

## **SAFETY OF SCHOOL CHILDREN FOODS IN INDONESIA**

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### **ABSTRACT**

Survey from National Agency for Drug and Food Control (BPOM) on the condition of school children foods (SCF) showed that many microbial contaminations and hazardous chemicals, and also misused of food additives. This study aimed to **know** the profile of the safety on school children foods in Indonesia, reviewed from the chemical and microbiological parameters.

Safety of SCF sampling was conducted in 1328 elementary schools which is part of the 4500 elementary school in 18 provinces where the previous survey was conducted. Selection of **sampling** locations and **types** of food **was** based on **purposive sampling** technique. School children foods samples were analyzed **by** chemical and microbiological methods. Food which are sold in most school surrounding are **snacks** (54.1%), drinks (26.0%) and main food (2.0%). **Of** SCF **groups** sold, more than half (55.8%) SCF are registered as ready-to-eat food, and the next **36.0%** are registered as domestic brand (MD).

The results of chemical analysis on **the main food showed that 12.9% and 9.7%** of food samples were positive for formaldehyde and borax respectively. **Of the snacks tested**, 16.0% of samples were positive for formaldehyde and 9.1% positive for borax, 2.2% positive for Rhodamin B, 0.4% and **1.4%** were **positive** for Methanyl Yellow and Amaranth respectively. The analysis results in **the drinks also showed that** they contained Rhodamin B, Methanyl Yellow and Amaranth at concentrations of 4.0%; **3.7%** and 5.0% respectively. Based on the **results of benzoate in drinks**, as many as 3.8% of samples **did not** comply with he standard, whereas cyclamate analysis showed that 7.0% of samples *did not* comply with the standard. The results of microbiological analysis of main food samples showed that as many as **45.9% of food samples are of** poor quality. Meanwhile, there **were** 32.6% of food **samples** contained of *Staphylococcus aureus*. The total plate count on snack food showed that as many as 27.8% of **food** samples contained microorganisms above the standards, and *Staphylococcus aureus* **was found in 16.0%** of **those** food samples. Based on

**the total plate count of drink samples, 9.5% of samples** were of poor quality. **Based on E. coli analysis**, it was found that 69.0% of samples did not comply. The **exposure** value of cyclamate and benzoate in school children foods is still lower than the ADI value and the number of school children foods which were not complying with standards was less than 10% of school children foods samples.

## **INTRODUCTION**

Snack food played an important role in providing energy and nutrient intake for children of school age. The **survey** result which **was** conducted in Bogor in 2004 claimed as many as 36.0% of **energy needs of school children** were achieved from the consumption of snack food. However, this strategic role is not matched by **the** food safety and quality as good snacks.

The **condition of unsafe** snack food for school children was indicated by the results of study conducted by National Agency for Drug and Food Control (BPOM) in 2006. It showed that 21.38% cases occurred in schools and the elementary school students most frequently (75.53%) experienced food poisoning from School Children Foods (SCF). Therefore, it is necessary to do the comprehensively **risk** assessment to obtain scientific data and information which suitable to the community condition; hence the actual profile of national safety issue of *SCF* could be known for the basis for further determination of risk management policy.

## **METHODOLOGY**

### **Study Location**

This activity was part of the "Survey to Monitor and Verify the Profile of National Safety of School Children Food Safety Year 2008" **held in** 4500 of elementary schools at 79 District/City which are distributed in 18 provinces throughout Indonesia. The 18 provincial selections were conducted by **considering the representation** of provinces on the cluster of food consumption in Indonesia. This cluster **grouping** was arranged according to the equation of regional food consumption patterns in Indonesia area obtained from analyses

**data** of SUSENAS consumption **module** year 2007 conducted by Central Bureau of Statistic Indonesia (BPS).

SCF sampling was conducted in 1328 elementary schools which are part of 4500 elementary schools (ES) in 18 provinces as previous survey location. The number of 1328 ES is the root number of ES from each province of the 18 provinces where the survey done. Meanwhile, the number of elementary schools where the location of SCSF sampling in the selected districts/city is determined based on the following calculation:

$$\text{Sampling location (SD/MI)} = \frac{n}{N} \times n \text{ area}$$

Description:

