Investigation of microbial contamination in processed food according to Indonesian National Standards and The food and Drug Supervisory Agency at The Microbiology Laboratory of Faculty of Medicine, Universitas Indonesia, Jakarta

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ABSTRACT
Food is all ingredients in processed from that are eaten by humans as a basic requirement needed for energy sources in daile activities. Proper and correct food processing is very beneficial for the body, otherwisw food can be a potential source of infection if it is contaminates by microorganisms which can cause food poisoning. The purpose of this stydy was ti determine the quality of processed food sent to The Microbiology Laboratory of Faculty of Medicine, Universitas Indonesia. A total of 246 processed food samples were examined using food investigation methods, which are Total Plate Count (TPC), Most Probable Number (MPN) and pathogenic bacteria culture according to Indonesian National Standard (SNI) 7388:2009 and Regulation of Food and Drug Supervisory (BPOM) No. 13 of 2009. The samples examined from 5 types of consumers, namaely : hospitals, health laboratories, catering services, restaurants and companies. The samples examined consisted 0f 28 categories. The largest sample was in 2015, while the lowest was in 2020, respectively 49 and 13 samples. 47 from 246 processed food samples did not meet the standards. Samples that do not meet the requirements, the most in 2017 (31.4%) and the lowest in 2019 (11.1%). Food samples that did not meet the standards were spread out in 14 of categories. The highest categories were : vegetables, seaweed , beans and seeds (29.79%). Some 19.11 % of processed food did not meet the standards. Regular laboratory investigation are very important do to ensure that the food served is safe for consumption and meets quality standards.
Keywords : microbial investigation, microbial contamination, processed food, quality standard

INTRODUCTION

Food is anything that comes from biological sources of agricultural, plantation, forestry, fishery, animal husbandry and waters, both processed and unprocessed which are designated as food or beverage for human consumption, including food additives, food raw materials others that are used in the process of preparing, processing and/or making food or beverages (Depkes RI, 2003). Processed food is food that beverage that is processed in a certain way or method with or without additives (Depkes RI, 2009).

Food is a sourcr of energy needed by humans to be able to do activities every day, but food can be potential a potential source of infection if it is contaminated by microorganisms that can cause food poisoning. The global burden of foodborne diseases by 2020 is 33 million annually, approximately 600 milion foodborne diseases with 420.000 mortaliy (Shamim et al., 2019).

Indonesia as a developing country with a very large area has limitations in the supervision and control of food product in an effort to protect consumer health and safety (Sunarno et al., 2012). The food and Drug Supervisory Agency (Badan Pengawas Obat dan makanan /BPOM) informs that 25 provinces that report food poisoning outbreaks, there are 3 cities with the highest frequency, including Semarang with 14 incidents (10,94%) and Lampung 12 incidents (9,38%) (Dinkes Jawa Tengah, 2016).

One of the sources of disease transmission and the cause of food poisoning is food and beverages that do not meet hygiene and sanitation requirements. This condition is influenced, among others by the cleanliness of cooking utensils and cutlery used in the process of supplying food and beverages (Cahyaningsih et al., 2012).

Currently, the public's need for food and drinks provided outside the home is inceasing, both in various hospitals because of the large number of patients in the Cocid-19 pandemic era and food products provided by companies or individuals in offices.

The food products provided must be guaranteed healthamd safety by taking account several factors, such as food processing palces, storage places, cooking and eating utensils. In addition, it is necessary topay attention to cooks, food handlers, cooking processes, pollutants and preservatives and food additives (Nine, 2012).

Food has a very important role in public health. Healthy and safe food is one of the important factors to improve the health status of the community, therefore the quality of food both bacteriological, chemical and physical needs to be maintained (Depkes RI, 2002 ; Marpaung et al., 2012).

