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RESEARCH PAPER

The impact of food hygiene and sanitation on food quality in public and private elementary school canteens

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Abstract

Cases of food poisoning after consuming snacks, food, and drinks from elementary school canteens are still widely occurring in the Central Java Province of Indonesia. This study aimed to evaluate food hygiene sanitation and food quality in public and private elementary school canteens. This study was an observational study with a cross-sectional design. The sample was 225 school canteens selected by stratified random sampling techniques. Hygiene and sanitation data were obtained using an observational checklist from the Indonesian Health Ministry and laboratory tests. Physical observations and laboratory tests were used to examine the food quality in school canteens and the canteen premises. The data were analyzed using the chi-square and Fisher's exact test. The results showed that the quality of school canteen food that did not comply with the six criteria of food hygiene and sanitation was 0.88%, 7.1% in chemical tests, and 44% in microbiological tests. It also revealed differences in the food quality in the chemical testing in public and private school canteens ($p = 0.039$). There was a relationship between food quality, food raw materials ($p = 0.022$), and the kitchens where the food is prepared ($p = 0.006$). There were differences in the physical test results between food raw materials and food quality in public and private primary school canteens ($p = 0.034$). The findings confirmed that hygiene and sanitation have an impact on food quality. Chemical food contamination was introduced to the food through cheap, poor-quality additives and preservatives, which are banned for use in the food industry. This study highlights the need for regular implementation, guidance, and enforcement of food safety checks in school canteens, emphasizing food hygiene and sanitation to prevent deliberate food contamination and cross-contamination from the surrounding environment, storage, and handling.

1. Introduction

Food is needed for human survival. One of the food providers in Indonesian schools is school canteens. School canteens sell a variety of snacks and drinks in schools, and school children love them. Snacks account for 10.5-36.0% and 11.1-27.4% of students' daily energy and protein needs, respectively, during their time (6-8 hours/day) at school (Mensink *et al*., 2012; Nila, 2013; BPOM RI (Indonesia National Agency of Drug and Food Control, 2014; Shen *et al*., 2015; Wiraningrum *et al*., 2015; Otuneye *et al.,* 2017; Hidayanti *et al*., 2022). More than 90% of them buy snacks at school (Hadi et al., 2021). Snacks can provide an alternative to the nutritional needs of elementary school students. However, snack safety in school canteens has become a problem. Microbiological problems and unhygienic ready-to-eat foods were often found in school canteens. This condition is due to the chemical contamination of processed food products. In addition, the problem is caused by food handling procedures that ignore aspects of food safety, so food monitoring in the canteen is the main focus in realizing a healthy school canteen (Rahman *et al*., 2018) to avoid food contamination. One of the reasons for food contamination is poor food

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hygiene and sanitation (Rohmah *et al*., 2018).

Cases of food poisoning are rarely reported. However, there have been about 48 million food poisoning cases in the United States, with 3000 deaths (Scharff *et al.*, 2016). Based on the Integrated Disease Surveillance Program (IDSP) report in India from 2009 to 2018, food poisoning accounted for 572 deaths (Bisht *et al.,* 2021). In the Philippines, foodborne diseases afflicted 4,964 school-age students and 25 school teachers over 17 years; out of the 3919 hospitalization cases, about 58% of the cases were children in the age bracket of kindergarten to Grade 6 (Limon *et al*., 2022). In Indonesia, cases of foodborne diseases led to 291 deaths between 2000 and 2015 (Arisanti *et al*., 2018). In the Cimahi area of Bandung city, food poisoning cases are still present, and West Java generally has the highest number of food poisoning cases in Indonesia (Riyanto *et al*., 2018). In Central Java province, poisoning cases could still be found in Semarang City (Lathif, 2019; Radlis, 2019; Zamani, 2020). Snacks contributed to 13.5% of the food poisoning cases in Indonesia, and 18.5% of the cases occurred in the school environment, with the highest group of the affected cases being elementary school students (SD) (BPOM RI (Indonesia National Agency of Drug and Food Control), 2015).

Several studies have shown that many harmful and prohibited ingredients are still used as food additives, such as formalin, borax and Rhodamin B (Matondang *et al*., 2015; Suntaka *et al*., 2015 Pratmanitya and Aprilia, 2016). In general, consuming harmful food additives negatively impacts health in the long term, which may lead to conditions such as cancer. Moreover, the consumption of harmful food additives in high doses can cause direct adverse effects on health, such as poisoning and even death. One food group vulnerable to being contaminated with harmful food additives is snacks commonly consumed by school children. Practitioners, especially the government, have implemented policies to reduce the misuse of food additives, including enforcing regulations on food additives. However, the continued use of harmful food additives in food is attributed to economic factors, inadequate knowledge, and law enforcement issues. Tests of snack samples for school children from 538 elementary schools in 26 cities in Indonesia showed that 45% of snack samples tested did not comply with food safety because they were found to contain microbial contaminants and prohibited food additives (Wahyudi, 2017).