N = total number of SD / MI as sampling location (= 1328)

N = total number of SD / MI as the previous survey location  
(= 4500 elementary school)

n area = number of SD / MI in a certain area (province/  
district/city) as the previous location)

### ***Sampling Plan and Analytical Plan for SCSF Sampling***

Snack food sampling is an activity to obtain school children-snack food samples which have been determined and selected to analyze the chemical and microbiological quality. Snack food sampling was conducted in the selected schools which sold SCSF in each province. The selection of sampling locations and types of food are according to the purposive sampling technique based on the number of SD / MI in each province. The chosen snack foods were a lot of consumed by students either by consumption frequency and amount in certain provinces.

### **Chemical and Microbiological Analysis for Parameter of SCSF Safety**

Chemical analysis was conducted to determine the level of borax, formaldehyde, preservatives, sweeteners, and coloring. Meanwhile, the microbiological analysis was conducted to determine total plate count (TPC), *E. coli* and *Staphylococcus aureus*. The qualitative identification of hazardous materials such as formaldehyde and borax using test methods is according to SNI 01-

2894-1992; meanwhile **the** analysis **of** textile dyes (Rhodamin B, Methanil yellow, Amaranth) **was** conducted **by** test methods **which** are **according** to the SNI 01-2895-1992. The analysis of cyclamate and benzoate **level** in several provinces was conducted using SNI 01-2893-1992 **and** SNI 01-2894-1992 respectively. Microbiological test for **TPC** is commonly **using** agar **pour** plate; meanwhile *E.coli* **and** *S. aureus* using inoculation, isolation, and **identification** with **media** on **tube**.

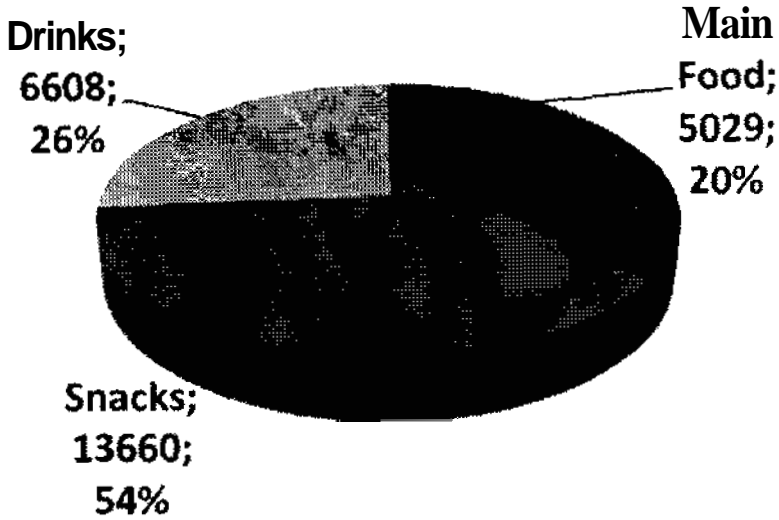
### **Determination of Cyclamate and Benzoate Exposure in School Children**

The exposure **of** cyclamate and benzoate (mg/cap/day) was calculated by multiplying the consumption of certain type of snack food using cyclamate or benzoate (g/cap/day) **with** the cyclamate or benzoate content **in those** type of **food** (mg/kg) in each province. Total exposure of **cyclamate** or benzoate obtained was then **calculated** the **exposure** value **per** child **based** on the average of **student body weight (BW)** in each province (mg/kg BW/day), and also compared with **ADI (Acceptable Daily intake)** for cyclamate and benzoate.

## **RESULT AND DISCUSSION**

### **Profile of School Children Food**

**The result** of data collection of SCF **sold** in school of survey location was **grouped as** main food, **snacks**, and **drinks**. Of **more than** 25000 **types of food sold**, snacks had the **greatest** amount as compared to **two other food groups**, i.e. as many as **13.660 or 54.1%**.



