

Sanitary Test of Penyetan Vendors' Plates Using Swab Test Method of Total Plate Count and *Escherichia coli* in Tambaksari District of SurabayaTiara Puspawarni Mulyono^{1*}, Fadjar Kurnia Hartati², Arlin Besari Djauhari²¹Microbiology Department, PT. Saraswati Indo Genetech²Faculty of Agriculture, Dr. Soetomo University

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ABSTRACT

The number of female workers has been on the rise along with life necessities. The usual role of women to cook for the family gradually transforms into preparing for customers on street foods. Penyetan is one of the favourite kind of street foods due to its availability and extensive selection of side dish options. The plate is standard dishware used to serve penyetan. One plate typically used to serve many customers one after another with the washing process in between. This research serves the purpose of finding out the hygiene of the street foods in Tambaksari, Surabaya, using the presence of *Escherichia coli* bacteria as a marker towards 76 penyetan street foods in Tambaksari district. From 76 places, the result showed that only eight places (11%) meet the requirements of the Health Minister Regulation No. 1096/2011 about Hygiene Sanitation for Catering Services, while the other 68 plates (89%) contained bacteria that surpass the threshold of the regulation. And for *E. coli*, the result was 20% (15 places) are positive, while the other is negative (80% or 61 places).

Keywords: sanitation; food safety; Total Plate Count; *Escherichia coli*; swab test.

INTRODUCTION

The increase of life necessities makes the woman involves in helping her family's economy. The statistics released by the Central Bureau of Statistics (BPS) from 2015 to 2017 showed the rise of working women as much as 14.63%, 15.02%, and 15.17%, respectively. This increase impacted in the less homeworking time such as cooking or preparing food for the family member. It further has implications on the increasing habit of eating out because it is more practical. The most favoured street food is Penyetan because people in Surabaya loves its spicy characteristics. It is also evident in their availability and long queues (Wicaksono *et al.*, 2014).

Behind its practicality, street food has the problem of sanitary and hygiene. The sanitary hygiene requirements for street food vendors have been regulated in the Decree of Ministry of Health of the Republic of Indonesia No. 942/Menkes/SK/VII/2003 about Guidance of Sanitary Hygiene Requirements of Snacks and Ministerial Regulation of Ministry of Health of the Republic of Indonesia No. 1096/MENKES/PER/VI/2011 about Food Service Sanitary Hygiene that requires the germ count or Total Plate Count (TPC) to be as much as 0 (zero). Satyaningsih *et al.* (2017) found 87% of cake sellers in Kendari City Market did not meet the decree's requirements. 40% of the cake even contains *Escherichia coli*.

Related to the utensils, Alhabsyi *et al.* (2016), through the TPC test using the swab test method on several restaurant's plates in Manado, found the various result numbers, from 10.7 cfu to 226.6 cfu. Several types of bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella*, et cetera are detected in some plates.

Haderiah *et al.* (2015) also found many discoveries on the utensils of two restaurants as many as 1187 cfu/cm² on MR restaurant and 1207 cfu/cm² on MJ restaurants. Three pieces of research above have the similarity: it has not analysed the quantitative amount of *Escherichia coli* on its utensils, mainly the plates.

The previous research also stated that the existence of pollutant bacteria is due to reasons such as dishwater cleanliness and cleanliness of the napkins to clean the plate. One of the pollutant bacteria is the *Escherichia coli*. This bacterium is generally known for the indicator of faeces contamination and enteric pathogens (Donnenberg, 2016).

Tambaksari district is the densest district in Surabaya (BPS, 2014). Moreover, the waiving of Suramadu toll road fee in June 2015 for motorcycle (Aditiasari, 2015) and later for all types of vehicles in October 2018 (Wismabrata, 2018) increases the possibility of population growth of this district, due to the ease of access. It is the reason for this research to be conducted in Tambaksari district.

Departs from the previous researches and regulations, it is necessary to conduct the sanitary test to the utensils of street food vendors using the Total Plate Count and *E. coli* quantitative analysis in the Tambaksari district of Surabaya.

METHODS

This research is a non-participant observation using the descriptive approach that illustrates the analysis result of TPC and *Escherichia coli* on the plates of street food vendors in Tambaksari district, Surabaya.