For the microbiological examination of food, the Indonesian National Standard (SNI) 7388 : 2009 has set limits on microbial contaminations in food for various tupes of food in Indonesia which are categorized according to the food category number. The standard was then revised by

BPOM RI in 2019 in Regulation of the Food and Drug Supervisory Agency No. 13 of 2019 cocerning the Maximum Limit of Microbial Contamination in Processed Food (SNI 7388: 2009, 2009 ; BPOM, 2019).

This study aims to investigate microbial contamination in processed food according to SNI and BPOM RI in the the Microbiology Laboratory, Faculty of Medicine, Universitas Indonesia during 2013-2020. It is hoped that results obtained can improve the quality of processed food in Indonesia, especially against microbial contamination so that it can improve the quality of food that plays role in efforts to improve public health.

MATERIAL AND METHODS

Homogenization was carried out by grinding 25 gr sample in 225 mL Buffered Pepton Water (BPW) (Oxoid) using blender (Isolab) at speed of 12.000 rpm – 14.000 rpm for 1-2 minutes then carried out according to the investigation method, which are *Total Plate Count* (TPC), *Most Probable Number* (MPN) and culture pathogenic bacteria (SNI 01-2897-1992, 1992 ; Cappuccino & Sherman, 2014).

Total Plate Count (TPC)
Serial dilutions were carried out in a number of tubes containing 9 mL of peptone water (Oxoid). One mililiter of the homogenized sample is put into the first dilution tube, then take 1 mL from the tube to put in the second dilution and so on until the 10th tube. In this last dilution tube, 1 mL are removed to the entire volume of 9 mL. Into the petridish, 1 mL of each dilution was inserted in duplicate (SNI ISO 4833-1:2015, 2015). Then as much as 15 mL of Plate Count Agar (PCA) (Oxoid) media was poured into the petridish, shaken left and right to make it evenly distributed. After freezing, the petridish were turned over and incubated at 35°C, for 24 hours. Colony count are carried out on agar plates with a colony number of 30-300 colonies. The result is obtained by multiplying the average number of colonies on the agar plate by the appropriate dilution factor (SNI ISO 6687-1:2012, 2012).

Most Probable Number (MPN)
This method consists of preumtive and confirmation examination.
Presumptive Test. Put 1 mL of 10^{-1} dilution into each of the tubes containing 5 mL of lactose broth (Becton Dickinson) in which there is an inverted durham tube. In the same way, it was carried out for a 10^{-2} dilution in the secong 3 tubes and 10^{-3} in the third 3 tubes. Incubated at 35°C for 24 jam. The tube forming the gas is followed by a confirmation test (SNI 01-2897-1992, 1992 ; Cappuccino & Sherman, 2014).
Confirmation Test. Inoculated 1 loop from the tube that forms gas in the preumptive test on the containing 10 mL of *Brilliant Green Bile Broth* 2 % (BGLB) (Oxoid). Incubated at 35°C for 24-48 hours. The presence of gas strengthens the presence of Coliform bacteria. The number of positive tubes was compared with the MPN Coliform table (SNI ISO7218: 2012, 2012).

Examination for pathogenic bacteria.

Culturing to detect the presence of the pathogenic bacteria is carried out using a selective medium in accordance with the bacteria being sought. The stages consist of Gram staining and identification according to bacterial growth ((SNI 01-2897-1992, 1992 ; Cappuccino & Sherman, 2014).

RESULTS

The number of processed food sample examinations during 2013-2020 at the Microbiology Laboratory of Faculty of Medicine, Universitas Indonesia, Jakarta can be seen in Table 1. The data shows, 246 processed food samples have been examined, 47 of its (19.11%) not in accordance the standards. The largest sample in 2015 and the lowest in 2020, that is 49 and 13 samples respectively. The highest samples that do not meet the standard was in 2017 (31.4%) and the lowest was 2019 (11.1%).