**Figure 1.** The number of SCF based on group of food

The main food group mostly (94.0%) consisted of dish menu, only 6.0% was processed food included instant noodles. The dish menu group was mostly (61.0%) processed products with rice. Snacks group had the greatest amount of whole types of food sold in school area (54.0%) (Figure 2). On the drinks group, iced drinks was the most drink sold in school area i.e. as many as 42.0% (Figure 3).

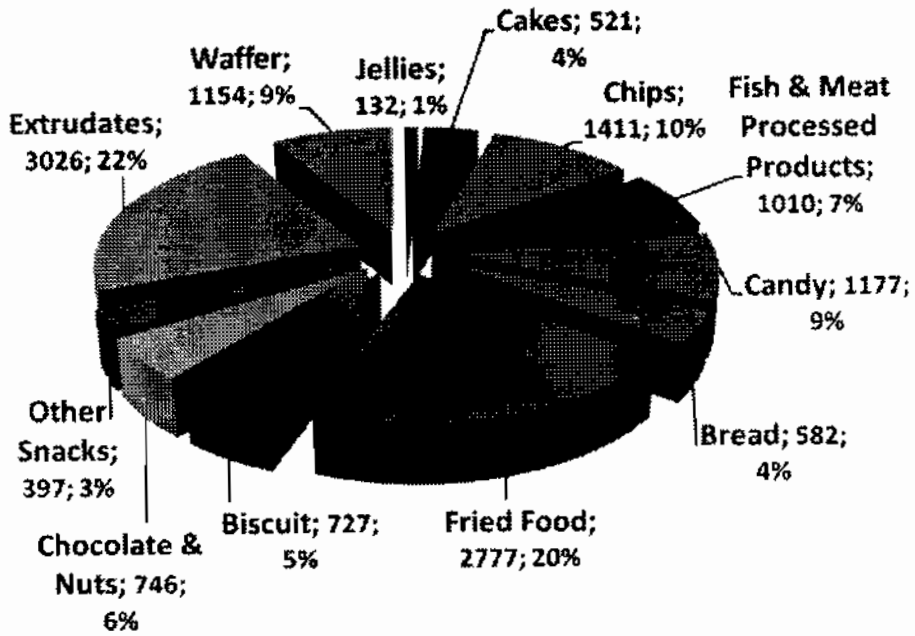


Figure 2. Profile of snacks group of SCF sold in school

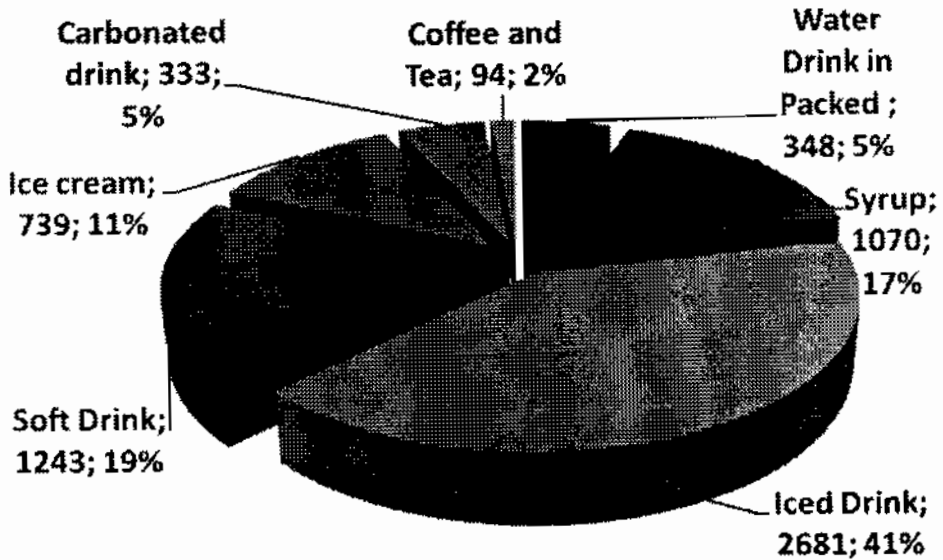


Figure 3. Profile of drinks group of SCF sold in school

More than a half (56.0%) of SCF formed as ready-to-eat food, 36.0% was registered as domestic brand (MD); only 2.0% of food group was registered as small industry product (SP-PIRT), and none was registered as foreign brand (ML). However, there was 6.0% or a total 1426 of the SCF which was not registered. All of the unregistered products were snack group.

