SHORT COMMUNICATION

Microbial assessment of utensil and worktop surfaces at university food court

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Abstract:

The contaminated utensils and worktop surfaces are known as one of the causes of food contamination. This study was conducted to identify the presence of Escherichia coli and Staphylococcus aureus on the utensils and worktop surfaces, and to identify the hygiene level in the premises and also to determine the relationship between food premise rating and the bacteria count. Environmental swab of utensils and worktop surface was carried according to ISO 18593:2004. 126 samples of swab from seven type of utensils from six food premises was collected. For the food premise rating, standard form by Ministry of Health Malaysia was used. The average numbers of Escherichia coli colonies ranged from 2.0 - 269.3 (cfu/ml). For the *Staphylococcus aureus* the average numbers of colonies are ranged from 1.0 – 186 cfu/ml. All the result of *Staphylococcus aureus* showed the positive result. The hygiene level of the premise ranged from 53% to 86%. The highest level was recorded in the premise that has 86% of evaluation marks. However there is no significant difference in mean of bacteria count in clean premises and less clean premises.

Keywords: Environmental swab, food premise, hygiene, worktop surfaces, Utensils

1. INTRODUCTION

Food safety is an important and a main concern for public health. Food safety policies are needed to cover the entire food chain, from production to consumption. However, it becomes one of the most challenging tasks to do where it comes to the quality management and safety encounter [1]. According to the Martinona et al., the lack of management in the hygiene can cause the reduction of the food quality and will cause the adverse effect to the economy and human health [2]. Therefore, it is important to develop the effective sanitation and disinfection to reduce the potential source of the contamination. In preparing food, raw materials and cooked food would be in contact with so many surfaces and utensils, if the utensils and worktop surfaces are not being properly clean and sanitize it can be the source of direct contamination to the food [3]. The contamination could occur when the utensils in contact with the food and the utensils itself are not properly clean and sanitize [4]. The detection of the bacteria on the surface is important because if the surface was contaminated it will cause the health problem which is can lead to the disease outbreaks [5].

According to Dewi et al., an unhygienic condition, improper sanitation of eating utensils and also improper managing of the services in the premise also can be the causes of contamination [6]. Some of the studies found a decrease of knowledge about the food hygiene and sanitation among the food handlers [7]. According to Kauser and Lakshmi [8] about 97% of the food borne cases at the food outlet is due to the improper handling of the food.

2. MATERIALS AND METHODS

The study was cross-sectional and conducted in eateries within the students' residential college of Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam (UCS KPA). The study was done in 2 colleges which were Kolej Angsana and Kolej Raflesia UCS KPA. The study was carried out to identify the presence of *Escherichia coli* and *Staphylococcus aureus* on the utensils and worktop surfaces and also their relationship with food hygiene cleanliness score. Environmental swab was carried out and brought back to Food Safety laboratory, Centre of Environmental Health and Safety UiTM, for bacterial detection. The attachment of the microorganism to the food contact surfaces can be identified through observation or the microbiological swab surface [9]. Hygiene score was done using a standard form; the Food Premise Assessment Format (Borang KKM-PPKM-1/14) that are currently being used by the Ministry of Health (MOH) for food premise cleanliness rating and also for closure purposes.

2.1 The environmental swab on utensils and worktop surfaces

ISO method 18593: 2004 has been used for environmental swab of utensils and worktop surfaces[10].

The sampling procedure had been done as followds, the swab tubes were labeled with the sufficient details which indicated the number of the utensils, location, time and date of the collection. Secondly, the swab stick was removed from the sterile wrapping. The tip of the stick was moistened by immersing it in a tube containing dilution liquid (peptone water). The tip of the stick was pressed against the inside wall of the tube to removed the excess fluid. Before the abbing activity, the area ($100cm^2$) to be swabbed was selected. Then, the tip of the swab was pressed onto the surfaces and was streak in two directions at right angles whilst rotating the swab stick between thumb and forefinger. The swab was put back in the tube with the dilution material and the stick was aseptically broken or cut off. After that, the sampled area was cleaned with the alcohol wipes and the sample tube was put in the cool box with the temperature below 4˚C. Then, the sample was transported to the Food and Safety Laboratory for the analysis.

2.2 Spread Plate Method

In the laboratory, the samples were quickly put in the incubator for enrichment purpose for about one hour. After that, the samples were taken out of the incubator for the spread plate method. The Mannitol Salt Agar petri dish of agar was labeled with the number of the sample. Then, the sample tube was sterilized by placed the opener of tube to the light blue area of flame of a Bunsen burner. Then, the 0.1 ml of the sample was taken out of the tube using pipette and placed on the surface of the agar. A sterile glass spreaded was soaked in the 70% of alcohol dilution and was heat to the blue area flame of the Bunsen burner. Then, the spreader was cooled before spreading the sample on the agar . The procedure was carried out around the flame. Then, the procedure was repeated to spread the same sample on the Mac Conkey's agar. After that, both agars (Mac Conkey's Agar and Mannitol Salt Agar) were placed in the incubator for 24 hours at room temperature which is 37 ˚C. The agars were taken out of the incubator and colonies of *Escherichia coli* and *Staphylococcus aureus* observed.