Table 1: Number of investigation of processed food samples in 2013-2020

No.	Year	Number	Not meet standar (%)
1.	2013	30	6 (20.0)
2.	2014	26	4 (15.4)
3.	2015	49	9 (18.4)
4.	2016	28	6 (21.4)
5.	2017	35	11 (31.4)
6.	2018	38	6 (15.8)
7.	2019	27	3 (11.1)
8.	2020	13	2 (15.4)
	Total	246	47 (19.11)

Based on food categories, the samples examines consisted of 28 categories, 19 categories were included in SNI 7388:2009. While the other included in the food categories in BPOM 2019 (Table 2).

Tabel 2: Types of samples investigation based on food categories

No.	Year	Food	category						
		SNI 01.1	SNI 4.1.1	SNI 4.1.2	SNI 4.2.2	SNI 06.1	SNI 06.4	SNI 06.8	SNI 07.1
1	2013	0	0	0	15	0	0	0	0
2	2014	0	0	0	11	1	0	0	0

3	2015	0	2	0	25	7	0	2	0
4	2016	0	0	0	14	2	0	4	0
5	2017	0	0	3	7	0	1	5	0
6	2018	2	0	1	10	2	1	5	1
7	2019	0	0	1	6	0	0	2	0
8	2020	0	0	0	0	0	0	0	0

No.	Year	Food		category					
		SNI 8.1.1	SNI 08.2	SNI 08.3	SNI 9.2.2	SNI 9.2.4	SNI 9.2.5	SNI.10.1	SNI 10.3
1	2013	0	0	0	0	10	4	1	0
2	2014	0	0	0	0	11	1	2	0
3	2015	2	1	0	0	6	0	1	0
4	2016	1	2	0	0	3	0	0	0
5	2017	0	8	1	0	2	0	0	1
6	2018	3	3	0	2	0	1	0	2
7	2019	1	2	0	1	3	0	0	0
8	2020	0	0	0	0	0	0	0	0

No.	Year	Food category					
		SNI 10.4	SNI 12.6	SNI 4.1.2	BPOM 04.1.2.7	BPOM 04.2.2.2	BPOM 4.2.2.3
1	2013	0	0	0	0	0	0
2	2014	0	0	0	0	0	0
3	2015	1	1	1	0	0	0
4	2016	1	0	1	0	0	0
5	2017	0	1	6	0	0	0
6	2018	0	1	4	0	0	0
7	2019	0	1	0	0	2	2
8	2020	0	0	0	1	1	0

No.	Year	Food category					
		BPOM 04.2.2.6	BPOM 06.8.4	BPOM 06.8.6	BPOM 08.2.2	BPOM 9.2.2	BPOM 9.2.4.3
1	2013	0	0	0	0	0	0
2	2014	0	0	0	0	0	0

3	2015	0	0	0	0	0	0
4	2016	0	0	0	0	0	0
5	2017	0	0	0	0	0	0
6	2018	0	0	0	0	0	
7	2019	1	1	1	1	1	1
8	2020	0	0	0	0	0	0

