THE EFFECTIVENESS OF PAPER WRAPPING IN PREVENTING MICROBIOLOGICAL CONTAMINATION OF READY TO EAT STREET BURGERS

MARYAM INSYIRAH ZULKIFLI (CORRESPONDING AUTHOR)
INTERNATIONAL INSTITUTE FOR HALAL RESEARCH AND TRAINING
(INHART), INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, KUALA
LUMPUR, 50728,
MALAYSIA.
insyirahzu@yahoo.com

IBRAHIM ABU BAKAR
DEPARTMENT OF NUTRITION SCIENCES, KULLIYYAH OF ALLIED HEALTH
SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA,
JLN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA
25200 KUANTAN, PAHANG,
MALAYSIA
iab@iium.edu.my

ABSTRACT

Introduction: The objective of this study was to evaluate the effectiveness of commercial plastic laminating paper wrapping in preventing microbiological contamination of ready to eat (RTE) street burgers. **Methods:** About 21 samples of RTE burgers, which were prepared and wrapped using plastic laminating papers were purchased to determine their microbiological quality and shelf life. The samples were divided into 7 groups and were left at ambient temperature for seven interval hours (<4h, 4h, 8h, 12h, 16h, 20h, 24h). The analysis of TPC and *S. aureus* were then performed for each groups of the samples. **Results:** The results showed that all RTE street burgers had low to medium microbiological risks and RTE burgers which were just prepared and wrapped with plastic laminating paper and were left at ambient temperature are safe for consumption up to 24 hours. **Conclusions:** Commercial plastic laminating paper is suitable to be used to prevent microbiological contamination and prolong the shelf life of RTE street burgers.

KEYWORDS: Ready to eat street burger, Plastic laminating wrapping paper, Total Plate Count, *Staphylococcus aureus* and Shelf Life Study.

INTRODUCTION

Ready to eat (RTE) burger is appreciated well by people around Malaysia especially young generation due to its taste, low cost and fast prepared for immediate consumption. However, RTE burger could be easily contaminated with various food-borne pathogens and could be a source of food-borne illnesses as many are prepared and sold at open stall near the roadside. Bacteria *Staphylococcus* species exist in meat and meat product food (Al-Mutairi, 2011). A number of studies related to the safety of street vended foods including RTE food were conducted in Malaysia (Haryani *et al.*, 2007 & Jamali *et al.*, 2013). *Staphylococcus aureus* were detected in selected RTE food that were sold at street market (Shafizi *et al.*, 2016).

In recent years, several studies have been conducted in order to investigate the microbiological and safety quality of RTE foods served in various sectors (Almualla *et al.*, 2010, Garayoa *et al.*, 2011, Legnani *et al.*, 2004 and Marzano & Balzaretti, 2011). However, knowledge about the microbiological contamination of RTE burger in Malaysia is still limited. Burgers have limited stability, mainly caused by microbial spoilage and lipid oxidation. During meat processing, there were high initial counts of viable psychotropic and mesophilic microorganisms found in the samples (Karpińska-Tymoszczyk, 2010).

The purposes of this study was to evaluate the effectiveness of commercial plastic laminating paper wrapping in preventing microbiological contamination of RTE street burgers sold at street market in Kuantan town, Malaysia.

METHODS

Samples

Fourteen samples of RTE burgers were purchased at the same time from one street stall burger vendor in Kuantan town. The samples were divided into 7 pairs and were subjected to seven interval of holding hours i.e. <4h, 4h, 8h, 12h, 16h, 20h, 24h. All the samples were wrapped in plastic with laminated wrapping paper and were transported immediately to the microbiological laboratory at Department of Nutrition Sciences, International Islamic University Malaysia Kuantan campus.

Microbiological Analysis

a) Sample preparation

For each interval hour, the plastic laminating wrapping papers of the burgers were opened aseptically and about $25 \pm 1g$ samples were transferred into a sterile stomacher bag and homogenized for 60s with 225ml of sterile peptone water (Oxoid, Basingstoke, UK) using Stomacher Lab-blender 400 (Seward Medical, London, UK). Three serial dilutions were made using 1ml of the homogenate mixed with 9ml of sterile peptone water.

b) Total Plate Count (TPC)

About 0.1 ml samples from each dilution series were pipetted on the Plate Count Agar (PCA) plates and were spread using bent glass rod (hockey stick). The plates were then incubated for 48 ± 2 hours at 37 ± 1 °C in an incubator. After incubation, the colonies of all the bacteria were observed to have appeared as white colonies. The plates which have 25-250 visible colonies were counted. The total number of bacteria was calculated as mean colonies counted on each plate multiply with the dilution factor and then divided by the amount of diluted sample which was pipetted on the agar. The amount of total bacteria that was less than 1.0×10^3 cfu/g was considered low while the amount between $1.0 \times 10^3 – 1.0 \times 10^6$ cfu/g was considered medium and those which was more than 1.0×10^6 cfu/g was considered high (Roberts & Greenwood, 2003).