The chemical additives were used to reduce production costs and extend the food storage period (Pratmanitya and Aprilia, 2016). In the short term, the impact of chemicals like borax can cause symptoms of malaise, nausea, vomiting blood, diarrhea, anxiety, tremors, and mental pressure on the central nervous system. It can affect the pharynx and eardrum membranes. The long-term impact of borax can cause some digestive problems, kidney injuries, liver problems, seizures, circulatory system failure, and death (Fauzi and Susanna, 2019; Ghanwat and Sontakke, 2019). Therefore, this study aims to evaluate the existing food hygiene and sanitation in public and private elementary school canteens in Semarang City, the capital of Central Java Province, on the quality of the food. The study is expected to provide data for maintaining and monitoring food quality to ensure food safety in the school canteens.

2. Materials and methods

2.1 Study design

It is an observational study with a cross-sectional design

2.2 Quantity and sampling technique

The population in this study was 512 elementary schools in Semarang City with canteens. We use the Slovin formula to obtain the number of school canteens for sample size.

$$n = \frac{N}{1 + N\,(d^2)} = \frac{512}{1 + 512\,(0.05^2)}$$

The calculated results were 225 elementary schools with canteens of which, 145 were public schools and 80 were private schools. The sample schools were selected by stratified random sampling from five districts and sixteen educational authorities. Figure 1 shows the map of Semarang city and sampling sites of the school canteens.

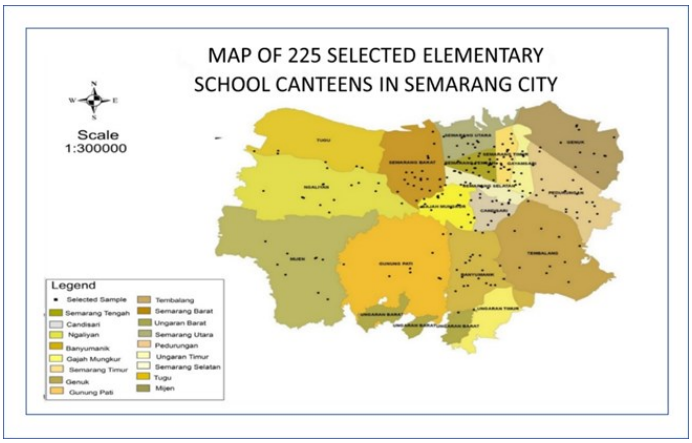

Figure 1. Map of Semarang city and sampling sites of the elementary school canteens.

2.3 Data collection

2.3.1 Hygiene and sanitation checklist

Data collection was conducted at the beginning of 2020 in Semarang City elementary school canteens.

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Collection of food hygiene and sanitation data was conducted based on six criteria (Raw materials, the finished food, storage of raw material, Kitchen space, food processing equipment, and food serving) from the Indonesian Ministry of Health checklist observation sheets (Menteri Kesehatan Republik Indonesia, 2018). Observation criteria according to the checklist mentioned above consisted of the following checklist:

Raw material: food ingredients are fresh, not rotten, and not spoiled; packaged food ingredients do not expire.

Finished food: no smell, which is not the signature scent, not slimy, not mouldy, not expired.

Storage of raw material: Separate placement of ingredients from finished food. Pesticides are not allowed in the storage area; there is a refrigerator that can be used to store food, free from insects and mice.

Kitchens Space: The kitchen building must be kept clean, not directly related to latrines and firecrackers, kitchen countertops should be easy to clean, there is a means or tool that serves as a way out of the smoke, and kitchen space should be free of insects and mice, minimum exposure of 10-foot candles, Flat floor, easy to clean and not slippery, there are facilities or a place for washing hands equipped with soap, there is a place for washing equipment, there is a robust, waterproof and closed trash can.

Food processing equipment: it must be clean, not cracked, not faded, not corroded, clean cloth/ napkin use, and not dirty, equipment should be stored in storage racks, and the cutting board should not made of wood

Food serving: Serving containers must be closed, free of rust, and clean; Serving time should not be more than 6 hours after cooking for high protein and coconut milk foods (after more than 6 hours must be reheated); each type of food is served in a separate container, the storefront is easy to clean, does not rust, is not made of materials containing toxic, hazardous materials.

The observation results were designated as" comply" when the score of the six criteria was ≥70%. When the score of the six criteria is <70 %, it is designated as "not comply."