An example of the results of the investigation of microbial contamination in processed food shown in Figure 1-3 and Table 3.
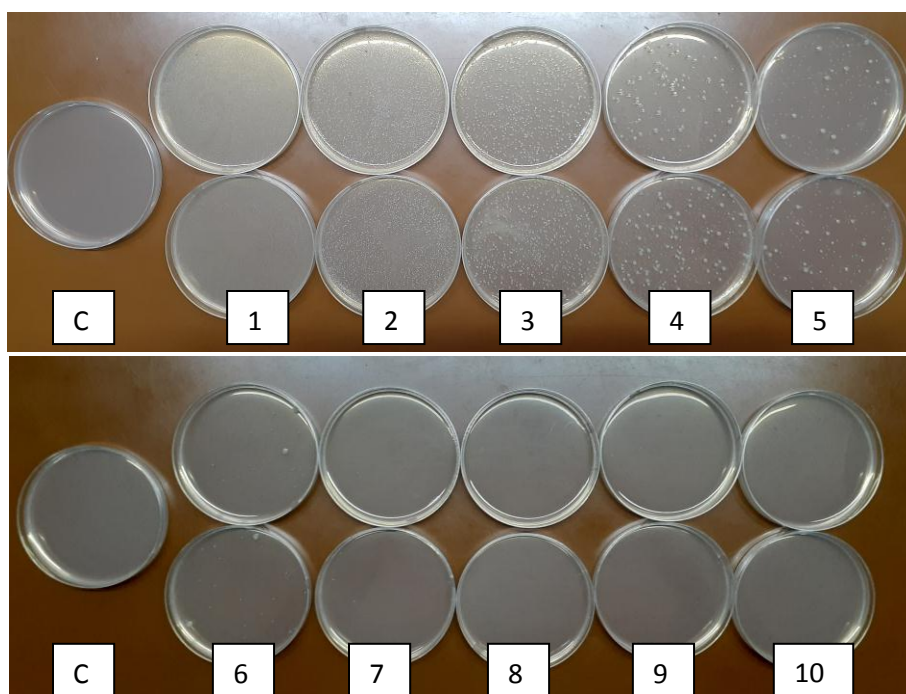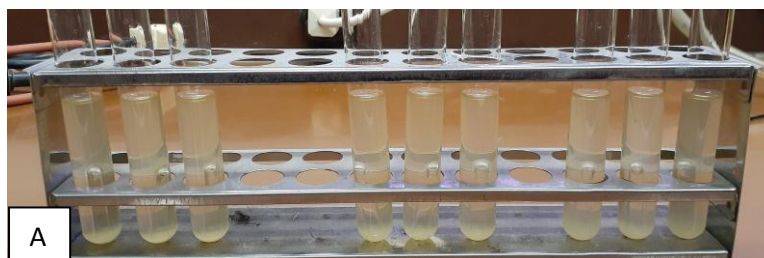

Fig 1 :Total Plate Count (TPC) (colony/mL). C: Control. No. 1-10 : serial dilution 10^1- 10^{10}
No.1: Infinity, No.2; Infinity, No. 3: 900, No.4: 500, No.5: 97, No. 6 : 20, No 7: 0, No. 8 : 0.
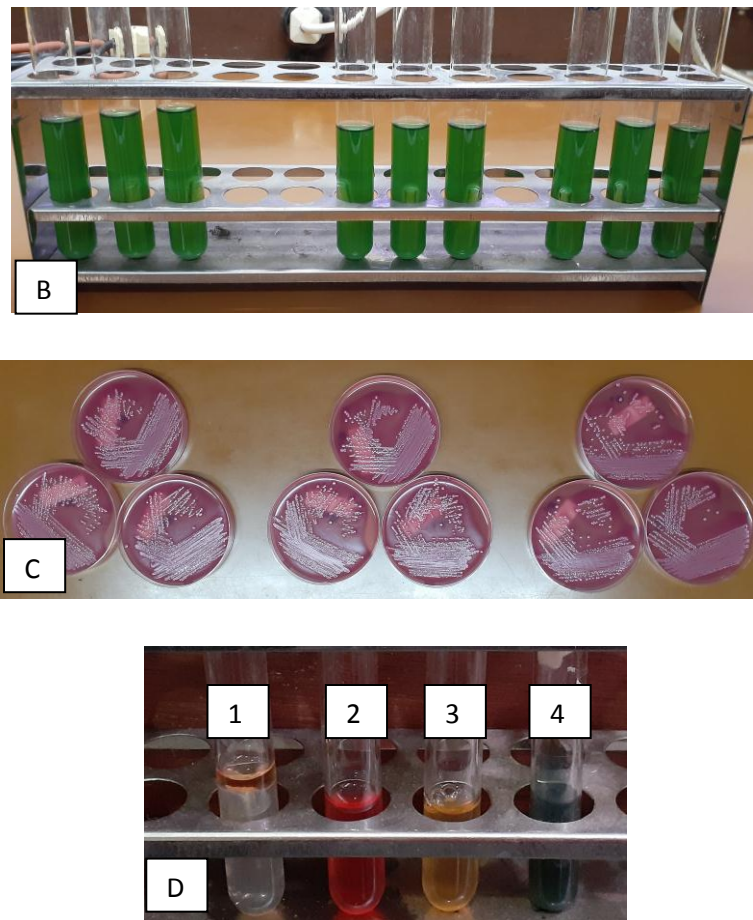No. 9 : 0. No. 10: 0