Population in this research is 94 street food vendors in 2018. The amount of samples is determined by the Slovin formulation, which results in 76 vendors. Sample's gathering technique is done randomly through three times of replications on each vendor's plate.

Besides the plate's swab test, there are also observations towards the supporting data such as water source for dishwashing, dishwater replacement frequency, napkin replacement frequency, and observation on napkin condition during the sampling process.

Swabbing technique is conducted according to ISO 18593:2018, by using the liquid medium of Maximum Recovery Diluent and then put into swab tube. The TPC test will following the Indonesian National Standards (SNI) ISO 4833-1:2015, using Plate Count Agar. *E. coli* test is following the SNI ISO 16649.2:2016 using the medium of Tryptone Bile X-glucuronide agar (Hartati, 2016).

Data analysis is conducted descriptively. For TPC test, the results obtained will be compared with the Health Minister's Regulation No. 1096/MENKES/PER/VI/2011 about Food Service Sanitary Hygiene.

RESULT AND DISCUSSIONS

Water source

Most of the street food vendors use tap water for dishwashing (60 vendors). Besides its easy access, vendors considered tap water as clean and have better quality. They usually bought the water in a jerrycan, but some vendors obtain them directly from the tap water faucet.

Table 1. Water Source

No	Water Source	Frequency	Percentage (%)
1	Water well close to the vendor	16	21
2	Tap water (PDAM)	60	79
	Total	76	100

Source: Primary Data (2018)

Some vendors who utilise well water nearby (16 vendors) said that it is more affordable and no need to buy tap water. In this research, water type used for dishwashing also impacts the TCP test result, even though it is also influenced by another factor such as water replacement frequency and napkin used to dry the plate after dishwashing.

Based on Table 1, most of the vendors use tap water from the Regional Water Utility Company (PDAM) of Surabaya (60 vendors) while the minority uses water well close to the vendors (16 vendors).

Dishwashing water replacement frequency

There are two types of dishwashing water replacements: by water faucet and every night replacement. The utilisation of water faucet means is that the vendors do not contain the water on a tub as other vendors. This faucet is generally accessed from the surrounding buildings such as house, factory, office, et cetera. Every night replacement means that vendors collect the water in available tubs and the water will be replaced for the next night selling.

Table 2. Dishwater Replacement Frequency

No	Water Source	Frequency		Percentage	
		K*	SM**	K*	SM**
1	Water well close the vendor	1	15	1	20
2	Tap water (PDAM)	12	48	16	63
Total		76		100	

Source: Primary Data (2018)

Note : * By water faucet

** By water tub, and the water is replaced every night

Based on Table 2, there are two types of water replacement frequency, which are by water faucet (frequently replaced) and every night replacement (the water is put in a basin/tub). For well water, only one vendor uses the faucet while another vendor uses a water tub. On the tap water-sourced vendors, 12 vendors use water faucet, and the remainings use water tub.

Napkin cleanliness

All vendors said that they replace the napkin every night. Places classified as clean have many s with delegated into different uses and not mixed. s to clean the plate in this clean place is different from the ones for cleaning the dirty table. The places with dirty s have several reasons, such as:

1. Only one napkin available for all purposes
2. The place has many napkins, but due to many plates to clean, the damp napkin must be utilised to clean another plate. Dishwater then accumulates in the napkin. This case happens in Penyetan vendors with many customers such as in code area PKi7, which situated close to intersection. This strategic location draws many customers.
3. The dishwater is not clean. The tap water (PDAM water) is usually more sanitary than well water because it has its network of pipes to minimise external contamination. Meanwhile, the well water can absorb outside contamination that generally comes from the contaminated rivers.
4. The poor way of dishwashing which leads to poor cleanliness of the plate. It will also lead to the stains on the not thoroughly-cleaned plate can transfer to another plate by the napkin.

Table 3. Cleanliness

No	Cleanliness	Frequency	Percentage (%)
1	Clean	48	63
2	Medium	20	26
3	Dirty	8	11
Total		76	100

Source: Primary Data (2018)

Observation on the napkin is to obtain the supporting data of the TPC and *E. coli* test result. Forty-eight vendors have clean napkin, twenty vendors have medium clean napkin, and eight vendors have dirty napkin. The scoring of the cleanliness is not only based on the visual appearance of stains but also its dampness level.

