Microbiological quality of selected street vended foods in Port Harcourt metropolis, Rivers State, Nigeria

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Accepted 23 February, 2016

Microbiological quality of selected street - vended foods in Port Harcourt metropolis, Rivers state was investigated. Four different ready-to-eat street food samples (Egg burger, vegetable salad, packaged fried rice and meat pie) were randomly purchased. The samples were prepared and analyzed using standard procedures. Mean viable counts of heterotrophic, bacteria, coliform bacteria and Salmonella-shigella bacteria were determined on egg burger 41 x 10⁵ cfu/g, 17 x 10³ cfu/g and 18 x 10³ cfu/g; packaged fried rice 42 x 10⁵ cfu/g, 23 x 10³ cfu/g and 14 x 10³ cfu/g; Meat pie 30 x 10⁵ cfu/g, 19 x 10³ cfu/g and 13 x 10³ cfu/g; Vegetable salad 51 x 10⁵ cfu/g, 13 x 10³ cfu/g, and 24 x 10³ cfu/g, respectively. Bacillus spp, Proteus spp, Staphylococcus aureus, Psedomonas spp, Shigella spp, Enterobacter spp and Streptococcus spp, were isolated from the food samples. The presence of coliform bacteria in the vegetable salad, fried rice and egg burger could be handling/preparation practices and faecal contamination from the food samples.

Key words: Street foods, ready-to-eat foods, microbiological quality.

INTRODUCTION

Food is an essential instrument for health promotion and disease prevention. Poorly prepared and packaged street vended foods had been identified in many countries as causes of food borne disease (FAO, 1997). The sales of street foods have grown significantly in recent years and a source of income to people. Although street foods belong to the informal sector of the Nigerian economy, it is rapidly expanding especially in the urban cities. It plays a significant role in the feeding of urban population with cheap accessible and nutritious foods. Street foods are ready-to-eat (RTE) foods and beverages either prepared on the street and sold along the streets by vendors and hawkers or prepared at home, transported from home and consumed on the streets without further processing (Muinde and Kurria, 2005). These foods are now popular in the developing countries due to economic changes, population growth and urbanization. However, there are a number of factors that can result to food borne diseases; these may include failure to cook food thoroughly, holding food at ambient temperature optimal for bacterial growth, poor handling, storage and transportation of cooked foods, lack of hygienic practices, among others (Mensah et al., 2002).

According to FAO (1997), street foods raised concern with respect to their potential food poisoning outbreaks due to improper handling and unhygienic practices among street food vendor. Port Harcourt is an urban city in the South South region of Nigeria and diversified street foods are prepared and vended along the streets. These may include vegetable salad, egg burger, packaged fried rice, meat/fish pies, roasted plantain/yam/fish, moin-moin, pancake and many others. Several microorganisms of public health concern have been implicated in street foods sold in some African countries such as fecal coliform bacteria, Salmonella species (Achinewhu and Amadi, 1996; Gitahi et al., 2012). These may include vegetable salad, egg burger, packaged fried rice, meat/fish pies, roasted plantain/yam/fish, moin-moin, pancake and many others.

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Table 1. Mean bacterial count of selected street vended foods.

<table>
<thead>
<tr>
<th>Food Sample</th>
<th>Heterotrophic Count (cfu/g)</th>
<th>Coliform Count (cfu/g)</th>
<th>SSB Count (cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg burger</td>
<td>$41 \times 10^5$</td>
<td>$17 \times 10^3$</td>
<td>$18 \times 10^2$</td>
</tr>
<tr>
<td>Packaged fried rice</td>
<td>$42 \times 10^5$</td>
<td>$23 \times 10^3$</td>
<td>$14 \times 10^3$</td>
</tr>
<tr>
<td>Meat pie</td>
<td>$30 \times 10^5$</td>
<td>$19 \times 10^3$</td>
<td>$13 \times 10^3$</td>
</tr>
<tr>
<td>Vegetable salad</td>
<td>$51 \times 10^5$</td>
<td>$13 \times 10^3$</td>
<td>$24 \times 10^3$</td>
</tr>
<tr>
<td>WHO standard</td>
<td>$1.6 \times 10^4$</td>
<td>$1 \times 10^4$</td>
<td>$2 \times 10^3$</td>
</tr>
</tbody>
</table>

SSB = Salmonella-Shigella Bacteria.

