Are Street Foods Safe: Detection of *Escherichia coli* in Street Foods Sauces

Flyndon Mark S. Dagalea¹,²*, Karina Milagros C. Lim¹,², Manuela Cecille G. Vicencio², Jonsel Juris C. Ballicud³, Moises Ronn B. Burac³, Justine Jane B. Vibar³ and Vincenette Brea E. Villadolid³

¹Department of Physical Sciences, College of Science, University of Eastern Philippines, University Town, Northern Samar, 6400, Philippines.

²University Research and Development Services, University of Eastern Philippines, University Town, Northern Samar, 6400, Philippines.

³Senior High School Laboratory School, University of Eastern Philippines, University Town, Northern Samar, 6400, Philippines.

Authors’ contributions

This work was carried out in collaboration among all authors. Authors FMSD, KMCL and MCGV designed the study, performed the statistical analysis and wrote the protocol. Authors FMSD, MRBB, JJCB, JJBV and VBEV managed the analyses of the study, wrote the first draft of the manuscript and managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Good manufacturing practices (GMP) is the key in quality food services. This is to ensure that the food our body take in is safe from harmful bacteria that may cause disorder in its normal function. In this research, detection of *Escherichia coli* (*E. coli*) was done in the sauces of the street foods vendor at the University of Eastern Philippines. The result of this study will be of use to the local units that need to regulate the franchise of these street foods; to ensure that safety in the delivery of food products. Samples were collected from the stalls of the street vendors and were subjected to microbial analysis. Results showed that *E. coli* is present in the street sauces but in minimal count. Though the count is far from the threshold, vendors must consider increasing their knowledge and practices with GMP to ensure safe and quality food delivery.
Keywords: Escherichia coli; street foods; GMP.

1. INTRODUCTION

*Escherichia coli* are members of a large group of bacterial germs that inhabit the intestinal tracts of humans and other warm-blooded animals. Newborns have a sterile alimentary track, which within two days become colonized with *E. coli* [1].

Because of its prominence as a normal intestinal bacterium in most humans, *E. coli* is currently one of the indicators to monitor fecal contamination in water, food and dairy products. According to this rationale, if *E. coli* is present in a water sample, fecal pathogens such as salmonella, viruses, or even pathogenic protozoa may also be present. Coliforms such as *E. coli* are used because they are present in larger numbers, can survive in the environment, and are easier and faster to detect than pathogens. If a certain number of coliforms are detected in a sample, the water is judged unsafe to drink [2].

According to Roberts, et al. [3], *Escherichia coli* strains are almost universal residents of the intestinal tracts of humans and a number of other animals. Although most strains are harmless, certain ones produces specific virulence factors that allow them to cause intestinal disease other strains, with different virulence factors, cause urinary tract infections, septicemia, and meningitis.

As cited from Ching [4], the World Health Organization (WHO) [5] explained that EHEC produces toxins known as toxins known as verotoxins or Shiga-like toxins similar to the toxins produced by *Shigella dysenteriae*. This is the reason why enterohemorrhagic *Escherichia coli* (EHEC) is also being referred as Shigatoxin-producing *E. coli* or vericytotoxin-producing *E. coli*. EHEC symptoms may include abdominal cramps and diarrhea which sometimes lead to bloody diarrhea (haemorrhagic colitis). Fever and vomiting may also occur. Commonly, EHEC affect high risk group such as children and elderly.

At present, street vended food is becoming a serious public health concern due to the intervention of different pathogenic microorganisms. The lack of hygiene in the preparation of street vended foods (SVFs) poses risk factors for borne disease outbreaks globally.

Lack of knowledge among street food vendors about the causes of food-borne disease is a major risk factor [4]. Poor hygiene, inadequate access to potable water supply and garbage disposal, and unsanitary environmental conditions such as proximity to sewers and garbage dumps further exacerbate the public health risks associated with street foods.

Food borne bacterial agents are the leading cause of severe and fatal food borne illnesses. Of the many thousands different bacterial species, more than 90% of food-poisoning illnesses are caused by species of *Staphylococcus*, *Salmonella*, *Clostridium*, *Campylobacter*, *Listeria*, *Vibrio*, *Bacillus*, and *Enteropathogenic Escherichia coli* [6].

In the study of Ching [4] were he used street vended fried chicken and barbeque sold in the vicinity of the university revealed that there are *Escherichia coli* colonies present in the gravy sauce than the ketchup in terms of fried chicken and in the barbeque, sour sauce had the highest *E. coli* count and followed by the spicy sauce and the lowest is sweet sauce. The preparation may affect the growth of *Escherichia coli* in terms of barbeque sauce.

Thus this study aimed to determine the presence of *Escherichia coli* in street food sauces collected around the university main campus of UEP.

2. METHODOLOGY

Using a sterile cup, the researchers collected per stall three sample of sweet sauce and spicy sauce and were immediately tested at that same day of collection. The samples had three (3) trials for both physical properties and microbial analysis.