Total Plate Count (TPC)

The lowest number of the average, which is 1.0×10^1 cfu/100 cm² is obtained from the area code of T2. Based on visual observation, water used for dishwashing comes from the tap water through the faucet from the building behind the street vendor. If one napkin started to dampen, the napkin was put on rice warmer that produces warm steam. The napkin then later will dry and replace another wet napkin. The electricity of this vendor also gathered from the building behind it. Location of this street vendor is in a residential area, so it will not easily be contaminated as the roadside one.

The highest TPC result, 5.3×10^6 cfu/100 cm² is obtained from the area code of R1, which located on the roadside. Dishwater comes from the well nearby then contained in several tubs: the first tub for dirty plates (leftovers are previously put into the garbage), the second tub for washing, and the third tub for rinsing. There is only one napkin, which will not be replaced even if it is wet. Those factors can increase the TPC number on the swab test result, as stated in Table 3. Haderiah *et al.* (2015) agree with this. The dishwashing method of using tubs will result in a higher number of TPC result if compared to the water directly from the faucet. The research also stated that besides the water factor, other factors such as napkin also impacted this TPC result on the plate.

The negative indicator means that the TPC value is 0 cfu/100 cm² or no growing colony on agar medium. This negative indicator is found in 11% of the samples (8 vendors) while the remaining (68 vendors/89%) records TPC value more than zero. The detailed information on each code is stated in Table 4.

This zero value is obtained from area codes of R4, PKb6, PKi6, T2, T3, DS9, G2, and KB4 from the swab test of a thoroughly dry plate. There is a possibility that this plate is prepared as the backup of all plates available are used (all dirty) and taken out when there are many customers, and the owner has no time to wash the used plate.

There is an exception on DS9. When another vendor's tent set up on the riverside, this seller established its vendor on a small road in the middle of the residential area. The water source is from the tap water, and its replacement is done every night, just like another seller.

There are nine places which have the TPC value above 10^1 . 6 of them uses tap water as the source while the remaining uses well water. This proves that besides water, another sanitary utility such as napkins also impacts the TPC score. TPC value above 10^6 is detected in 4 places, three from area code beginning with DS and one from an area code beginning with R. The well water as the course becomes one of the high TPC numbers because those places are located close to a polluted river. Napkin's cleanliness also influences TPC. The napkins in the area code of R, DS9, and DS11 is dirty during the sample obtaining.