## **Profile of Food Chemical Safety of School Children Food**

### **Main Food**

Main food was grouped into 3 major groups, i.e. (A) Processed food using wheat flour (chicken noodle, meatball noodle, and other noodles); (B) Processed food using rice (rice and other processed rice); and (C) other products.

The result of analysis (Table 1) showed that 12.9% main food of total sample analyzed (N=709) was positive for formaldehyde. Of the rice based processed food (yellow rice, fried rice, rice cooked with coconut milk, rice cake and rice cake with vegetables), 7.3% contained formaldehyde. Meanwhile, 4.9% of processed products using wheat flour also contained formaldehyde.

**Table 1.** Result of the hazardous chemical in main food group of SCSF

No	Group of Food	FORMALIN				BORAX			
		N TOT	N (+)	%(1)	%(2)	N TOT	N (+)	%(1)	%(2)
<b>A</b>	<b>Wheat Flour Based</b>	<b>247</b>	<b>35</b>	<b>14,17</b>	<b>4,94</b>	<b>217</b>	<b>45</b>	<b>20,74</b>	<b>5,84</b>
1	Chicken noodle	13	0	0,00	0,00	9	0	0,00	0,00
2	Meatballs noodle	133	34	25,56	4,80	163	41	25,15	5,32
3	Other noodle products	101	1	0,99	0,14	45	4	8,89	0,52
<b>B</b>	<b>Rice Based</b>	<b>423</b>	<b>52</b>	<b>12,29</b>	<b>7,33</b>	<b>512</b>	<b>26</b>	<b>5,08</b>	<b>3,38</b>
4	Rice products	367	50	13,62	7,05	437	20	4,58	2,60
5	Other rice products	56	2	3,57	0,28	75	6	8,00	0,78
<b>C</b>	<b>Other main food</b>	<b>39</b>	<b>5</b>	<b>12,82</b>	<b>0,71</b>	<b>41</b>	<b>4</b>	<b>9,76</b>	<b>0,52</b>
	<b>Total sample [ABC]</b>	<b>709</b>	<b>92</b>		<b>12,98</b>	<b>770</b>	<b>75</b>		<b>9,74</b>

Description → %(1): N(+) to sub group of food, %(2): N(+) to N Total

As many 9.7% of food samples of total samples analyzed (N=770) were positive for borax. Wheat flour-based processed food (5.8%) contained this misused additive. As many as 3.4% of processed rice (rice cooked with coconut milk, fried rice, and yellow rice) also contained borax and it was only 0.5% of other food products group (satay and tekwan (fish ball soup)) contained borax.

### Snacks

Snacks were grouped into 6 group include (1) Processed food using non-wheat flour, (2) bread, (3) processed food using wheat flour other than bread, (4) dried snack, (5) sauce, chili sauce, jam and (6) other snacks.

The chemical analysis result (Table 2) showed that 16% snacks of samples analyzed (N=716) were positive for formaldehyde and 9.1% snacks of samples analyzed (N=81) were positive for borax. The snack group which primarily contained formaldehyde and borax were processed food using non-wheat flour such as empek-empek (fish cake), cassava chips, and fried banana.

**Tabel 2.** Result of hazardous chemical in snacks group of SCF

No	Group of Food	FORMALIN			BORAX		
		N	NCS	%NCS	N	NCS	%NCS
1	Processed food using non-wheat flour	203	31	4.33	333	32	3.60
2	Bread	166	22	3.07	183	5	0.56
3	Processed food using wheat flour other than bread	59	22	3.07	68	2	0.22
4	Dried snack	143	24	3.35	137	25	2.81
5	Sauce, chili sauce, jam	12	0	0.00	12	0	0.00
6	Other snacks	133	16	2.23	156	17	1.91
	<b>Total</b>	<b>716</b>	<b>115</b>	<b>16.06</b>	<b>889</b>	<b>81</b>	<b>9.11</b>

All snack groups analyzed commonly contained Rhodamin B, except the sauce, chili sauce and jam group. However, only 2.2% snacks of samples analyzed (N=781) were positive for Rhodamin B. Snacks which was found to contain Rhodamin B were empek-empek, bread, doughnut, cassava chips, mungbean porridge and fried banana.



