

Consumer Perception and Microbiological Analysis on Safety of Street Food Dipping Sauces

Eufemio G. Barcelon*, Dan Mark R. Collado, Shekinah A. Eustaquio, Maria Nikkita H. Luna, Kim Joshua C. Santos, Mary Chenneth S. Sombrano and Danielle P. Villaceran

College of Education, Department of Food Technology, University of Santo Tomas, España, Manila, 1015 Philippines

*Corresponding author's email: fbarcelon [AT] yahoo.com

ABSTRACT— *Different kinds of sauces come together with street foods that are available for consumer satisfaction. This study aims to understand the consumer perception of college students of University of Santo Tomas in Manila, Philippines on the safety of street food dipping sauces and their awareness on the possible health hazards linked to the products. Also, this study aims to determine the microbial quality of street food sauces by counting colonies, yeasts and molds, and coliforms specifically Escherichia coli. The pH of these sauces was also recorded. A survey had been performed to determine their insights about street food sauces. To assess microbial quality, the sauces served by the most visited ambulant vendors along the four corners of the university were taken as samples. Based on the surveys, the safety and the cleanliness of street food sauces are still considered when buying street food. Results also showed that the number of colonies and coliforms present are too numerous to count. The results for yeasts and molds showed that some of the sauces exceeded the limit of acceptable count. The results for the presence of E.coli were negative on all plates but there may be a risk for human consumption. It is suggested that proper food safety handling and storage for better hygienic and sanitary control must be practiced to avoid any food contamination.*

Keywords—food safety, microbial quality, consumer preference, street food, sauces, Philippines

1. INTRODUCTION

Culture has always been linked to the living and working environment of Filipinos but it has been always changing in condition with the needs of the people. Street food is both pop art and a comfort food that is found almost in every corner of Manila which contributes to this fast-paced world, allowing consumers with low or medium income to eat inexpensive foods like street food. Filipino street food gives us a variety of which include fish balls, tempura, chicken balls, egg waffle (*kwek-kwek*), kikiyam, calamares, siomai, fried chicken intestine (*Isaw*) and etc. These are the available street food that are dipped in variety of sauces mainly, sweet, spicy and sour.

Sauces is a worldwide tradition not only for street foods but also from international cultures too, like dipping Japanese sushi and dumplings in soy sauce to the very American tradition of dipping cookies into milk. But the idea of dipping and dunking food in liquid for added flavour and moisture can provide problems. Nowadays, local authorities, international organizations and consumer associations are increasingly aware of the socio-economic importance of street foods but also of their associated risks. The major concerns are sanitation problems (waste accumulation in the streets and the congestion of waste water drains), traffic congestion in the city also for pedestrians (occupation of sidewalks by street vendors and traffic accidents) and especially the health hazards that affects the consumers. (FAO of United Nations, 2013).

The general objective of this study is to determine the consumer perception towards street food dipping sauce. Specifically, to assess the awareness of consumers on the safety of dipping sauce. In line with this is the determination of the presence and microbial load on the dipping sauce. The significance of this study is to justify the consumer perception on the safety of street food dipping sauce through microbial analysis. It would be able to compare which ambulant vendor is more recommended to the consumers. Consumer survey was limited to the college students of a university and it only focuses in identifying whether the microbial load is within the standard limit of number of microorganisms present.

Dipping street food in a bowl of sauce is one way of transferring the sauce to the food. Gradual or double dipping in the sauces may cause food-illness from different causes. Direct double dipping can directly transfer saliva – there are different mouth bacteria that can be transferred in the sauce through direct dipping, species such as *Streptococcus*, *Prevotella*, and *Veillonella*. *Streptococcus* species causes strep throat, skin disease and nausea which leads stomach to vomiting. (Medicinet, 2014). Bacteria present the most important biological foodborne hazard for any food establishment; they are indeed responsible for more cases of foodborne illnesses than any other hazards. *S. aureus* are present in the

nasal passages and throats and on the hair and skin of healthy individuals. Therefore, food handlers are usually the main source of food contamination in food poisoning outbreaks. (Devahastin, 2011)

Food safety awareness is the key to the emerging problems raised by the local authorities. There are different projects implemented by Food and Agriculture Organization (FAO) with the view to improve conditions under which street foods are prepared and sold, undertake further research on street food sector: hygienic and nutritional improvement, improve vendor's knowledge about sanitation, food hygiene and nutritional values through education and training and most of all raise the awareness among consumers about nutrition and hygiene aspects of streets foods.

