

The level of *Escherichia coli* contamination in foods and drinks sold at canteens campus

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Abstrak

Latar belakang: Kontaminasi bakterial pada makanan yang disediakan di kantin kampus merupakan hal yang sering terjadi dan dapat mengganggu aktivitas akademik. Penelitian ini bertujuan mengetahui tingkatan kontaminasi *Escherichia coli* pada makanan dan minuman yang dijual di kantin sebuah kampus universitas.

Metode: Sebanyak 49 makanan dan 24 jenis minuman diperiksa dengan menggunakan metode konvensional untuk pengukuran Most Probable Number (MPN), yaitu uji penduga, uji penguat, dan uji pelengkap. Analisis kontaminasi pada makanan dan minuman dilakukan di Laboratorium Kesehatan Lingkungan Fakultas Kesehatan Masyarakat Universitas Indonesia. Analisis data dengan membuat tingkatan kontaminasi berdasarkan kelompok makanan dan minuman serta lokasi kantin.

Hasil: Hampir semua kelompok makanan terkontaminasi. Makanan dengan sambal adalah makanan yang paling berisiko untuk terkontaminasi *E. coli* (90,15%), diikuti oleh makanan kering, sedangkan makanan berkuah adalah yang paling kecil risikonya (38,89%). Minuman yang paling tinggi kontaminasinya adalah jus lacy, diikuti oleh jus jambu, lalu jus sirsak dan orange di peringkat ketiga, sementara jus mangga kontaminasinya terendah. Jus melon, cappucino dan coctail tidak menunjukkan adanya kontaminasi.

Kesimpulan: Makanan dan minuman yang ditemukan pada tiga lokasi yang menduduki urutan tertinggi disebabkan oleh terkontaminasinya alat makan dan tangan penjamah makanan. (*Med J Indones 2011; 20:66-70*)

Abstract

Background: Bacterial contamination is a common phenomenon in foods served in campus canteens and may cause physical illness which will affect academic activity. The aim of this study was to rank the level of *Escherichia coli* contamination in food and drink in campus canteens.

Methods: Forty nine (49) foods and 24 types of drink were examined using conventional agar broth method for calculation of most probable number (MPN). The steps of the method were presumptive test for coliforms, fecal coliforms and *E. coli*, confirms test for coliforms, fecal coli and *E. coli* and then completed test for *E. coli*. An analysis for contamination by *E. coli* in meals, utensils, and on the hands of the server was also undertaken. The data analyzed in percentage and rank all type of foods and drinks, also rank based on the location.

Results: Almost all type of meals was contaminated. Meals with chili sauce were the most risky from the contamination of *E. coli* (90.15%), then followed by dry meals (38.89%), while the wet meals were the most unrisky meals. In drinks, the highest was lacy juice, followed by jambu (guava) juice, then Sirsak and Orange juices on the third rank, while the mango juice was the lowest contamination. Melon juice, cappucino and fruit-coctail did not have *E. coli* contamination.

Conclusion: The contamination in the top three rank of contamination could be from the utensils used and foodhandler. (*Med J Indones 2011; 20:66-70*)

Key words: campus, canteen, drink, *Escherichia coli*, food

Meals that served for university members in campus, mainly served in canteen and some by group of mobile eatery in the area of the campus, which organized or not by the faculty management. Meals contamination may cause physical illness, which related to productivity of the costumers, and will affect the academic activity. The previous studies in the same area found that there were quite low in knowledge on food hygiene and sanitation of the food handlers.^{1,2}

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Canteen in the area of campus means a place where people get meals. Canteen sometimes is also used for discussion or for social events, and the peak time is mostly during the lunch time. Each canteen served different type of meals, from the very light meals to heavy meals. It is necessary to monitor each canteen about the bacterial contamination, for instance, *Escherichia coli*, condition of sanitation, personal hygiene, knowledge and practice of the food handler,

as well as the materials and utensils used, since they are all related to the so called food-borne diseases. Some physical illness that related to hygiene and sanitation of the meals are diarrhea, gastroenteritis and poisoning.³

The Decree of Ministry of Health no.715/MENKES/SK/V/2003 mentioned that it is necessary to control food, people, place and the utensil uses to avoid possible hazards or illness. The decree also mentioned that every eatery or canteen need to have the licence from local government, and for the hygiene and sanitation aspect has to be certified by the local health office. The workers in the canteen has their own health standard, since they related directly to the foods and the instruments that served to the costumers, so they have to possess health and chef certificate, but sometimes is neglected especially in small canteens.