Analysis result of Methanil Yellow in samples (N=688) showed that there was 0.4% snack was positive for Methanil Yellow. Those snacks were wet chips and cassava chips. Meanwhile, as many as 1.4% snacks of samples analyzed (N=701) contained Amaranth. The snacks groups containing Amaranth were processed food using wheat flour, bread and sauce, chili sauce and jam (Table 3).

**Table 3.** Result of hazardous colorant in snacks group of SCF

No.	Group of Food	Rhodamin B			Methanil Yellow			Amaranth		
		N	NCS	%NCS	N	NCS	%NCS	N	NCS	%NCS
1	Processed food using non-wheat flour	263	3	0.38	171	2	0.29	170	2	0.29
2	Bread	167	7	0.90	168	0	0.00	170	2	0.29
3	Processed food using wheat flour other than bread	58	2	0.26	58	0	0.00	58	0	0.00
4	Dried snack	135	1	0.13	135	1	0.15	135	0	0.00
5	Sauce, chili sauce, jam	25	0	0.00	25	0	0.00	37	6	0.86
6	Other snacks	133	4	0.51	131	0	0.00	131	0	0.00
	<b>Total</b>	<b>781</b>	<b>17</b>	<b>2.18</b>	<b>688</b>	<b>3</b>	<b>0.44</b>	<b>701</b>	<b>10</b>	<b>1.43</b>

Analysis of sweetener (Table 4) showed that 74.3% samples of total samples analyzed (N=305) were positive for cyclamate and about 4.0% (N=12) of samples had cyclamate over than its maximum amount allowed by the standard. Those samples were processed food using non wheat flour such as empek-empek, doughnut, cassava chips, mungbean porridge, and sausage.

Based on the analysis of benzoate content (number sample analyzed N=438), 62.0% of food samples were positive benzoate and 5.0% (N=23) of samples contained benzoate above the maximum amount allowed. Those food samples were empek-empek, bread, doughnut, cassava chips, cimol sauce, lumpia, and sausage.

**Table 4.** Level of cyclamate and benzoate in snacks group of SCF

No.	Group of food	Cyclamate			Benzoate		
		N	NCS	%NCS	N	NCS	%NCS
1	Processed food using non-wheat flour	86	4	1,31	171	3	0,68
2	Bread	93	0	0,00	111	10	2,28
3	Processed food using wheat flour other than bread	3	1	0,33	37	1	0,23
4	Dried snack	47	3	0,98	63	3	0,68
5	Sauce, chili sauce, jam	11	0	0,00	10	2	0,46
6	Other snacks	65	4	1,31	46	4	0,91
	<b>Total</b>	<b>305</b>	<b>12</b>	<b>3,93</b>	<b>438</b>	<b>23</b>	<b>5,25</b>

### Drinks

Drinks were grouped into 5 major groups. Those 5 groups were (1) Water in pack, (2) Ice stick, (3) Iced drinks, (4) Syrup, and (5) Tea beverages.

The analysis of Rhodamin B (N=969), Methanil Yellow (N=877) and Amaranth (N=860) in drinks samples showed positive result of 4.0%, 3.7% and 5.0% respectively. Syrup and iced drinks were groups with most content of these 3 hazardous colorants. Tea beverages group also contained Rhodamin B and Amaranth; meanwhile water in pack and ice stick did not contain any of these 3 coloring additives (Table 5).