2. MATERIAL AND METHODS

2.1. Collection of Sample

Sauce samples namely sweet, spicy and sour were collected from the ambulant vendors around the corners of the University. Vendors were blinded and were not aware that their sauce is being used for this study. Sample sauce were gathered each day at the same time per each corner of the university; two ambulant vendors with three types of sauce each per day. The samples were obtained by buying them from the target ambulant vendor; it is contained in plastic cups. A weight of approximately twenty five (25) grams is collected from each sauce to be analyzed.

2.2. Survey

A survey was conducted to obtain consumer's insight about street food sauce. Before the final questionnaire was distributed, pretesting was done to a smaller group of respondents to see if there are any errors in the interpretations of the questions. The improved questionnaire was distributed to fifty (50) respondents. Convenience sampling was used under the Non-probability sampling methods. It was selected because there is a lack of access to all members of the population, since the university have a big population. It aims to know the perception of the consumers about street food sauce, whether or not they think it's clean.

2.3. Microbial analysis

During collection, samples were placed in plastic cups and labelled accordingly. These were then brought to the laboratory for microbial analysis which is colony counting of potential presence of Coliforms, Aerobic bacteria, yeast and molds. Under aseptic conditions, 11 ml each of sample were weighed and homogenized in a sterile blender with 99 ml of peptone water. This resulted in a 10^{-1} dilution. Further dilutions were prepared by transferring 1.0 ml of the homogenized sample to a sterile 9 ml peptone water until 10^{-4} dilution was achieved. Test tubes were shaken vigorously in the vortex to obtain evenly distributed sample.

Aerobic plate count

An aliquot of 1.0 ml from each dilution was placed in sterile disposable petri dish. Sterilized melted and tempered (at 121°C) Plate Count Agar was then poured onto the inoculum. The agar and sample were mixed in eight-motion and allowed to solidify before incubation. Plates were then placed inside an incubator held at 37°C for 24 - 48 hours in inverted position. Colonies were counted and plates containing 25-250 colonies were considered for Colony Forming Units (CFU) per ml computation.

Yeast and Molds count

An aliquot of 1.0 ml from each dilution was placed in sterile disposable petri dish. Sterilized, melted and tempered (at 121°C) Potato Dextrose Agar was then poured onto the inoculum. The agar and sample were mixed in eight-motion and allowed to solidify before incubation. Plates were then placed inside an incubator held at 37°C for 24 - 48 hours in inverted position. Colonies were counted and plates containing 25-250 colonies were considered for Colony Forming Units (CFU) per ml computation.

Coliform count

An aliquot of 1.0 ml from each dilution was inoculated onto 3MTM Petrifilm CC/EC Count Plate. Films were then incubated at 37°C for 24 - 48 hours to obtain coliform count. Petrifilm used was two-in-one, which shows present coliforms and as well, one particular species the *Escherichia coli*. Coliform colonies showed red color, while the specific *E. coli* showed blue color. Colony-forming units (CFU) per ml were then computed.

3. RESULTS AND DISCUSSION

3.1. Consumer Perception Survey

A survey questionnaire was conducted inside the university about the perception of consumers on street food sauces. There were 50 respondents selected based on convenience sampling method. The results (Figure 1), shows that there is 80% of them occasionally consume street food. However, 14% of them never consumed street food. They were also asked where they usually buy street food and the answers revealed that the most number of consumers was in the Dapitan side, while the least one is in the Lacson side. Majority, consumers asked showed that they were often buying the street food in *merienda* time.