There are limited number of information and literature on food hygiene and sanitation and so are researches in this related area in Indonesia. Survey in Three type of food establishment in Jakarta in 2003 study found that *E. coli* contamination in served cooked, fresh cooked food, and raw food were 12.2 %, 7.5 %, and 40 % respectively. Contamination also found in water, food handlers and kitchen utensil with various percentage, they were 12.9 %, 12.5 %, and 16.9 %.⁴ In an outbreak in Bogor (2005), *E. coli* found in raw meat and beefsteak seemed to be causative organism.⁵

The source of *E. coli* contamination might be from meat, milk, water, and food handlers. It have been proven that all meat (100%) coming from abattoirs and traditional markets were contaminated with *E. coli* O157:H7, in addition to most of the fresh and pasteurized milk samples (73.3%) coming from cattle ranches and home industries. Contamination was also found in most of the water samples (60%) and in food handlers (41.7%).⁶

Another study showed that there are more or les around 35 types of common bacteria exist in foods, some of them are *Bacillus*, *Camphylobacter*, *Clostridium*, *Escherichia*, *Salmonella*, *Shigella*, and *Staphylococcus*.⁷ One of the strains of *E. coli* is *E. coli* O₁₅₇:H₇. The contamination of *E. coli* O₁₅₇:H₇ will risk people with diarrhea and could lead to hemorrhagic colitis, hemolytic uremic syndrome (HUS), and thrombotic thrombocytopenic purpura (TTP), which is quite dangerous to human body.

Canteen costumers in a campus are mostly students, and they prefer to get cheap meals. The problem then is not about cheap or expensive meals, but the most

important aspect is whether these meals are healthy or save to be consumed. During first to fourth semester 2006, gastroenteritis was put at the second position of the ten diseases in University of Indonesia, although moved from 2 to 3 in first semester 2007. In order to know the contaminating bacteria and to guarantee that the foods and or drinks served by canteens are healthy, measuring the presence *Escherichia coli* in food and drinks is needed. The objective of this study was to measure the existence of *E. coli* in all type of foods sold in canteens around the campus of University of Indonesia.

METHODS

This was a cross-sectional study, conducted around campus of University 'X' (this is a university's initial), between 2007 and 2008. Thirteen canteens around the Depok Campus of University of Indonesia were observed for the presence of *E. coli* in meals served in each canteen. For ethical purposes, the real name of the canteens was given by the initial names. Those were A for canteen from Faculty of Mathematic and Sciences, B for Faculty of Engineering, C for Faculty of Law, D for Faculty of Economic, E for Faculty of Psychology, F for Faculty of Humanities, G for Faculty of Social and Politics Science, H for Faculty of Public Health, I Faculty of Nursing, J for Faculty of Computer Science, K canteen next to the Tower, and finally L for Rectorate's canteen. There were 4 category of foods observed and analyzed: dry foods where no water added in the meals, wet foods, and food with *sambal* (chili) and *sambals* itself. Food mixture with *sambal* is kind of traditional meals; named as *gado-gado*, *pecel*, *karedok*, *siomay*, which contain vegetables added or mixed with *sambal* (mix of chili, peanut, onion, garlic, sugar, and salt). A total of 49 type of foods were sampled, consisted of 18 dry food, 14 wet food, 9 food with *sambal* mixture or poured, and 8 type of *sambals* that used in many different type of meals. Twenty four types of drink were also examined, which consisted of 16 juices, 4 iced teas, and others. An analysis for contamination by *E. coli* in meals, utensils, and on the hands of the server was also undertaken. Each sample measured in food and drink, in the utensil used for preparation and serving, and on the hand of the food handlers.

Data were collected by 5 trained collectors. Sample of meals were analyzed in the Faculty of Public Health-University of Indonesia Laboratory for the presence of *E. coli* in meals and drinks using most probable number (MPN) method. The data analyzed in percentage and in

rank of each category of meal for all type of foods, also made rank based on the location where the samples were come from with symbolic letters from A to M (13 locations).