2.3.2 Food quality evaluation

Food quality evaluation consisted of microbiological, chemical and physical contaminants. Microbiological and chemical contaminants were determined according to a standard method (Riyanto *et al.*, 2018). Microbiological determination consisted of total plate count (TPC), *Coliform* and *E. coli*. Chemical contaminants were borax, formalin, rhodamine-B, metanil-yellow dye, saccharin and cyclamate; and physical contaminants were hair, gravel, bones and staples. The laboratory tests of food and beverage samples were based on food groups sold in the canteen, i.e., main foods, wet snacks, dry snacks, drinks, and fruit, with priority on foods and drinks that do not have a food label. When microbiological, chemical, and physical contaminants were not found, it was designated as negative, and when they were found, they were designated as positive.

2.4 Research variables

The variables in this study were food hygiene, sanitation, and food quality in public and private elementary school cafeterias. This study examines food hygiene and sanitation using six criteria (food raw materials, finished food, raw material storage, kitchen space, food processing equipment, and food serving).

2.5 Statistical analysis

Food hygiene and sanitation and food quality were analyzed descriptively using frequency distribution tables. The Chi-Square Statistical test analyzed the relationship between the variables for categorical data. If an expected frequency value is less than 5, the Fisher exact test was conducted.

2.6 Ethics

This research has passed the ethical clearance test by the Ethics Committee of the Faculty of Public Health of Diponegoro University and was granted ethical approval No.49/EA/KEPK-FKM/2020.

3. Results and discussion

Approximately 69.7% of elementary schools in Semarang City have mixed canteens with the entrustment of a second party that processes their food and self-processing (Table 1). Food coming from outside the canteen cannot be monitored and assessed directly because the suppliers process and prepare the food from their respective homes to save time due to the long cooking process. In addition, some schools only provide a limited place to sell food. With this condition, some sellers bring partially prepared food and portable cooking utensils to finish the preparation of certain foods in the school canteen. A typical example of such food is deep-fried foods and drinks. Each school has at least one canteen on the premises, and there are some schools with more than one. Schools with more than one canteen are more challenging to monitor for food hygiene and sanitation because the school superintendent officers are

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limited; they are usually sports teachers with other duties.

Table 1. Characteristics of the school canteens.

Category	n	%
School status		
Public	145	64.4
Private	80	35.6
Food processing		
Self-processing food	43	19.1
Second-party food supplier	25	11.1
Self-processing food and second-party food supplier (mixed)	157	69.7
Number of canteen in each school		
One canteen	174	77.3
Two canteens	29	12.9
More than two canteens	22	9.8

Physical testing revealed that there were still low-quality snacks in school canteens that did not meet the requirements for physical testing (0.88%) (Table 2). Physical contaminants in the form of hair were found in snacks. This contaminant is similar to findings by Sadiku *et al.* (2020), who found hair in snacks. It may not directly affect health, but its unpalatable appearance may distort the consumer's appetite, and if it is contaminated with *Staphylococcus aureus* bacteria may cause indigestion (Al-Bahry *et al.*, 2014).

The most common chemical contaminants in snacks in 7.1% of school canteens manifested as food preservatives (Table 2). The results of the food coloring test showed that the food was free of non-food colorings such as Rhodamine B and methanol yellow. The testing of artificial sweeteners did not find saccharin and cyclamate in the food. However, tests on food preservatives found that the sampled food contained borax and formalin even though the chemical can no longer be used in food. Ministerial Regulation Number 33 of 2012 of the Minister of Health of the Republic of Indonesia concerning Food Additives states the prohibited use of these chemicals as food preservatives or additives in Indonesia (Kementerian Kesehatan RI, 2012). A study in Bitung, Indonesia, by Suntaka *et al*.

Table 2. Frequency distribution of food hygiene and sanitation and the overall food quality.

Hygiene and food sanitation	n	%	Notes
Raw materials			
Comply	189	84	
Not comply	36	16	
Finished food			
Comply	225	100	
Not comply	0	0	
Storage of raw materials			
Comply	141	62.7	Most do not have a refrigerator
Not comply	84	37.3	
Kitchen			
Comply	89	39.6	
Not comply	136	60.4	
Food processing equipment			
Comply	77	34.2	
Not comply	148	65.8	
Food serving			
Comply	11	4.9	Almost entirely no display case
Not comply	214	95.1	
Food Quality			
Physical contaminant			
Positive	2	0.88	Hair
Negative	223	99.1	
Chemical contaminant			
Positive	16	7.1	Borax, formalin
Negative	209	92.9	
Microbiological contaminant			
Positive	99	44	Total Plate Count (TPC), Coliform and *E. coli*
Negative	126	56	

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(2015) shows that among the meatballs sold by street vendors, 22% contained formalin. Another study by Pratmanitya and Aprilia (2016) showed that 15.3% of snack samples sold to primary school children in Bantul contained borax. Consumption of borax in low doses does not directly impact health. However, its accumulation in the liver, brain, and testicles may cause side effects in the long term (Amir, 2014).