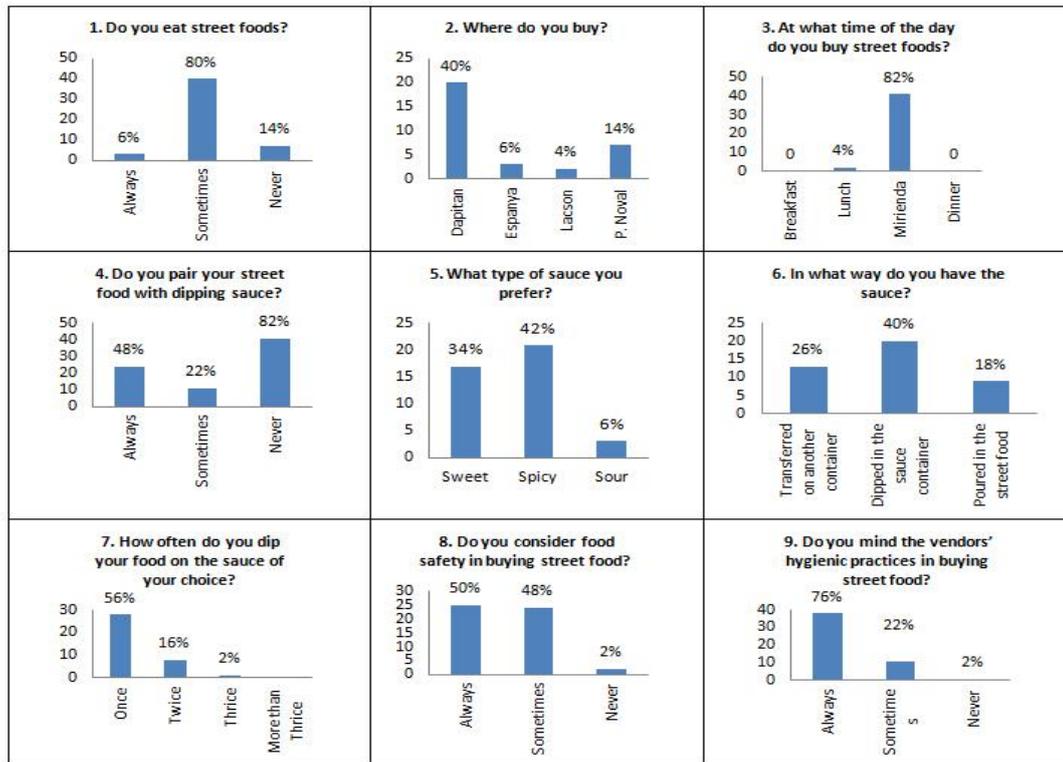


Figure 1.a. Consumer Perception Response on Street Food Sauces

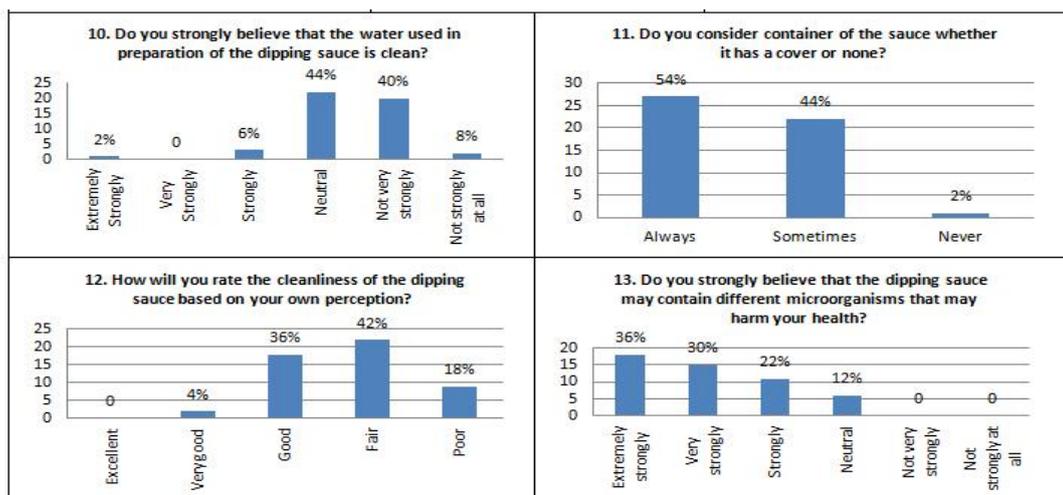


Figure 1.b. Consumer Perception Response on Street Food Sauces

In line with this, respondents were asked if dipping sauce is used upon purchase of the street food. There is 48% of them who pairs dipping sauce with their street food and 14% of them was not. Among the 24 respondents who used to dip on street food sauce, 42% of them liked the spicy sauce and the least percentage was the sour.

Upon purchase of street food from ambulant vendors, these sauces were served in different ways. From 50 respondents, 26% of them transferred their sauce in a plastic cup, 40% dip their street food on the sauce's container and 18% of the respondents pour the sauce on their chosen street food. Among the 20 respondents who like their street foods to be dipped in the sauce's container, 56% of them dip it only once, 16% dip it twice, 2% dip it thrice and 6% of them dip it more than thrice (Figure 1.a.). This shows that there is a great possibility of contamination may occur since respondents revealed most number of direct contacts with the dipping sauce. In terms of food safety, half of the respondents always consider it upon buying street food, while 48% occasionally think about it and 2% were never. Meanwhile, 76% were always concerned with the hygienic practices of the vendors, 22% at times only, and 2% answered never. Probably, these percentages of respondents observe and choose a particular vendor that could exhibit the food safety guidelines.