Colonies of the bacteria were calculated using formula;

$$N = \frac{\sum \frac{\text{colony}}{\text{petridish}} \times \frac{1}{p}}{s}$$

Where;

N: number of colonies per mL or gram sample

p: solution ratio

s: volume (mL) or weight of the sample in grams

RESULTS

Totally there were 49 types of foods that divided into 4 categories. The examination found that almost all type

of meals from eah canteen were contaminated by *E. coli*. Meals with *sambal* were the most risky from the contamination of *E.coli* (90,15 %), then followed by dry meals (38,89%), while the wet meals were the the most unrisky meals.

For the dry meals, rice with chicken grilled has the highest contamination of *E. coli*, whereas *Kweetiauw* was the lowest. *Lontong sayur* was in the first rank of *E.coli* contamination in wet meals, while the lowest contamination was lamb soup. In food with *sambal*, *karedok*, *gado-gado*, *pecel*, and *ketoprak* were the type of foods with higher contamination compared with *siomay*. At last, the *sambal* in rib soup and in chicken grilled were riskier than others type of *sambals* from 13 canteens around Campus. (Table 1)

Table 2 shows the rank of 'positive' percent of *E. coli* in drinks per mL from 13 canteens around campus, 2008.

Tabel 1. The rank of 'positive' percentage of *E. coli* in foods (per mL) from 13 canteens around campus, 2008

Food Category	Type of foods	Number of measured (n=49)	Frequency of measured	Number of 'positive'	Percentage of 'positive'	Rank of its category of foods
Dry meals	Fried rice	7	21	5	23,88	4
	Mix rice	3	9	4	44,44	3
	Rice + chicken grilled	1	3	3	100,00	1
	Padang rice	4	12	8	66,67	2
	Kweetiauw	1	3	0	0,00	6
	Fried noodle	2	6	1	16,66	5
	Total		18	54	21	38,89
Wet meals	Lamb soup	1	3	0	0,00	4
	Tongseng	1	3	1	33,33	2
	Meet soup	2	6	2	33,33	2
	Chicken soto	3	9	1	11,11	3
	Noodle soup	2	6	2	33,33	2
	Meat soto	1	3	1	33,33	2
	Rib soto	2	6	2	33,33	2
	Lontong sayur	1	3	2	66,67	1
	Noodle + chicken	1	3	1	33,33	2
Total		14	42	12	28,57	4
With Sambal	Ketoprak	2	6	3	50,00	4
	Gado-gado	4	12	10	83,33	2
	Karedok	1	3	3	100,00	1
	Pecel	1	3	2	66,67	3
	Siomay	1	3	1	33,33	5
	Total		9	21	19	90,15
'Sambal'	in meat soup	1	3	1	33,33	2
	in chicken soto	2	6	0	0,00	3
	in noodle soto	1	3	1	33,33	2
	in rib soup	2	6	4	66,67	1
	for chicken grilled	1	3	2	66,67	1
	for Padang rice	1	3	0	0,00	3
	Total		8	24	8	33,33

The highest *E. coli* contamination was Lacy juice, followed by Guava juice, while the Mango juice was the lowest. Although Sour sop, Guava and Orange juices had a same percentage, here, they were given different rank because the number of samples undertaken was different. Since *Jambu* juice had more samples than

Sour sop and Orange, it is higher in rank, so Sour sop and Orange had the same lower rank because they had the same samples. Melon juice, cappuccino and fruit-cocktail did not have a rank because they were not *E. coli* contamination.

Tabel 2. The rank of 'positive' percentage of *E. coli* in drinks (per mL) from 13 canteens around campus, 2008

Drink Category	Type of drink	Number of measured (n=24)	Frequency of measured	Number of 'positive'	Percentage of 'positive'	Rank of its category of drinks
Juice	Mango	4	12	4	25	6
	Sour sop	2	6	4	67	3
	Guava	4	12	8	67	2
	Orange	2	6	4	67	3
	Avocado	4	12	6	50	4
	Lacy	1	3	3	100	1
	Melon	1	3	0	0	-
Iced Tea		4	12	4	33	5
Others	Cappuccino	1	3	0	0	-
	Fruit-cocktail	1	3	0	0	-
	Total	24	72	33	46	

Frequency of measured: in food, utensil, and food handler

Based on the location where foods come from, we rank the order or level of *E. coli* contamination from the highest to the lowest: C; F and K; E; D and I; B, G, and M; A and L, respectively (Table 3).