The microbiological testing produced the highest positive results (44%) compared to physical and chemical contaminants tests (Table 2). The samples tested were positive for coliform and *E. coli*. The type of food tested in this study is the same as reported by (Hadi et al., 2021) and Rachmadewi *et al*. (2021) packaged foods that contain high levels of sugar and salt. Some iced tea drinks that use sugar and ice cubes can potentially be contaminated microbiologically and chemically. A study showed that microbial contamination in beverages comes from ice cubes and unprocessed utensils contaminated with bacteria (Hadi *et al*., 2014; Soukoulis *et al*., 2014). Several factors cause bacterial contamination of food: water availability, temperature, and the right time (Vurayai *et al*., 2022). Street food snacks are easily contaminated with bacteria due to various factors, including food transportation, the location of sale, the food preparation process, and how the food is served (Makkau *et al*., 2019).

When assessing the sanitation aspect, most of the kitchens were found not to comply. Most of them (60.4% - Table 2) were not processing the food in their kitchen but getting it from other suppliers outside the school (second-party food suppliers). Besides, the kitchen facilities were inadequate - no chimney, inadequate utensils, and not clean as per the required standard.

This study shows that private schools are better in terms of food hygiene and sanitation, especially in terms of food raw materials and food quality through physical contamination checks, compared to public elementary schools (Table 3). This research corresponds to research in Brazil by Wognski *et al.* (2021), which found that most assessments of hygiene practices were better in private elementary schools than in public elementary schools. Based on this research, all operational costs of public elementary schools come from the government through the School Operational Assistance Fund (BOS) (Karmila, 2016; Herman *et al*., 2019). Meanwhile, private elementary school funding comes from various sources, including government, foundations and dues from parents of students. This research did not investigate the reason behind the better hygiene, sanitation and food quality in private schools than in public schools.

The food hygiene and sanitation physical testing results indicated that the food raw materials generally affected food quality in public elementary schools (Table 4). On the aspect of food hygiene and sanitation, 8.5% (Table 4) of public elementary school kitchens in the 'comply' category had chemical contamination, compared to 19% in private school kitchens. On the storage of raw materials, 46.1% of the sampled private elementary schools for traces of chemicals compared to 6.7% of the public schools in the 'comply' category. All the samples indicated no chemical contaminants in the aspect of 'Food Serving'; 100% of public and private schools had negative test results. Chemical contaminants in food can be found because when buying, the raw material already contains preservatives such as formalin and borax. At the time of food processing, preservatives are deliberately added to the food, which is prohibited so that the food can last a long and not spoil quickly. Moreover, the food sellers want to make a more significant profit by using cheap banned preservatives that are readily available while avoiding more pricy preservatives specific to food. Many traders are also ignorant about the prohibitions of these preservatives, thereby endangering the general public's health. Prohibited preservatives such as borax are used to make cheap snacks like crackers and rice cakes, which are popular with the Indonesian public, including children.

There are five keys to Food Safety (World Health Organization (WHO), 2006; BPOM RI, 2012) maintaining good hygiene and cleanliness, separating raw food from cooked food, proper cooking, keeping food at a safe temperature, and using safe water and raw materials. School management and related parties (education and health offices) in private and public schools must regularly check food quality and adequately implement the regulated health checks to perpetuate an excellent food-health culture that will guarantee healthy school canteens. Food safety is necessary for preventing foodborne illnesses. Different health effects may occur if the food served in the canteen does not meet the health requirements. Food supervision in the canteen is the main focus of realizing a healthy canteen (Rahman *et al*., 2018).

3.1 Limitations of the study

The limitation of this study is that not all types of food sold in Indonesian school canteens were examined in this research. However, with particular considerations, unlabeled food was tested based on the researchers' intuition; for example, red crackers were examined for Rhodamine B and meatballs were examined for borax. Tests conducted based on suspicion may miss out on

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Table 3. Frequency distribution of food hygiene and sanitation, and food quality in public and private elementary schools.