S. aureus **count**

About 0.1 ml samples from each dilution series were pipetted on a Baird Parker Agar (BPA) plate and were spread using glass hockey stick. The plates were then incubated for 48 ± 2 hours at 37 ± 1 °C in an incubator. After incubation, the colonies of presumptive *S. aureus* appeared as black colonies surrounded by a light region. The plates which have 25-250 visible colonies were counted. The amount of *S. aureus* which was less than 1.0×10^2 cfu/g was considered low whereas the amount between $1.0 \times 10^2 – 1.0 \times 10^4$ cfu/g was considered as medium level and more than 1.0×10^4 cfu/g was considered as high.

Assessment of Shelf Life

The samples wrapped in plastic laminated wrapping paper were kept at room temperature in the laboratory according to seven dedicated holding hours (<4h, 4h,

8h, 12h, 16h, 20h, 24h). The microbiological analysis were performed for each group of samples at each interval holding hours.

RESULTS

The results of microbiological quality and shelf life of the burgers kept at ambient temperature for several interval hours are shown in the Table 1.

Table 1: Total Plate Count and *S. aureus* count in RTE street burger samples according to different holding time intervals

Holding Time	**1**Total Plate Count (cfu/g)	**2**S. *aureus* Count (cfu/g)
3<4 hour	**4**1.2×10^2	**5**0.5×10^2
64 hour	**7**0.6×10^2	**8**1.6×10^2
98 hour	**10**1.7×10^2	**11**1.9×10^2
1212 hour	**13**1.4×10^2	**14**1.4×10^2
1516 hour	**16**0.4×10^2	**17**0.8×10^2
1820 hour	**19**1.1×10^2	**20**0.3×10^2
2124 hour	**22**1.3×10^2	**23**1.4×10^2

DISCUSSION

The results shows that Total Plate Count were in the range of 0.4×10^2 - 1.7×10^2 cfu/g for all samples according to interval holding time. This means TPC counts are low in RTE halal street burgers even though they were left over up to 24 hours at ambient temperature. *S. aureus* count in the other hand were in the range of 0.3×10^2 - 1.9×10^2 cfu/g. These results show that the count of *S. aureus* in RTE street burger samples have low or medium risks. Medium count of *S. aureus* showed that the initial count of *S. aureus* in the samples increased slowly after several holding hours. After cooked, contamination could also happen by improper food handling by unclean food handlers during burger preparation. The low - medium risks of RTE halal street burgers may also due to proper wrapping of the burgers with plastic laminating paper even though they are left over at ambient temperature up to 24 hours. These results indicate that the burgers are still safe to be consumed within 24 hours of holding time at ambient temperature.

The low count of TPC in street burgers may due to several reasons such as the burger were just cooked or still hot at the time of sampling. The burgers also were

wrapped properly using laminated paper were not exposed to the environment. The mean bacterial count for burgers sold in Saudi Arabia market was ranged from 3.3×10^7 cfu/g (AL-Dughaym & Al-Tabari, 2010). Total viable count of meat burger was 4.1×10^4 cfu/g (Safa Mustafa Ibrahim *et al.*, 2014). Local study showed that TPC analysis of local brand beef burgers was very low, that is in the range of 1×10 to 8×10 cfu/g. Similarly, with the chicken burgers, the local brand chicken burgers had TPC range from 1×10 to 4×10 cfu/g. The time lapse between processing, handling, transportation, storage and packaging would definitely increase chances of bacterial multiplication (Babji *et al.*, 2000).

The medium count of *S. aureus* in RTE street burger samples indicate cross contamination or improper food handling after frying the burger or during the process of filling other materials in cooked burger or during the wrapping of the burger. *S. aureus* is traditionally used as hygiene indicator of food handling.

CONCLUSION

The TPC counts are low in RTE street burgers even though they were left over up to 24 hours at ambient temperature in plastic laminating wrapping paper. The count of *S. aureus* in RTE street burger samples on the other hand have low or medium risks when left over at ambient temperature up to 24 hours in plastic laminating wrapping paper. Commercial plastic laminating wrapping paper is suitable to be used to prevent microbiological contamination and prolong the shelf life of RTE street burgers.

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