Table 4. TPC Results Average

No	Area code	TPC results average
1	P1	6.1×10^2 cfu/100 cm ²
2	P2	7.6×10^2 cfu/100 cm ²
3	P3	1.5×10^2 cfu/100 cm ²
4	P4	2.4×10^2 cfu/100 cm ²
5	P5	1.1×10^3 cfu/100 cm ²
6	P6	1.5×10^4 cfu/100 cm ²
7	R1	5.3×10^6 cfu/100 cm ²
8	R2	8.0×10^1 cfu/100 cm ²
9	R3	1.3×10^3 cfu/100 cm ²
10	R4	3.0×10^1 cfu/100 cm ²
11	R5	1.2×10^3 cfu/100 cm ²
12	R6	1.6×10^3 cfu/100 cm ²
13	R7	1.1×10^3 cfu/100 cm ²
14	PKb1	1.7×10^3 cfu/100 cm ²
15	PKb2	7.3×10^5 cfu/100 cm ²
16	PKb3	4.6×10^2 cfu/100 cm ²
17	PKb4	1.1×10^3 cfu/100 cm ²
18	PKb5	2.1×10^2 cfu/100 cm ²
19	PKb6	2.2×10^2 cfu/100 cm ²
20	PKb7	2.4×10^2 cfu/100 cm ²
21	PKb8	1.5×10^2 cfu/100 cm ²
22	PKb9	8.2×10^2 cfu/100 cm ²
23	PKb10	1.8×10^5 cfu/100 cm ²
24	PKb11	1.3×10^3 cfu/100 cm ²
25	PKI1	1.6×10^2 cfu/100 cm ²
26	PKI2	1.9×10^4 cfu/100 cm ²
27	PKI3	1.6×10^2 cfu/100 cm ²
28	PKI4	3.3×10^1 cfu/100 cm ²
29	PKI5	1.7×10^3 cfu/100 cm ²
30	PKI6	2.2×10^2 cfu/100 cm ²
31	PKI7	2.2×10^5 cfu/100 cm ²
32	PKI8	1.1×10^3 cfu/100 cm ²
33	PKI9	2.2×10^3 cfu/100 cm ²
34	PKI10	8.8×10^2 cfu/100 cm ²
35	T1	1.8×10^3 cfu/100 cm ²
36	T2	1.0×10^1 cfu/100 cm ²
37	T3	4.6×10^2 cfu/100 cm ²
38	T4	1.5×10^3 cfu/100 cm ²
39	T5	5.0×10^1 cfu/100 cm ²
40	T6	1.0×10^3 cfu/100 cm ²
41	T7	1.6×10^3 cfu/100 cm ²
42	T8	1.7×10^4 cfu/100 cm ²
43	T9	4.5×10^3 cfu/100 cm ²
44	T10	1.9×10^2 cfu/100 cm ²
45	T11	1.1×10^4 cfu/100 cm ²
46	DS1	1.2×10^5 cfu/100 cm ²
47	DS2	3.5×10^4 cfu/100 cm ²
48	DS3	1.5×10^6 cfu/100 cm ²
49	DS4	9.3×10^4 cfu/100 cm ²
50	DS5	1.1×10^4 cfu/100 cm ²
51	DS6	5.0×10^1 cfu/100 cm ²
52	DS7	8.3×10^1 cfu/100 cm ²
53	DS8	1.0×10^6 cfu/100 cm ²
54	DS9	2.8×10^2 cfu/100 cm ²
55	DS10	3.5×10^5 cfu/100 cm ²
56	DS11	1.8×10^6 cfu/100 cm ²
57	G1	3.1×10^4 cfu/100 cm ²

No	Area code	TPC results average
58	G2	1.0×10^1 cfu/100 cm ²
59	G3	6.0×10^1 cfu/100 cm ²
60	G4	2.8×10^4 cfu/100 cm ²
61	G5	2.7×10^2 cfu/100 cm ²
62	G6	9.7×10^2 cfu/100 cm ²
63	G7	9.0×10^2 cfu/100 cm ²
64	G8	3.5×10^4 cfu/100 cm ²
65	G9	7.7×10^2 cfu/100 cm ²
66	G10	8.5×10^3 cfu/100 cm ²
67	G11	1.3×10^4 cfu/100 cm ²
68	G12	1.2×10^3 cfu/100 cm ²
69	G13	9.6×10^3 cfu/100 cm ²
70	G14	1.1×10^3 cfu/100 cm ²
71	KB1	3.2×10^3 cfu/100 cm ²
72	KB2	9.0×10^2 cfu/100 cm ²
73	KB3	4.0×10^2 cfu/100 cm ²
74	KB4	2.3×10^2 cfu/100 cm ²
75	KB5	1.1×10^2 cfu/100 cm ²
76	KB6	1.9×10^2 cfu/100 cm ²

Source: Primary Data (2018)

The average number of quantitative analysis of the TPC test of 76 samples gathered from the plates of Penyetan street vendors in Tambaksari varies from the lowest number of 1.0×10^1 cfu/100 cm² to the highest number of 5.3×10^6 cfu/100 cm².

Table 5. Vendors who passed the minimum requirements from the Health Minister's Regulation No. 1096/2011

No	Assessment criteria	Frequency	Percentage (%)
1	Passed	8	11
2	Failed	68	89
Total		76	100

Source: Primary Data (2018)

Health Minister's Regulation of 2011 stated that the maximum threshold for bacterial contamination is negative or 0 (zero). There are eight vendors that qualified, while 68 vendors cannot meet the threshold because its TPC score is more than zero.