	Elementary School				P-value
	Public		Private		
	n	%	n	%	
Food hygiene and sanitation					
Raw materials					
Comply	119	63	70	37	0.382
Not comply	26	72.2	10	27.8	
Finished food					
Comply	145	64.4	80	35.6	1.000
Not comply	0	0	0	0	
Storage of raw materials					
Comply	89	63.1	52	36.9	0.694
Not comply	56	66.7	28	33.3	
Kitchen					
Comply	47	52.8	42	47.2	0.005*
Not comply	98	72.1	38	27.9	
Food processing equipment					
Comply	50	64.9	27	35.1	1.000
Not comply	95	64.2	53	35.8	
Food serving					
Comply	8	72.7	3	27.3	0.791
Not comply	137	64	77	36	
Food quality					
Physical contaminant					
Positive	2	1.4	0	0	0.540
Negative	143	98.6	80	100	
Chemical contaminant					
Positive	6	37.5	10	62.5	0.039*
Negative	139	66.5	70	33.5	
Microbiological contaminant					
Positive	66	66.7	33	33.3	0.633
Negative	79	62.7	47	37.3	

*significantly different at $p<0.05$

tests for unknown compounds. Therefore, the results are insufficient to determine a definitive condition of the food sold in the school canteens. The study also did not examine why some tests on the same aspect presented different results between public schools and private ones. Further studies on the topic would consider examining this aspect as well.

4. Conclusion

The observational and lab tests on the sample school canteens and the food therein reaffirmed the importance of hygiene to quality food and public health. The findings also revealed the existence of a government mechanism for ensuring hygiene and good sanitation for quality food in school canteens. However, the results indicated that many schools, especially public schools, did not meet the cut of the appropriate standard of hygiene to ensure quality food available to school children in their canteens. Issues such as not regularly enforcing existing health standards of food safety at the school level are areas of concern. The same is true for allowing outside parties to provide food to children in schools without having a robust process of regularly checking how they conduct these activities and compelling them to comply with food safety requirements.

The outcome of this research could be instrumental in developing efforts geared towards improving policies and practices in the field of food and nutrition, especially snacks for school children. Awareness creation efforts to food traders and vendors about the dangers of non-food additives are crucial, coupled with strict enforcement against food vendors who indulge in such devious practices that may be detrimental to public health. This

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Table 4. The relationship between food hygiene and sanitation, and food quality in public and private elementary schools in Semarang city.

Food sanitation and hygiene	Food quality									
	Public					Private				
	Positive		Negative		p	Positive		Negative		p
	n	%	n	%		n	%	n	%	
Physical contaminant										
Raw materials										
Comply	0	0	119	100	0.034*	0	0	70	100	1
Not comply	2	7.7	24	92.3		0	0	100	100	
Finished food										
Comply	2	1.4	143	98.6	1.000	0	0	80	100	1
Not comply	0	0	0	0		0	0	0	0	
Storage of raw materials										
Comply	1	1.1	88	98.9	1.000	0	0	52	100	1
Not comply	1	1.8	55	98.2		0	0	28	100	
Kitchen										
Comply	0	0	47	100	0.822	0	0	42	100	1
Not comply	2	2	96	98		0	0	38	100	
Food processing equipment										
Comply	0	0	50	100	0.776	0	0	27	100	1
Not comply	2	2.1	93	97.9		2	2.1	53	97.9	
Food serving										
Comply	0	0	8	100	1.000	0	0	77	100	1
Not comply	2	1.5	135	98.5		0	0	3	100	
Chemical contaminant										
Raw materials										
Comply	6	5	113	95	0.531	10	4.3	60	85.7	0.442
Not comply	0	0	25	100		0	0	10	100	
Finished food										
Comply	6	4.1	139	95.9	1.000	33	41.3	47	58.8	1
Not comply	0	0	0	0		0	0	0	0	
Storage of raw materials										
Comply	6	6.7	83	93.3	0.120	41	46.1	48	53.9	1
Not comply	0	0	56	100		25	44.5	31		
Kitchen										
Comply	4	8.5	43	91.5	0.166	8	19	34	81	0.128
Not comply	2	2	96	98		2	5.3	36	94.7	
Food processing equipment										
Comply	4	8	46	92	0.209	4	14.8	23	85.2	0.929
Not comply	2	2.1	93	97.9		6	11.3	47	88.7	
Food serving										
Comply	0	0	8	100	1.000	0	0	3	100	1
Not comply	6	4.4	131	95.6		10	13	67	87	
Microbiological contaminant										
Raw materials										
Comply	53	45.4	65	54.6	1.000	26	37.1	44	62.9	0.103
Not comply	12	46.2	14	53.8		7	70	3	30	
Finished food										
Comply	66	45	79	54.5	1.000	10	12.5	70	87.5	1
Not comply	0	0	0	0		0	0	0	0	
Storage of raw materials										
Comply	41	46.1	48	53.9	1.000	20	38.5	32	61.5	0.651
Not comply	25	44.6	31	55.4		13	46.4	15	53.6	
Kitchen										
Comply	24	51.1	23	48.9	0.453	14	33.3	28	66.7	0.199
Not comply	42	42.9	56	57.1		19	50	19	50	
Food processing equipment										
Comply	24	48	26	52	0.795	10	37	17	63	0.759
Not comply	42	44.2	53	55.8		23	43.4	30	56.6	
Food serving										
Comply	2	25	6	75	0.404	2	66.7	1	33.3	0.754
Not comply	64	46.7	73	53.3		31	40.3	46	59.7	

*significantly different at $p<0.05$

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work could also call for school stakeholders to devise ways to prevent circumstances that may lead children to take in unsafe and unhealthy food while under their care.