Fig 2 : Most Probable Number (MPN) *E.coli.* A. Presumtipve test. B. Confirmed test.
C. MPN *E. coli*. D. IMViC Test (1. Indol +, 2. Metyl Red +, 3.Vogues Proskauer -, 4.Citrate -)
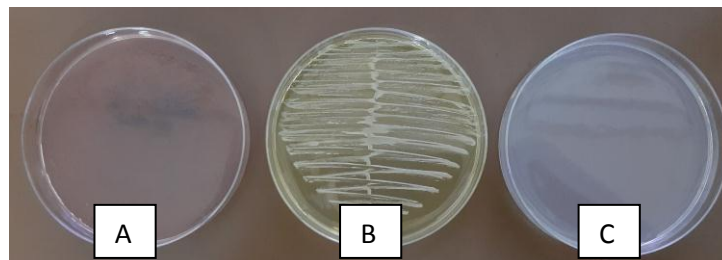

Fig 3: Pathogenic Microbe Examination : *Salmonella*, *Staphylococcus aureus* and Fungi.
A. SS agar : Negative Salmonella. B. MSA Agar : *Staphylococcus aureus* 1x 10^5 koloni/g. C.
SDA Agar : negative fungi

Table 3 :One of result investigation of microbial contamination in processed food does not meet standard

Parameters	Maximum microbial limits	Result
TPC	5×10^5 koloni/g	9.7×10^6 koloni/g
MPN *E.coli*	< 3/g	>110/g
Salmonella sp	Negatif/25 g	Negatif
Staphylococcus aureus	1×10^3 koloni/g	1×10^5 koloni/g
Mold	$< 1 \times 10^3$ koloni/g	Negatif

Sample : Smoked tuna, coconut milk seasoning
SNI 7388: 2009. No. Food category : 09.2.5. Food category : Fish products are smoked, dried, fermented without salt.

Table 4 shows the various types of food categories examined according to the sample accompanied by number of food categories that are not in accordance with the standard.

Table 4 : Food categories that are not in accordance with the standard.

No.	SNI/BPOM	Food categories	Not meet standard
1.	SNI 01.1	Milk and milk based drinks	0
2.	SNI 04.1.1	Fresh fruit	1
3.	SNI 04.1.2	Processed fruit	3
4.	SNI 04.2.2	Vegetables, seaweed, nuts, seeds	14
5.	SNI 06.1	Whole seeds, broken pieces, rice	3
6.	SNI 06.4	Pasta, noodles and similar products	1
7.	SNI 06.8	Soy products	0
8.	SNI 07.1	Bread and plain bakery products	0
9.	SNI. 08.1.1	Fresh frozen and minced meat	1
10.	SNI 08.2	Processed meat products	4
11.	SNI 08.3	Processed meat products are refined	0
12.	SNI 09.2.2	Starchy fish products are frozen	1
13.	SNI 09.2.4	Fish products, steamed, boiled and fried	5
14.	SNI 09.2.5	Fish products are smoked, dried, fermented without salt	4