Escherichia coli

Based on Table 6, the *E. coli* positive samples are recorded on 15 out of 76 vendors, or 20% of the total sample. This appearance is due to the positive TPC value. 18% of the vendors shared both positive values of *E. coli* and TPC. The negative presence of *E. coli* is recorded in 61 vendors (80% of the sample).

The highest result is in the area code of DS8, as many as 8.3×10^1 cfu/100 cm². It is in accordance with the description that stated this vendor is located on the riverside. DS8 placed as the worst sanitary place, proven by the TPC and *E. coli* analysis. On Table 3, besides using well water, DS8 also has a bad napkin quality, which worsens the final assessment score. The significant appearance of *E. coli* due to the vendor's location may have a high risk for diseases such as diarrhoea. People who use the well water that close to the polluted river even got a higher risk of diarrhoea if the river water is also used for washing napkins and dishes (Syafitri, 2017).

The discussion above concludes that only eight vendors (11%) that have qualified the threshold stated in the Health Minister's Regulation No. 1096/2011 while the 68 vendors (89%) have exceeded the threshold. If divided according to the TPC average numbers, there are six groups: groups of 10^1 (9 vendors), groups of 10^2 (26 vendors), 10^3 (21 vendors), 10^4 (11 vendors), 10^5 (5 vendors), and 10^6 (4 vendors).

The research also discovered that the positive result of *E. coli* on 15 vendors (20%) while the remainings (61 vendors/80%) are negative. This means that vendors who have both positive *E. coli* result and high TPC count are 20% out of all vendors. The difference on both tests can be due to several things such as the water source, water replacement frequency, napkin cleanliness, and selling location.

Table 6. Average Number of *Escherichia coli*

No	Area code	Average result of <i>E. coli</i>
1	P1	0 cfu/100 cm ²
2	P2	0 cfu/100 cm ²
3	P3	0 cfu/100 cm ²
4	P4	0 cfu/100 cm ²
5	P5	0 cfu/100 cm ²
6	P6	6.0×10^1 cfu/100 cm ²
7	R1	2.0×10^1 cfu/100 cm ²
8	R2	0 cfu/100 cm ²
9	R3	0 cfu/100 cm ²
10	R4	0 cfu/100 cm ²
11	R5	0 cfu/100 cm ²
12	R6	0 cfu/100 cm ²
13	R7	0 cfu/100 cm ²
14	PKb1	0 cfu/100 cm ²
15	PKb2	2.4×10^1 cfu/100 cm ²
16	PKb3	4.0×10^0 cfu/100 cm ²
17	PKb4	0 cfu/100 cm ²
18	PKb5	0 cfu/100 cm ²
19	PKb6	0 cfu/100 cm ²
20	PKb7	0 cfu/100 cm ²
21	PKb8	0 cfu/100 cm ²
22	PKb9	0 cfu/100 cm ²
23	PKb10	7.0×10^1 cfu/100 cm ²
24	PKb11	0 cfu/100 cm ²
25	PKI1	0 cfu/100 cm ²
26	PKI2	0 cfu/100 cm ²
27	PKI3	0 cfu/100 cm ²
28	PKI4	0 cfu/100 cm ²
29	PKI5	0 cfu/100 cm ²
30	PKI6	0 cfu/100 cm ²
31	PKI7	5.0×10^1 cfu/100 cm ²
32	PKI8	0 cfu/100 cm ²
33	PKI9	0 cfu/100 cm ²
34	PKI10	0 cfu/100 cm ²
35	T1	1.0×10^1 cfu/100 cm ²
36	T2	0 cfu/100 cm ²
37	T3	0 cfu/100 cm ²
38	T4	0 cfu/100 cm ²
39	T5	0 cfu/100 cm ²
40	T6	0 cfu/100 cm ²
41	T7	0 cfu/100 cm ²
42	T8	1.0×10^1 cfu/100 cm ²
43	T9	0 cfu/100 cm ²
44	T10	0 cfu/100 cm ²