Conflict of interest

The author states that the paper's publication has no conflict of interest.

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References

Al-Bahry, S.N., Mahmoud, I.Y., Al-Musharafi, S.K. and Sivakumar, N. (2014). *Staphylococcus aureus* contamination during food preparation, processing and handling. *International Journal of Chemical Engineering and Applications*, 5(5), 388-392. https://doi.org/10.7763/IJCEA.2014.V5.415

Amir, S., (2014). Analisis kandungan boraks pada pangan jajanan anak di SDN Kompleks Lariangbangi Kota Makassar. Makassar, Indonesia: Universitas Hasanusddin, Thesis. [In Bahasa Indonesia].

Arisanti, R.R., Indriani, C. and Wilopo, S.A. (2018). Kontribusi agen dan faktor penyebab kejadian luar biasa keracunan pangan di Indonesia: kajian sistematis. *Berita Kedokteran Masyarakat,* 34(3), 99 -106. https://doi.org/10.22146/bkm.33852

Bisht, A., Kamble, M.P., Choudhary, P., Chaturvedi, K., Kohli, G., Juneja, V.K., Sehgal, S. and Neetu Taneja, N.K. (2021). A surveillance of food borne disease outbreaks in India: 2009–2018. *Food Control,* 121, 107630. https://doi.org/10.1016/j.foodcont.2020.107630

BPOM RI (Indonesia National Agency of Drug and Food Control) (2015). POM Agency Performance Report. Jakarta, Indonesia: https://www.pom.go.id/new/home/en. [In Bahasa Indonesia].

BPOM RI. (2012). Lima Kunci Keamanan Pangan Untuk Anak Sekolah. Retrieved from BPOM RI website: https://klubpompi.pom.go.id/. [In Bahasa Indonesia].

BPOM RI. (Indonesia National Agency of Drug and Food Control) (2014). Penguatan peran komunitas sekolah untuk penjaminan keamanan pangan. Retrieved from website: https://docplayer.info/45995577-Peran-komunitas-sekolah-untuk-penjaminan-keamanan-pangan.html. [In Bahasa Indonesia].

Fauzi, F.S. and Susanna, D. (2019). Borax Content in Foods Sold in a Campus and Its Trader Characteristics. *Indian Journal of Public Health Research and Development,* 10(1), 346–349. https://doi.org/10.5958/0976-5506.2019.00068.8

Ghanwat, G.H. and Sontakke A.V. (2019). Effect of Vitamin C supplementation on insulin resistance, β-cell function and insulin sensitivity in obese and non obese individuals. *Indian Journal of Public Health Research and Development,* 10(1), 183–188. https://doi.org/10.5958/0976-5506.2019.00038.X

Hadi, B., Bahar, E. and Semiarti, R. (2014). Uji bakteriologis es batu rumah tangga yang digunakan penjual minuman di Pasar Lubuk Buaya Kota Padang Basri. *Jurnal Kesehatan Andalas,* 3(2), 119–122. https://doi.org/10.25077/jka.v3i2.44 [In Bahasa Indonesia].

Hadi, H.K.R., Triastanti, Anggraeni, D., Nurwanti, E. and Lewis, E.C. (2021). The role of the school food environment in improving the healthiness of school canteens and readiness to reopen post COVID-19 pandemic: A study conducted in Indonesia Hamam. *Journal of Public Health*, 11, 2287.

Hidayanti, L., Rahfiludin, M.Z., Nugraheni, S.A. and Murwani, R. (2022). Association between the Habitual Snack Consumption at School and the Prevalence of Overweight in Adolescent Students in Tasikmalaya, Indonesia. *Open Access Macedonian Journal of Medical Sciences,* 10, 980–986. https://doi.org/10.3889/oamjms.2022.9858

Herman, Amin, M.M. and Chiar, M. (2019). Manajemen dana bantuan operasional sekolah di Sekolah Menengah Pertama Bruder Singkawang. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 8(10), 1 -11. [In Bahasa Indonesia].

Karmila, A. (2016). Biaya operasioanal sekolah pada SMP Negeri 5 Poso Kota Utara Kabupaten Poso. *Jurnal Ilmiah Administratie* 6(1), 1–6. [In Bahasa Indonesia].