15.	SNI 10.1	Fresh eggs	0
16.	SNI 10.3	Preserved eggs	0
17.	SNI 10.4	Eggs based deesert dish	0
18.	SNI 12.6	Sauces and similar products	0
19.	SNI 14.1.2	Fruit juice and vegetable juice	7
20.	BPOM 04.1.2.7	Sugary fruit	1
21.	BPOM 04.2.2.2	Vegetables, seaweed, nuts	1
22.	BPOM 04.2.2.3	Vegetables and seaweed in processed	0
23.	BPOM 04.2.2.6	Raw materials and pulp for vegetables, nuts and seeds	0
24.	BPOM 06.8.4	Semi dry tofu	0
25.	BPOM 06.8.6	Fermented soybeans	0
26.	BPOM 08.2.2	Heat treated meat products	0
27.	BPOM 09.2.2	Frozen fish products	1
28.	BPOM 09.2.4.3	Fried or grilled fish products p	0
		Total	47

DISCUSSION

A total of 246 processed food samples were investigated, 46 of its (19.11%) did not meet the standards. The samples examined came from 5 different types of consumers, namely, hospitals, health laboratories, catering services, restaurants and companies. The high demand for samples examinations in 2015 seems related to extraordinary incidence rate of extraordinary events in several regions in Indonesia, such as in Central Java, with food poisoning where 289 sufferere belong to the school age group. Diarrhea cases handled were 480.124 cases (Dinkes Jawa Tengah, 2015).

Meanwhile, the low number of samples in 2020 seems to be related to the Covid-19 pandemic, where tests in laboratories and in some hospitals are concentrated on examinations for this virus. The number of samples thet did not meet the requirements from year to year showed varying results, it appears that in 2017 showed the highest results (31.4%). Based on laboratory records, the biggest consumers in that year (19 from 35) were offices. With the increasing need of the community for food and beverages provided outside the home, food products provided by companies or individuals must be guaranteed health and safety. Mishandling of food and

neglect of hygienic practices facilitate pathogens to come into contact with food causing disease in consumers (Mudey et al., 2010 ; Shamim et al., 2019).

Since 2003-2019, investigations of microbial contamination in processed food were examined according to the SNI 7388 standard of 2009, but since the standard was revised by BPOM RI in 2019, therefore since 2020 investigations have been carried out using the BPOM RI standard. There are 28 types of processed food categories, 19 categories based on SNI 7388 in 2009 while the other are included in the 2019 BPOM RI category.

One example of the results of the investigation is a sample of smoked tuna with coconut milk, which was examined in 2013. Based on SNI 7388:2009, the sample is included in categories : Fish products smoked, dried, fermented without salt with No. Food Category : 09.2.5. The results of these investigations showed that The TPC was above the standard (9.7×10^6 koloni/g) as well as the MPN values for *E. coli* (>110/g) and *Staphylococcus aureus* (1×10^5 koloni/g), although *Salmonella* and Fungi were negative but the results of this interpretation were processed food is not suitable for consumption because all requrements must be met.
It is also known that of the 28 types of processed food categories examined, food samples that did not meet the standards were spread over 14 types, the highest being food categories : vegetables, seaweed, beans, seeds with no. category SNI 04.2.2 which is (29.79%) (14 out of 47).

What attracts consumers come from both hospitals, companies and offices, where overall processed food is geares towards food processors and presenters. This shows the importance of processed food provides to carry out regular laboratory examinations to ensure that the food and beverages served are safe for consumptionas atipulated in the Minister of Health Decree No:1098/ Menkes/SK/VII/2003 and Government Regulation No. 28 of 2004 concerning food safety, quality and nutrition (Departemen Kesehatan, 2003 ; Peraturan Pemerintah RI, 2004). Good ready-to-eat food production methods must pay attention to food safety aspects by preventing the conatimnation of ready-to-eat food by biological conataminants that disturb, harm and endanger health (WHO 2010.

CONCLUSION

A total of 246 samples of processed food were included in 28 types of categories, 47 samples (19.11%) did not meet the standards. Samples that did not meet the standards were in 14 types of categories, the highest was found in the category : vegetables, seaweed, beans, seeds (SNI 04.2.2) that is 29.79% %.

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