Many of these street foods may have a high degree of hand contact in the process of preparation and vending which predisposes these foods to various levels of bacterial contamination especially those of human origin (Mepba et al., 2007).

This study is to evaluate the microbial quality of some of these street foods hawked along the streets of Port Harcourt and compared the results obtained with prescribed standards.

MATERIALS AND METHODS

Collection of samples

A total of 120 samples comprising 30 each of four ready-to-eat street foods (vegetable salad, egg burger, packaged fried rice and meat pie) were purchased from vendors. The samples were collected weekly for three weeks during which 40 samples/week was collected from different vendors. All the samples were collected in polythene bags as sold and placed in ice-cooled containers and transported to the food microbiology laboratory of the Department of Food Science & Technology for analysis within one hour after collection.

Isolation and enumeration of bacteria

Twenty-five (25 g) of each of the food samples were weighed into a sterilized stomacher blender (steward model: stomacher 400, UK) containing 225 ml of 0.1% buffered sterile peptone water and homogenized at 260 rpm for 2 mins to form a homogenate of the food sample. The resultant homogenate was diluted serially up to $10^{-5}$. From the appropriate dilutions, 0.1 ml was plated in duplicate onto the different media using the spread plate technique.

Nutrient agar, Mac-conkey agar and Salmonella-shigella agar were inoculated for total aerobic plate counts (Total heterotrophic counts, coliform bacterial counts and total Salmonella shigella counts, respectively. Nutrient agar was also used for isolation of S. aureus. Enumeration of bacteria and isolation of bacterial colonies was done after incubation of plates at 37°C for 24 h to obtain viable bacterial colonies. Plates containing 30 - 300 colonies were selected and counted at the expiration of the incubation period using the colony counter (Gallenkamp, England). Bacterial counts were expressed as colony-forming units per gram of food sample (cfu/g).

Characterization and identification of isolates

The identification of distinct bacterial colonies was based on standard methods (Cowan and Steel, 1985; Speck, 1976). The bacteria isolated were gram stained and specific biochemical tests performed. The morphological characterization of each of the isolated colonies was done by observing their shape, colour, texture and appearance. Biochemical test were performed on the isolates to examine for their ability to ferment sugars, catalase activity, Oxidase test, methyl red, citrate utilization, coagulase activity and motility test; and by reference to Buchansa and Gibbons (1994).

RESULTS

The data in Table 1 shows the mean bacterial load of selected street foods investigated. (Egg burger, packaged fried rice, meat pie and vegetable salad).

Table 1 reveal that vegetable salad had the highest mean Heterotrophic count of $51 \times 10^5$ cfu/g, followed by packed Fried rice ($42 \times 10^5$ cfu/g) then Egg Burger $41 \times 10^5$. The table also reveals that packaged Fried rice had the highest number of Coliforms ($23 \times 10^3$ cfu/g) followed by meat pie ($19 \times 10^3$ cfu/g).

Table 2 showed the bacterial types isolated from the different street-vended foods investigated (Egg burger, packaged fried rice, meat pie and vegetable salad). Table 2 also reveals that there were a total of seven genera of microorganisms isolated from the vended-street food samples, these include Proteus species and S. aurens isolated from Egg burger, Bacillus species and Psendeomonas species isolated from Fried rice and meat pie, Shigella species isolated from fried rice and meat pie, Enterobacter species and Streptococcus species isolated from vegetable salad.
DISCUSSION

This study revealed that the mean bacterial load was highest in vegetable salad followed by packaged fried rice and egg burger having the lowest microbial load. Also the organisms isolated from these street foods (Vegetable salad, fried rice, egg burger) were mostly coliform bacteria such as *Proteus* spp and *Enterobacter* spp.