In figure 1.b., around 44% of the respondents believed that the water used is either clean or not, while 40% does not very strongly agree. The vendors were observed to have a stock of water just below their cart that could be the reason of this high percentage. In terms of the cover of the sauce container, 54% always consider it being covered while 44% consider it every now and then, and only 2% never considered it. When asked with their perception towards the cleanliness of the sauce, the highest rate was fair with a percentage of 42%. The respondents possibly have not experienced any harmful effects or illness that may be caused by the sauce and led them to answering fair. Lastly, among the 50 respondents, 36% of them extremely believed that there are microorganisms in the dipping sauce. Factors such as unhygienic practices of the vendors, improper storage of water, and uncovered containers could be the reason the respondents believed that there are microorganisms present in the sauce.

3.2. Microbial Analysis

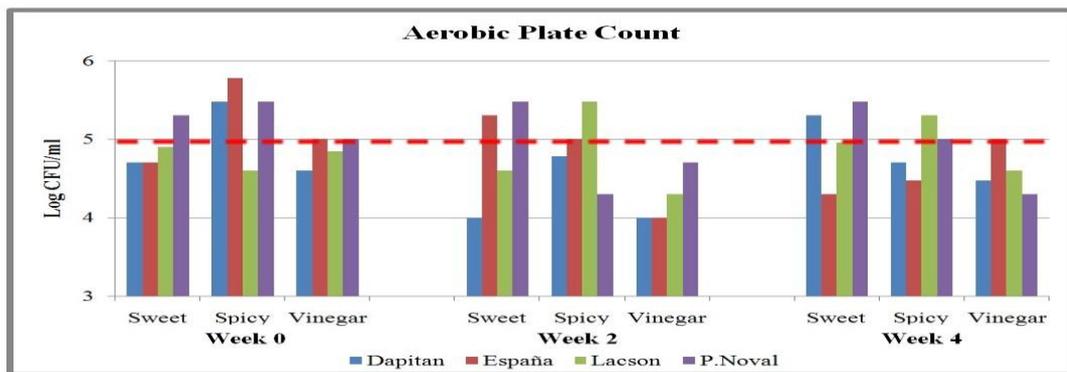


Figure 2. Growth of aerobic bacteria. Red broken lines indicate the unsatisfactory limit of growth which is ≥ 5 log cfu/ml

The pH of the samples was measured and was resulted to the range from 3-5. Vinegar consistently obtained pH 3 in all the stalls investigated while the spicy and sweet sauce obtained pH 4-5. One of the factors needed for microbial growth is the pH, thus low pH range of these sauces affects the microbial growth of each sauces.