**Table 5.** Result of hazardous chemical in drink group of SCF

No.	Group of Food	Rhodamin B			Methanil Yellow			Amaranth		
		N	NCS	%NCS	N	NCS	%NCS	N	NCS	%NCS
1	Water in pack	24	0	0.00	24	0	0.00	24	0	0.00
2	Iced stick	10	0	0.00	10	0	0.00	10	0	0.00
3	Iced drink	100	6	0.62	98	3	0.34	86	4	0.47
4	Syrup	540	29	3.00	453	30	3.42	451	28	3.26
5	Tea beverages	294	4	0.41	292	0	0.00	289	11	1.28
	<b>Total</b>	<b>968</b>	<b>39</b>	<b>4.03</b>	<b>877</b>	<b>33</b>	<b>3.76</b>	<b>860</b>	<b>43</b>	<b>5.00</b>

The benzoate analysis in drinks (N=521) showed that 69.0% of samples were positive for benzoate and 3.8% of samples contained benzoate over than its maximum allowable amount. Of 687 samples analyzed for the cyclamate content, as many as 81.0% were positive and 7.0% of samples contained cyclamate over than its maximum allowable amount. Syrup and iced drinks groups were the dominant groups that contained either cyclamate or benzoate above standards (Table 6).

**Table 6.** Level of cyclamate and benzoate in drink group of SCF

No.	Group of Food	Cyclamate			Benzoate		
		N	NCS	%NCS	N	NCS	%NCS
1	Water in pack	25	1	0.15	24	0	0.00
2	Iced stick	-	-	-	8	0	0.00
3	Iced drink	74	9	1.32	63	7	1.34
4	Syrup	388	36	5.27	292	11	2.11
5	Tea beverages	196	139	0.4	134	2	0.38
	<b>Total</b>	<b>683</b>	<b>185</b>	<b>7.2</b>	<b>521</b>	<b>20</b>	<b>3.84</b>

## Microbiological Safety of School Children Food

### Main Food

Microbiological analysis was conducted on main food group was total plate count (TPC) and *Staphylococcus aureus*. Based on TPC analysis of main food samples (Table 7), of samples analyzed (N=327), as many as 45.9% of samples were of poor quality. The maximum standard of TPC is  $5 \times 10^4$  CFU/g (ICMSF). Meanwhile, 37% (N=46) of samples were found to contain *S. aureus* and 32.6% of those sample did not comply with the standard. The maximum standard of *S. aureus* in ready-to-eat food is 20 CFU/g (ICMSF).

**Table 7.** Microbiological test result of TPC and *S. aureus* (Log (CFU/ml or CFU/g) in main food group of SCF

No.	Group of Food	TPC			<i>S. aureus</i>		
		N	NCS	%NCS	N	NCS	%NCS
<b>A</b>	<b>Wheat Flour Based</b>	<b>111</b>	<b>45</b>	<b>13.76</b>	<b>12</b>	<b>3</b>	<b>6.52</b>
1	Chicken noodle	10	7	0.31	1	0	0.00
2	Meatballs noodle	55	43	6.12	11	3	6.52
3	Other noodle products	46	30	7.34	-	-	-
<b>B</b>	<b>Rice Based</b>	<b>245</b>	<b>103</b>	<b>31.50</b>	<b>30</b>	<b>12</b>	<b>26.09</b>
4	Rice products	208	92	28.13	30	12	26.09
5	Other rice products	37	11	3.36	-	-	-
<b>C</b>	<b>Other Group</b>	<b>16</b>	<b>10</b>	<b>0.61</b>	<b>4</b>	<b>0</b>	<b>0.00</b>
	<b>Total sample [ABC]</b>	<b>372</b>	<b>292</b>	<b>45.87</b>	<b>46</b>	<b>15</b>	<b>32.61</b>

### Snacks

As many as 27.8% of 253 samples analyzed did not comply with the standard, and those food samples belong to group of processed food using non wheat flour and other snacks such as meatball stick, cilok, cilok sauce, cimol, wet chips, empek-empek, pastry, doughnut, cassava chips, bakwan, rice cake, banana cake, lumpia, nagasari, fried banana and putu.

The *Staphylococcus aureus* analysis on 45 samples of processed food using non wheat flour and other snacks group, it was found that 42% of snack samples were positive for *S. aureus* and 7% of those samples (cilok, bread, mungbean porridge, and fried banana) did not comply with the standard (Table 8).

