indo +
- Lysine decarboxylase +
- Ornitin deaminase +
- Honesty

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