Bacteria are most likely to grow in pH range from 4-9 (Rahman, 2007). Related to this, aerobic plate count was utilized to determine the growth of bacteria in these sauces. In this investigation, presence of aerobic bacteria was shown in a plate count agar. These bacteria grow in the presence of oxygen, at chill and at ambient temperatures (Lund, Baird-Parker, & Gould, 2000). Sauces since exposed to an open air, revealed growth of these microorganisms. The results in figure 2 showed that the spicy sauce obtained the highest number of growth. However, acceptable aerobic plate count should be < 5 log cfu/ml and the unsatisfactory limit is ≥ 5 log cfu/ml (Microbiological quality guide for ready-to-eat foods, 2009). Since the results exceeded the limit of the microbial load, this indicates that it may cause harm. Also, no identification of bacteria was performed thus, it can't be stated that it is hazardous.

Yeasts and molds counts are predominant in foods having low water activity, low ph, high salt, or high sugar content (An Evaluation of the Role of Microbiological Criteria for Foods and Food Ingredients, 1985). Molds usually grow in pH range 1.5-11 and yeasts ranging from 1.5 to 8.5 (Rahman, 2007). In its determination, potato dextrose agar was used to allow the growth. Figure 3 revealed that most of the sauces exceeded the limit of acceptable log cfu/ml. The acceptable yeast and molds count should be 2 log cfu/ml and the count which indicates potential health hazard is 4 log cfu/ml (FDA, 2013). High number of counts can be the effect of inadequately sanitized equipment or as in airborne contaminants (An Evaluation of the Role of Microbiological Criteria for Foods and Food Ingredients, 1985).

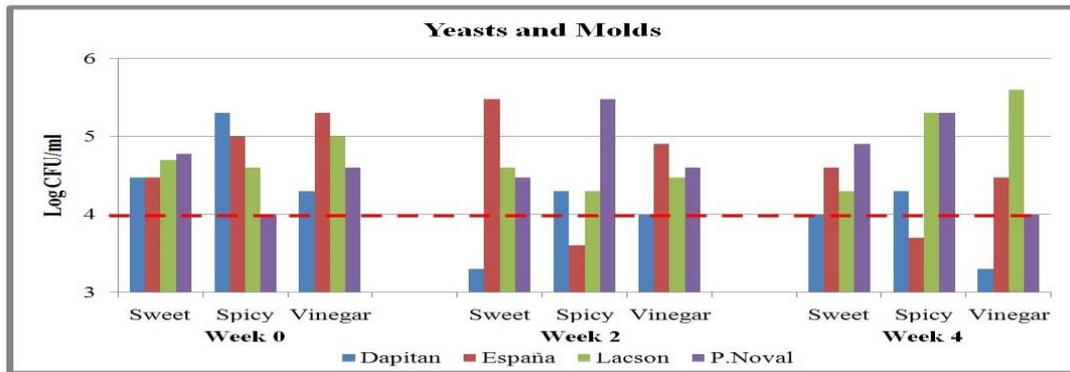


Figure 3. Growth of yeasts and molds. Red broken lines indicate the potential health hazard of growth which is 4 log cfu/ml