No	Area code	Average result of <i>E. coli</i>
45	T11	1.0 x 10 ¹ cfu/100 cm ²
46	DS1	8.0 x 10 ¹ cfu/100 cm ²
47	DS2	0 cfu/100 cm ²
48	DS3	1.0 x 10 ¹ cfu/100 cm ²
49	DS4	0 cfu/100 cm ²
50	DS5	0 cfu/100 cm ²
51	DS6	0 cfu/100 cm ²
52	DS7	0 cfu/100 cm ²
53	DS8	8.3 x 10 ¹ cfu/100 cm ²
54	DS9	0 cfu/100 cm ²
55	DS10	2.6 x 10 ¹ cfu/100 cm ²
56	DS11	6.7 x 10 ¹ cfu/100 cm ²
57	G1	0 cfu/100 cm ²
58	G2	0 cfu/100 cm ²
59	G3	0 cfu/100 cm ²
60	G4	0 cfu/100 cm ²
61	G5	1.0 x 10 ¹ cfu/100 cm ²
62	G6	0 cfu/100 cm ²
63	G7	0 cfu/100 cm ²
64	G8	0 cfu/100 cm ²
65	G9	0 cfu/100 cm ²
66	G10	0 cfu/100 cm ²
67	G11	0 cfu/100 cm ²
68	G12	0 cfu/100 cm ²
69	G13	0 cfu/100 cm ²
70	G14	0 cfu/100 cm ²
71	KB1	0 cfu/100 cm ²
72	KB2	0 cfu/100 cm ²
73	KB3	0 cfu/100 cm ²
74	KB4	0 cfu/100 cm ²
75	KB5	0 cfu/100 cm ²
76	KB6	0 cfu/100 cm ²

Source: Primary Data (2018)

The average number of *Escherichia coli* is a little different from the previous TPC result. Besides this test that is more specific on *E. coli*, the appearance of the number (positive indicator) on *E. coli* analysis indicates the poor hygiene and sanitary on a place, which can also show the presence of other pathogens (Donnenberg, 2016).

On Table 6, the positive appearance of *E. coli* is indicated on 15 out of 76 vendors (20% of all samples). Of the TPC result, 61 out of 67 vendors have recorded negative or zero numbers (80%). These two results of TPC and *E. coli* appearance means that 18% of all samples have both positive TPC and *E. coli* result.

Table 7. Appearance of *Escherichia coli*

No	Assessment criteria	Frequency	Percentage (%)
1	Positive	15	20
2	Negative	61	80
	Total	76	100

Source: Primary Data (2018)

Based on Table 7, places that positively contain *E. coli* are as many as 15 vendors, while another 61 vendors have a negative result.

CONCLUSION

The results of Plate Sanitary Test of Penyetan Street Vendors using Swab Test of Total Plate Count and *Escherichia coli* Tests in Tambaksari District of Surabaya are concluded as follows:

1. The result of the swab test of 76 vendors' plates shows that 89% of the vendors cannot meet the requirements in the Health Minister Regulation No. 1096/MENKES/PER/VI/2011 about Sanitary Hygiene of Food Services. 68 vendors not meeting the requirements have TPC numbers more than 0 (zero) while the remainings, eight vendors (11%) have fulfilled the requirement with the number of 0 (zero).
2. The result of the swab test of 76 vendors' plates shows that 20% (15 vendors) of the plates positively indicates *Escherichia coli*, while the remainings (61 vendors/80%) are showing a negative result.
3. The second point concludes that vendors with both TPC and *E. coli* positive are 15 vendors (20%). Vendors with *E. coli* positive result certainly have a positive amount of TPC result.

Factors that influences TPC and *E. coli* number, according to this research, are the water source, dishwater replacement frequency, napkin replacement frequency, napkin cleanliness, and vendor's location.

RECOMMENDATIONS

1. Almost all Penyetan vendors in Tambaksari district cannot meet the requirements of the Health Minister's regulation as mentioned earlier, so it is suggested for the customer to be more careful when consuming street vendor's Penyetan. The take-away method can decrease the health risk from the plate usage, but it is still having a chance from its take away wrappers.
2. City's Industrial and Trading and Health Board should give a counselling towards the Penyetan sellers, so they understand how to manage the foodstuffs, clean the utensils, and provide the hygiene sanitary, so the food is safe for the consumer, according to the applicable requirements.
3. The government should certify the Penyetan vendors according to the Health Minister's regulation to ensure its cleanliness.

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