3. RESULTS AND DISCUSSION

3.1 Colony-forming unit of *E. coli* and *S. aureus* in UCS KPA food premises

Based on Table 1 below, the mean value for colony-forming unit per millilitre (cfu/ml) of *Escherichia coli* are higher than *Staphylococcus aureus* in all premises sampled. Moreover, the highest mean of *Escherichia coli* colonies was recorded in the P3 which was 142.21 cfu/ml while the highest mean of *Staphylococcus aureus* colonies was recorded at the P6 with the value of 80.34 cfu/ml. Besides that, premise one has recorded the lowest mean of both types of the bacteria (*Escherichia coli* and *Staphylococcus aureus*) which were 16 and 12.04 cfu/ml respectively.

Table 1 The mean and standard deviation of the colonies of *Escherichia coli* and *Staphylococcus aureus*.

Types of premises	Mean ± SD *Escherichia coli* (Cfu/ml)	*Staphylococcus aureus* (Cfu/ml)
Premise 1	16 ± 25.49	12.04 ±17.24
Premise 2	76.5 ± 59.64	49.71 ± 60.52
Premise 3	142.21 ± 105.06	36.71 ± 21.72
Premise 4	135.08 ± 84.04	65.11 ± 43.37
Premise 5	113. 26 ± 66.89	65.91 ± 52
Premise 6	138.26 ± 55.56	80.34 ± 37.55

3.2 Mean colonies of *Escherichia coli* and *Staphylococcus aureus* on utensils.

As can be seen in Table 2, highest number of both *Escherichia coli* and *Staphylococcus aureus* colonies can be found on chopping board with 164.18 for *E. coli* and 87.52 for *S. aureus*, which was used to cut, dice or slice raw materials like meat, fish and vegetables. This proved the importance of separating utensils for raw materials and cooked food as it can cause cross contamination which would then increase risk for food borne illnesses. Worktop surfaces have a relatively high micro bacterial load. Meanwhile ladle and knife have lower bacterial load with a cfu/ml mean of 60.91 – 66.88 for *E. coli* and 35.02 – 45.95 for *S. aureus* and 44.97 88 for *E. coli* and 25.95 for *S. aureus* respectively. These findings are also in line with a study conducted by Rakhshkhorshid et al which found that utensils which are used for raw materials have higher bacterial count [11]. The same study also found that although there is no bacterial contamination found on cooked food, but utensils usually carry bacteria [11]. This means that food handler must know that contamination can be caused by the use of utensils especially if it is unwashed. Separated equipment should be used for raw and cooked food to avoid such contamination.

Table 2 Mean and standard deviation of *Escherichia coli* and *Staphylococcus aureus* colonies on utensils.

Utensils (n=126)	Mean *Escherichia coli*	SD	Mean *Staphylococcus aureus*	SD
knife	44.97	±32.96	25.95	±16.81
chopping board 1	145.08	±83.24	63	±29.88
chopping board 2	164.18	±104.74	87.52	±68.39
worktop surface 1	119.27	±76.54	37.7	±26.25
worktop surface 2	117.77	±72.86	66.3	±76.61
ladle 1	60.91	±65.35	35.02	±21.49
ladle 2	66.88	±56.01	45.95	±22.25

3.2 The hygiene level of the premise in the food court

Table 3 showed the result of premise inspection rating in the Angsana and Rafflesia food court. Borang KKM-PPKM-1/14 was used to grade and rate 6 premises in the food courts. Based on the table below, majority of the premises scored 51 and 70 marks which were in the grade C (P2, P3, P6). The premises that were categorized in the grad C category were the premise 2, premise 3 and premise 6 which 53%, 69% and 64% respectively. However, premise 1 scored the highest result which was 86% and was categorized in the grade A.

Table 3: The result of premise inspection of the selected premises in the Angsana and Rafflesia food court.

Names of the premises	Premise	Score (%)	Rating
Lina 's Cafe	Premise 1	86	A
Matahari Cafe	Premise 2	53	C
Ar-riqz Cafe	Premise 3	69	C
Rafflesia Cafe	Premise 4	75	B
Selera Pantai Timur Cafe	Premise 5	71	B
Taste Me Cafe	Premise 6	64	C

3.3 Premise hygiene score and the mean of colony-forming unit.

Table 4 below showed the independent t-test result between the average number of colonies and the hygiene rating of the premises. Table 4 show the comparison of means of colonies-forming unit / millilitre for premises with the rating of 70% and above (considered as cleaner premises) and premises with the rating of less than 70% (considered as less clean) for both *E. coli* and *S. aureus*. The table showed that the mean difference between the number of the colonies of hygiene level above the 70% or below the 70 % are not statistically significant (p = 0.49, 95% CI -79.93, 41.15). Hence, there is no significant difference between the average number of colonies and the hygiene level of the food premise. This means that rating score of the premises does reflect the level of microbial contaminants.

Table 4 Independent t-test between the average numbers of colonies with the hygiene level of the premises.

Variables	> 70 score Mean (SD)	< 70 score Mean (SD)	Mean diff (95% CI)	t-stats (df)	P value
Mean of colonies	67.90 (49.79)	87.28 (44.15)	-19.38 (-79.93, 41.15)	-0.718 (10)	0.49

4. CONCLUSIONS

In conclusion, the presence of *Escherichia coli* and *Staphylococcus aureus* could not be predicted by using cleanliness score or rating as they are not statistically and significantly associated. Therefore, a rating of A, B or C for any premises does not represent the food safety level for consumers. Besides that, even if cooked food is free from any pathogens or indicator microorganism, cross contamination could still occur if they come in contact with worktop surface or unclean and unsanitised utensils. Proper washing and sanitizing procedure need to be implemented in order to reduce the number of bacteria on the utensils, thus not only protecting consumers but also food handlers.

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