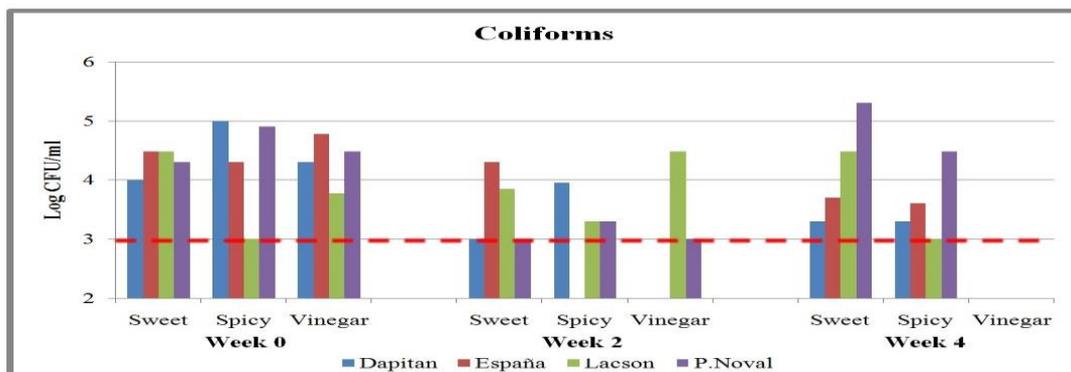


Figure 4. Growth of Coliforms. Red broken lines indicate the dangerous limit of growth which is 3 log cfu/ml

While in Coliforms and *E. coli*, petrifilms were used. Coliforms are capable of growing on a large number of media and in many foods. They can grow over a pH range of 4.4-9.0 (Jay, Loessner, & Golden, 2005). The sauces investigated revealed high number of count. Almost all the sauces exceeded the accepted number of colonies which indicates a risk to human consumption. This high number of results (Figure 4) can be due to improper hygienic practices of the vendors. Coliforms acceptable count must be 1 log cfu/ml and the dangerous limit is 3 log cfu/ml (FDA, 2013). Contamination of these sauces may come from the vendors preparing the sauces and utensils used for cooking or serving. According to the observation of the researchers to the selected vendors water could also be the source of contamination. Since street food vendors are mobile and do not have permanent places of selling their goods, there is lack of potable water for the preparation of sauces, including the water based of the sauces.

Escherichia coli is a natural component of intestinal tract of humans and warm-blooded animals. If its presence is identified in an environment, or in foods, it implies some reason of contamination (Adams & Mos, 2008). It generally grows within the pH range of 4.4-9.0 (Riemann & Cliver, 2006). In its determination, from week 0 to week 4, all sauces were negative from the presence of *E. coli*. Count of 0.5 log cfu/ml to <2 log cfu/ml is still acceptable but a count having ≥ 2 log cfu/ml is considered unsatisfactory (Microbiological quality guide for ready-to-eat foods, 2009). The presence of coliform in the samples indicates possible fecal contamination. Hence, the absence of *E.coli* does not mean the sample is free from fecal contamination.

The results obtained in each microbiological analyses vary due to different factors such as the amount of people dipping on the sauce per day, the pH value of the sauce, the temperature and weather during the day, the exposure to contaminants, the water used in preparing the sauce, and the handling during the preparation of the sauce.

4. CONCLUSION

Based on the results, the cleanliness of street food dipping sauces were mostly perceived to be fair. There are factors that the consumers consider about street food dipping sauces such as the container whether it has a cover or none, the

vendor's hygienic practices when they buy street food. On the microbial aspect, results showed that the number of colonies and coliforms present are too numerous to count. The results for yeasts and molds showed that some of the sauces exceeded the limit of acceptable count. The results for the presence of *E.coli* were negative on all plates, hence, its absence does not mean that the sauces are free from fecal contamination.

The study proposes that to ensure the quality of street food sauces, it is necessary for ambulant vendors to be properly trained on food preparation, handling, and cooking thus, improving their food safety practices for better hygiene and sanitary control. Also, future studies should be undertaken on the microbiological aspects of the street food sauces to further validate the safety or otherwise of the consumption of street food sauces.

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