To evaluate the pH of the samples, a pH meter was used to quantify the result. If the pH level is equal to 7.0, it is neutral; if the pH level is above 7.0 it is basic; and if the pH level is below 7.0 it is acidic. Salinity was measured using a refractometer. The samples were diluted using the ratio 1:1. Temperature was measured using a laser thermometer. All of these property tests were replicated three (3) times.

Before the start of the inoculation, the samples were diluted according to the standards of 6404/6414 *E. coli* / coliform count plate, 3M Petrifilm [7]. Butterfield’s phosphate buffer, 0.1% peptone water, peptone salt diluent, quarter-strength Ringer’s solution, saline solution (0.85-
of E. coli. This bacterium needs low pH to grow rapidly [8]. Increase in salt concentration triggers the increase of colony count of E. coli [9]. This bacterium also grows at temperatures greater than 30°C [10].

The sauce samples are prone to increase growth of E. coli. Low pH level, higher salinity, and room temperature increases the chances of increasing the colony count of the bacteria. Hence, it is advised to the vendors to check if the sauces are properly heated to kill the bacteria and to maintain the pH and salt level to inhibit the bacterial uprising.

In Table 2, this explains the colony count of the E. coli to the street food sauces. According to the USA Institute of Medicine [11], the acceptable E. coli count for ready-to-eat food intake is less than 100 CFU/g. The results showed that some street food stall have the bacteria are not exceeding the allowable colony formation in the human body. But, the sweet sauce of street food stall number 4 is above the allowable limit. Hence, the street vendor must review the good practices in food delivery so that the number of bacteria will not exceed again. The results were the mean of each food stall with three (3) replicates.

GMP’s principle is that quality is built into a product, and not just tested into a finished product. It is the assurance that the product not only meets the final specification, but that is has been made by the same procedures under the same conditions each and every time it is made. A presentation to the street vendors’ knowledge to GMP is presented in Fig. 1. It is seen in the result that their knowledge to good manufacturing practices is low hence a need to review and enhance their GMP attitude is a must. Ensuring a clean and healthy environment is a key factor in less or better zero contamination. If there is a low knowledge on GMP within the circles of vendors this should be address as an issue to the public health. The vendors must be knowledgeable to GMP as they offer basic foods that the students ate in lieu of a clean cooked food because of their hectic schedule. The local government unit through its sanitary unit must ensure to the public that every food stall should meet the minimum bare standards for delivery of food products, that is to ensure the safety of what the community eats.
Table 1. Physical properties of street food sauces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Vendor Street Food Stall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>I. Spicy Sauce</td>
<td>acidic</td>
</tr>
<tr>
<td>pH level</td>
<td>acidic</td>
</tr>
<tr>
<td>salinity</td>
<td>10.00%</td>
</tr>
<tr>
<td>temperature</td>
<td>29.40°C</td>
</tr>
<tr>
<td>II. Sweet Sauce</td>
<td>acidic</td>
</tr>
<tr>
<td>pH level</td>
<td>acidic</td>
</tr>
<tr>
<td>salinity</td>
<td>9.33%</td>
</tr>
<tr>
<td>temperature</td>
<td>29.83°C</td>
</tr>
</tbody>
</table>

Table 2. *E. coli* colony count of street food sauces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Vendor Street Food Stall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Sweet Sauce</td>
<td>10 CFU/g</td>
</tr>
<tr>
<td>Spicy Sauce</td>
<td>35 CFU/g</td>
</tr>
</tbody>
</table>

Fig. 1. Distribution of GMP knowledge to every street vendors

4. CONCLUSION

In terms of physical properties, all samples resulted to be acidic, high in salt level, and resulted to have temperature below the optimum temperature growth.

Based on gathered data, the researchers concluded that all of the sauce samples are contaminated with *Escherichia coli* but it does not exceed the acceptable *E. coli* CFU making the samples safe for a moderate intake. There were more *Escherichia coli* colonies visible in sweet sauce samples than spicy ones. It may have been because people dip more in sweet sauces causing it to be easily exposed to contamination. Even the samples are above the “satisfactory” limit, the public and the vendors must be knowledgeable on how to prevent this case in happening again. A training on basic GMP is necessary to address the issue of food contamination.

The result of this study indicates awareness for students and consumers in eating not only on street foods but in all kind of dishes. Vendors must be oriented in keeping a good sanitary business and to make sure that the foods they serve for the people is clean.

CONSENT

As per international standard or university standard, respondents’ written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Abdulkarim SM, Fatimah AB, Anderson JG. Effect of salt concentrations on the


3. *E. coli*/Coliform Count Plate. 3M Petrifilm™. 3M Health Care, USA; 2010.


9. Marler B. *E. coli* bacteria: what are they, where did they come from, and why are some so dangerous?; 2011. Available:https://www.marlerblog.com/articles/e-coli-information/


© 2021 Dagalea et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/68540