**Table 8.** Microbiological test result of TPC and *Staphylococcus aureus* (Log (CFU/ml or CFU/g) on snacks group of SCF

No.	Group of Food	TPC			<i>S. aureus</i>		
		N	NCS	%NCS	N	NCS	%NCS
1	Processed food using non-wheat flour	107	34	10,49	13	4	8.89
2	Bread	61	11	3.40	28	1	2.22
3	Processed food using wheat flour other than bread	28	3	0.93	-	-	-
4	Dried snack	64	16	4.94	-	-	-
5	Sauce, chili sauce, jam	-	-	-	-	-	-
6	Other snacks	64	26	8.02	4	2	4.44
	<b>Total</b>	<b>324</b>	<b>90</b>	<b>27.78</b>	<b>45</b>	<b>7</b>	<b>15.56</b>

### Drinks

As many as 9.5% of 415 drinks samples analyzed did not comply with the TPC standard. Those drinks were iced drinks and syrup, with 5.6% and 3.4% respectively samples contained TPC above the allowable limit. Based on *E. coli* analysis (total sample was 155) of drinks group, it was found that 69.0% did not comply with standard. The number of samples contained *E. coli* in iced drinks, syrup, and tea beverages group was 37.4%, 24.5% and 7.1% respectively (Table 9).

**Table 9.** Microbiological test result of TPC and *E. coli* (Log (CFU/ml or CFU/g) on Drink Group of SCF

No.	Group of Food	TPC			<i>E.coli</i>		
		N	NCS	%NCS	N	NCS	%NCS
1	Water in pack	11	2	0.49	-	-	-
2	Iced stick	2	0	0.00	-	-	-
3	Iced drink	46	23	5.58	17	11	7.10
4	Syrup	207	14	3.40	73	58	37.42
5	Tea beverages	146	0	0.00	65	38	24.52
	<b>Total</b>	<b>412</b>	<b>39</b>	<b>9.47</b>	<b>155</b>	<b>107</b>	<b>69.03</b>

## The Exposure Value of Cyclamate and Benzoate of SCF on Students

The average exposure of cyclamate and benzoate of SCF for snacks and drinks group on elementary students was 1.43 mg/Kg BW and 0.89 mg/Kg BW respectively. Students in Bali, South Kalimantan and Riau had higher exposure value to cyclamate than other provinces i.e. as many as 3 mg/Kg BW. Meanwhile, of the students in Riau province tends to have higher exposure value to benzoate than other provinces i.e. about 2 mg/Kg BW. However, both average exposure values were still lower than ADI (Acceptable Daily Intake) value i.e. as many as 11 mg/Kg BW for cyclamate and 5 mg/Kg BW for benzoate.

## CONCLUSION

The snack food group which was mostly sold in school area was snacks group (54.1%) as compared to main food and drinks group. Of whole snack food groups sold, more than half of SCF (55.8%) formed were ready-to-eat food, and 36.0% was registered as domestic brand (MD)

**Of the main food group**, 12.9% food samples were positive for formaldehyde, and 9.7% samples were positive for borax. Based on total plate count (TPC) of the food samples, 45.9% were of poor quality and based on *S. aureus* analysis, it was found 32.6% of samples did not comply with the standard.

**Of the snacks group**, as many as 16.0%; 9.0%; 2.0%; 0.4%; and 1.4% respectively samples were positive for formaldehyde, Rhodamin B, borax, methanol yellow and amaranth. As many as 4% and 5% samples did not comply with standard (NCS) for cyclamate and benzoate, respectively. Based on TPC of snacks group, 28% samples were of poor quality and based on *S. aureus* analysis, it was found 16% of samples did not comply.

**Of the drinks group**, as many as 4.0%; 3.7% and 5.0% samples were positive for rhodamin B, Methanil yellow and amaranth respectively. As many as 3.8% and 7.0% samples did not comply with standard for benzoate and cyclamate respectively. Based on TPC of

drinks group, 9.5% of samples were of poor quality and 69% of samples contained *E. coli* above the standard.

The national exposure value of cyclamate and benzoate in school children foods is still lower than the ADI value.