Table 3. The number of 'positive' Escherichia coli contamination for each canteen, from 13 canteens around campus, 2008

Canteen locations	Number of examinations	Number and Percentage of <i>E. coli</i> 'positive'	
		Amount of	Percentage
A	9	2	22,22
B	12	4	33,33
C	9	7	77,77
D	9	4	44,44
E	15	7	46,67
F	12	9	75,00
G	27	9	33,33
H	9	2	22,22
I	6	2	33,33
J	9	4	44,44
K	12	9	75,00
L	9	2	22,22
M	9	3	33,33
Total	147	64	43,53

DISCUSSION

Canteen or eatery around campus is one of the important location that to be observed periodically, since almost

all people in campus at least ever consume the meals there. Meals that they consumed actually are risky, due to bacterial contamination, and it could lead to a very specific illness, which could be avoided if each canteen is managed properly.

Microbiology analysis from the sample survey of each meal that served in the canteen around campus showed that almost all of the category of sampled were positively contaminated by *E. coli*. *Escherichia coli* represents the most frequent contaminating bacteria where 90% of foods were contaminated,⁸ and there are about 35 types of bacteria in meals, such as *E. coli* and Salmonella. Salmonella is bacteria that can cause typhoid, so the existence of salmonella in food becomes quite dangerous.⁷

The result showed that almost all of the type of meals analyzed from each canteen around campus were risking with the contamination of *E. coli*, which can cause an outbreak of diarrhea, typhoid or gastroenteritis. Table 1 and 2 show that contamination of *E. coli* existed in every canteen observed. From the type of meals, the most contaminated meals were 'rice with chicken', *karedok*, *gado-gado*, *pecel*, *ketoprak*, and *lontong sayur* also. It is proven that *E. coli* is the common contaminant in meals,⁸ besides Salmonella and Staphylococcus.⁷ The presence of Salmonella in foods as a company of *E. coli* has been proven at the same area,⁹ where the existence of *E. coli* is almost the

same with that of Salmonella. The existence of *E. coli* is very dangerous, and accordingly, it would rise the possibility of the existence of other pathogen, such as Salmonella, Shigella, and Staphylococcus.⁷

Karedok, gado-gado, pecel, and ketoprak were food that made by mixture of vegetables (sprouts, beans, *kol*, tofu, *tempe*, etc.) that poured by *sambal*. It is quite interesting to notice that according to the previous observation in the same area of canteens, those types of meals were still a risk to be consumed.^{1,10} This phenomenon proved that type of meals that made from many ingredients was risky to be contaminated. The more ingredient used in meals, the more the possibility to get contaminated is, including the contamination caused by food handlers and the utensil used.

The source of food and drink contamination might be caused by the water used. Regarding the source of the water, in general those have a good quality, since it is obtained from Water Drinking Supply Company, Pump, and water tower. No source of the water was contaminated by *E. coli*, but some of those were contaminated by Coliform.⁷ This condition is quite surprising, because the previous studies showed that most of the food and drink had *E. coli* contamination.^{1,2,10}

The highest risk of food contamination was in meal 'with *sambal*'. The reasons would be because the food comes from two kinds of sources. Firstly, food itself and the second is 'sambal'. This fact can be seen in *sambal* contamination which had the third position. On the other hand, 'wet meals' had the lowest contamination. This can be explained that meals almost served in hot condition or cooked first before served which is assumed to kill the bacterial.

The source of contamination in Lacy, Guava, and Orange juices could be from utensils and food handler, except for Sour sop juice from utensils only.⁹

The three top rank location of the canteen should obtain more attention concerning the contamination both food and drinks served. The first attention is for the behavior of the food handler and then utensils.^{6,9} For the purpose of contamination prevention in all canteens, the support from University management is needed.

Since the contamination was from utensils and food handler, improving the knowledge and practice of the food handlers become important. The certification regulation from district or provincial health office is also important to implement, such as mentioned in the Ministry of Health Decree no.715/MENKES/SK/V/2003.

It is important to improve the quality of meals served in canteen by giving more attention the types and locations of foods and drinks which had a highest contamination to avoid the unnecessary sickness due to bacterial contamination and by maintaining routine monitoring and evaluation of the meals material and personal hygiene and sanitation. Since contamination was also high on the hand of food handlers, so improving the knowledge and practice of the food handlers become crucial.

In conclusion, it is important to develop a mechanism to assure the quality of the canteens by giving more attention on the types and locations of foods and drinks especially for those with high contamination. The certification regulation from the district or provincial health office is also important to implement, such as mentioned in the Ministry of Health Decree.

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