The microbial loads of the street foods evaluated in Table 1 were far higher than WHO standards of THB $10 - 16 \text{ cfu/g}$, total coliform $0 - 10\text{ g}$ and SSB $20\text{ g}$ for street foods (WHO, 1996). Coliform bacteria are mainly found in water, soil and faecal matter. They are widely distributed in water, soil and vegetation (Rompre et al., 2002). The presence of coliforms in ready to eat food such as vegetable salad, packaged Fried rice and egg burger depicts a deplorable state of hygiene and sanitary practices employed during the preparation and packaging of these street foods (Jay, 2005). Coliforms are indication of unsanitary conditions, unhygienic practices during and after production and poor source of water used (Beuchat, 1995).

Muinde and Kuria (2005) reported that water used for preparation of street foods is often from sources that are not treated and lead to high bacterial count. The vegetables used in the preparation of the vegetable salad and fried rice always have contact with soil and if not properly washed with clean water could pose a high risk for street food consumers.

Prolong holding of food such as vegetable salad, egg burger and fried rice at ambient temperature with high relative humidity also predispose these street-vented food to high microbial multiplication (FAO, 1979). Hence the presence of coliforms in the vegetable salad and fried rice provided a direct evidence of likely faecal contamination probably resulting from poor personal hygiene such as hands not washed thoroughly after toileting and then food preparation and kitchen utensils. This observation is in agreement with the work of Wanyenya et al. (2004). Results of bacterial identification (Table 2) revealed that *S. aureus* was isolated from egg burger. It is present in nasal passage, throat, hair and skin, of healthy individuals; unsatisfactory levels of *S. aureus* indicate that time/temperature abuses of the egg burger may have occurred following improper handling of the food during preparation and sales with bare hands; Furthermore, the egg burgers are sold under the hot sun till evening without being protected.

*S. aureus* being a normal body microorganism could have also been introduced into the egg burger through unclean hands and mouth of the vendor where they attempt to open the packaging material by blowing air into it other to open it. The presence of *S. aureus*, a pathogenic organism is of public health concern (Odu, and Akani 2012).

*Pseudomonas, Proteus Salmonella* and *Enterobacter* species are environmental contaminants. Their presence in ready to eat street foods such as egg burger, meat pie and vegetable salad (Table 2) indicate poor food preparation and handling practices, cross contamination, unclean hands of the vendors and contact with sewage or contaminated water (Beuchat, 1995, Durgesh et al., 2008).

* Bacillus cereus* is normally associated with rice, its presence in the packaged fried rice (Table 2) may be due to the fact that a spore former and the spores can withstand high temperature during frying of foods. *Bacillus* spp has the ability to form spores which are heat resistant. Achinewhu and Amadi (1996) reported the presence of *B. cereus* in some street foods in Port Harcourt.

Conclusion

The study revealed high microbial load in the street-vented food investigated. The average counts for bacteria were above the maximum allowable limit in foods to be marked for consumption (103 cfu/g). Of the seven bacterial species isolated, some occurred in three food samples, others occurred in two food samples. Presence of bacteria in ready-to-eat food in this study could pose health risk to the consumers. Poor food preparation handling, water, exposure to environment, inadequate washing of hands and utensils may have contributed to the presence of the various species of

<table>
<thead>
<tr>
<th>Bacterial species</th>
<th>Egg Burger</th>
<th>Packaged Fried Rice</th>
<th>Meat Pie</th>
<th>Vegetable Salad</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Proteus</em> Species</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Bacillus</em> Species</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Pseudomonas</em> Species</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Shigella</em> Species</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td><em>Enterobacter</em> Species</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Streptococcus</em> Species</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

Key: X = Bacteria isolated, - = Bacteria not isolated.
bacteria in the ready-to-eat street vended foods ... and the high microbial load in vegetable salad, fried rice, egg burger vended in the streets of Port Harcourt.

REFERENCES