Kementerian Kesehatan RI. (2012). Permenkes Republik Indonesia No. 33 tentang Bahan Tambahan Pangan. PerMenKes Republik Indonesia No. 33. Retrieved from website: https://pergizi.org/permenkes-no-33-tahun-2012-tentang-bahan-tambahan-pangan/. [In Bahasa Indonesia].

Lathif, A.N. (2019). Polisi selidiki kasus keracunan massal SD 01 Tahunan Jepara. Retreived from Antara News Website: https://jateng.antaranews.com/berita/208201/polisi-selidiki-kasus-keracunan-massal-sd-01-tahunan-jepara. [In Bahasa Indonesia].

Limon, M.R., Paul, J., Vallente, C., John, C., Tarampi, Laurazeah, M.V., Coloma and Ubaldo, E.M. (2022).

Document analysis of foodborne diseases and intervention strategies in Philippine basic education for the last 17 years. *Food Control,* 138, 108984. https://doi.org/10.1016/j.foodcont.2022.108984

Makkau, B.A., Djaja, I.M. and Hartono, B. (2019). Quality of food bacteria in school snacks and canteens in east Jakarta health office working area in 2017. *Indian Journal of Public Health Research and Development,* 10(1), 341–345. https://doi.org/10.5958/0976-5506.2019.00067.6

Matondang, R.A., Rochima, E. and Kurniawati, N. (2015). Studi Kandungan Formalin Dan Zat Pemutih Pada Ikan Asin Di Beberapa Pasar Kota Bandung (Study of Formalin Content And Bleaching Substances In Salted Fish In Several Bandung City Markets). *Jurnal Perikanan dan Kelautan Unpad,* 6 (2), 70–77. [In Bahasa Indonesia].

Menteri Kesehatan Republik Indonesia. (2018). Keputusan Menteri Kesehatan Republik Indonesia. Nomor 942/MENKES/SK/VII/2003 tentang pedoman persyaratan hygiene sanitasi makanan jajanan. Retrieve from Regulasip website: https://www.regulasip.id/book/4946/read [In Bahasa Indonesia].

Mensink, F.F., Schwinghammer, S.A. and Smeets, A. (2012). The healthy school canteen programme: a promising intervention to make the school food environment healthier. *Journal of Environmental and Public Health,* 2012, 415746. https://doi.org/10.1155/2012/415746

Nila, H.R. (2013). Kontribusi makanan jajanan terhadap tingkat kecukupan asupan energi dan protein pada anak sekolah yang mendapat PMT- AS di SD Negeri Plalan 1 Kota Surakarta. *Journal of Chemical Information and Modeling,* 53(9), 1689–1699. https://doi.org/10.1017/CBO9781107415324.004 [In Bahasa Indonesia].

Otuneye, A., Ahmed, P., Abdulkarim, A., Aluko, O. and Shatima, D. (2017). Relationship between dietary habits and nutritional status among adolescents in Abuja municipal area council of Nigeria. *Nigerian Journal of Paediatrics,* 44(3), 128–135. https://doi.org/10.4314/njp.v44i3.1

Pratmanitya, Y. and Aprilia, V. (2016). Kandungan Bahan Tambahan Pangan Berbahaya Pada Makanan Jajan Anak Sekolah Dasar Di Kabupaten Bantul. *Jurnal Gizi dan Dietetik Indonesia,* 4(1), 49–55. https://doi.org/10.21927/ijnd.2016.4(1).49-55

Rachmadewi, A., Soekarjo, D., Maehara, M., Alwi, B., Mulati, E. and Rah, J.H. (2021). School Canteens in Selected Areas in Indonesia: A Situation Analysis. *Food and Nutrition Bulletin,* 42(2), 225–246. https://doi.org/10.1177/03795721211008021

Radlis, M. (2019). 12 Siswa SD di Tembalang Semarang Alami Keracunan Usai Santap Jajanan Ini. Retreived from Tribun Jateng website: https://jateng.tribunnews.com/2019/01/25/12-siswa-sd-di-tembalang-semarang-alami-keracunan-usai-santap-jajanan-ini. [In Bahasa Indonesia].

Rahman, A., Tosepu, R., Karimuna, S.R., Yusran, S., Zainuddin, A. and Junaid, J. (2018). Personal Hygiene, Sanitation and Food Safety Knowledge of Food Workers At the University Canteen in Indonesia. *Public Health of Indonesia,* 4(4), 154–161. https://doi.org/10.36685/phi.v4i4.219

Riyanto, A., Murwani, R., Sulistiyani, Rahfiludin, M.Z. and Megasari, M. (2018). Food preparation safety education of street food vendors around public elementary schools to improve bacteriological and chemical food safety. *The Southeast Asian Journal of Tropical Medicine and Public,* 49(2), 314–320.

Rohmah, J., Rini, C.S. and Cholifah, S. (2018). The relationship between hygiene and sanitation to *Escherichia coli* contamination on foods in a campus cafeteria. In: *IOP Conference Series: Materials Science and Engineering*, 420, 012143. https://doi.org/10.1088/1757-899X/420/1/012143

Sadiku, M.N.O., Ashaolu, T.J. and Musa, S.M. (2020). Food Contamination: A Primer. *International Journal of Advances in Scientific Research and Engineering,* 6(3), 1-7. https://doi.org/10.31695/IJASRE.2020.33736

Scharff, R.L., Besser, J., Sharp, D.J., Jones, T.F.,Germer-Smidt, P. and Hedberg, C.W. (2016). An Economic Evaluation of PulseNet: A Network for Foodborne Disease Surveillance. *American Journal of Preventive Medicine*, 50(5, Suppl. 1), S66-S73. https://doi.org/10.1016/j.amepre.2015.09.018

Shen, M., Hu, M. and Sun, Z. (2015). Assessment of School-Based Quasi-Experimental Nutrition and Food Safety Health Education for Primary School Students in Two Poverty-Stricken Counties of West China. *PLoS ONE,* 10(12), e0145090. https://doi.org/10.1371/journal.pone.0145090

Soukoulis, C., Yonekura, L., Gan, H.H., Behboudi-Jobbehdar, S., Parmenter, C. and Fisk, I. (2014). Probiotic edible films as a new strategy for developing functional bakery products: The case of pan bread. *Food Hydrocolloids,* 39, 231–242. https://doi.org/10.1016/j.foodhyd.2014.01.023

Suntaka, D.F.A.L., Joseph, W.B.S. and Sondakh, R.C. (2015). Analisis kandungan formalin dan boraks pada bakso yang disajikan kios bakso permanen pada beberapa tempat di Kota Bitung tahun 2014 (Analysis of the content of formalin and borax in meatballs served by permanent meatball stalls in

several places in Bitung. *Kesehatan Masyarakat,* 4 (1), 39–45. [In Bahasa Indonesia].

Vurayai, M., Strysko, J., Kgomanyane, K., Bayani, O., Mokomane, M., Machiya, T., Arscott-Mills, T., Goldfarb, D.M., Steenhoff, A.P., McGann, C., Nakstad, B., Gezmu, A., Richard-Greenblatt, M. and Coffin, S. (2022). Characterizing the bioburden of ESBL-producing organisms in a neonatal unit using chromogenic culture media: a feasible and efficient environmental sampling method. *Antimicrobial Resistance and Infection Control,* 11, 14. https://doi.org/10.1186/s13756-021-01042-2

Wahyudi, J. (2017). Mengenali bahan tambahan pangan berbahaya: ulasan. *Jurnal Penelitian dan Pengembangan,* 13(1), 3–12. https://doi.org/10.33658/jl.v13i1.88 [In Bahasa Indonesia].

World Health Organization (WHO). (2006). Five Keys to Safer Food Manual. Retreived from WHO website: http://www.who.int/foodsafety/publications/consumer/manual_keys.pdf.

Wiraningrum, E., Pudjirahaju, A. and Setyobudi, S. (2015). Pangan Jajanan Anak Sekolah (PJAS), Kecukupan Energi dan Zat Gizi Anak Sekolah Dasar (Snack Food for School Children (PJAS), Adequacy of Energy and Nutrients for Elementary School Children). *Jurnal Informasi Kesehatan Indonesia* 1 (1), 25–33. https://adoc.pub/pangan-jajanan-anak-sekolah-pjas-kecukupan-energi-dan-zat-gi.html. [In Bahasa Indonesia].

Wognski, A.C.P., Choma, C., Gava, G.R., Ferreira, B.G.C.S., Vieira, L.P., Oliveira, E.C.D., Santos, V.C., Mezzomo, T.R. and Stangarlin-Fiori, L. (2021). Good hygiene practices in school canteens: evaluation between types of schools and administration as well as presence of technical professional. *Brazilian Journal of Food Technology,* 24, e2019257. https://doi.org/10.1590/1981-6723.25719

Zamani, L. (2020). 85 Siswa di Boyolali Keracunan Usai Santap Jajanan dari Kantin Sekolah. Retreived from kompas website: https://regional.kompas.com/read/2020/02/05/20584951/85-siswa-di-boyolali-keracunan-usai-santap-jajanan-dari-kantin-sekolah?page=all. [In Bahasa Indonesia].

