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MICROBIOLOGICAL QUALITY OF EGYPTIAN TRADITIONAL LUNCHEON SLICED AT RETAIL MARKETS

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ABSRACT

During traditional slicing of luncheon for consumers at retail stores, additional hazards may contaminate the sliced product. Therefore, the main objective of the current study was to evaluate total bacterial counts, total coliform and fecal coliform counts (MPN), coagulase-positive staphylococci counts (CPS), and the occurrence of *Escherichia coli* and *Salmonella* spp. in luncheon meat samples sliced at supermarkets and grocery stores. One hundred and twenty sliced luncheon samples were collected and examined promptly after transferring to the Lab. The mean values were observed to be higher than the standard level determined by Egyptian Specification Organization (ESO) in considerable percentages. About 41, 20 and 29 % of samples were observed to be non-conformed to the ESO in relation to TBC, *Staphylococcus aureus* count and *E.coli* count, respectively. Three strains of serologically identified *E. coli* including O128: K67 (5 %), O124: K72 (4.2 %) and O55: K59 (3.33 %) were isolated. It could be concluded that the source of contamination of traditional sliced luncheon by different bacterial groups may be inadequate processing or mishandling and bad hygienic measures applied during preparation of sliced luncheon. Therefore, strict hygienic measures should be adopted in all supermarkets and grocery stores during preparation of these products.

Keywords: Luncheon, *Staphylococcus aureus*, Salmonellae, Coliformas, *Escherichia.coli*, Retail markets

INTRODUCTION

Ready-to-eat (RTE) foods are considered a high risk food group, since they are often consumed without further cooking or heating. Sales of ready-to-eat meat have grown rapidly in the last decade because of busy life style and their convenience and freshness. Luncheon meat is a RTE food widely consumed in Egypt due to its high palatability and attractiveness to consumers [1].

Luncheon is gaining popularity because it represents quick easily prepared meal of low price and renders the processors to convert the various types of meat into unified products. However, it is liable to harbor different types of microorganisms through a long chain of handling, processing, distribution and storage as well as preparation. Therefore, it is considered as serious source of food borne diseases and has been frequently linked to major outbreaks of food poisoning all over the world [2]. Accurately, up to 4000 deaths and 5 million illnesses each year is caused by contaminated meat and meat products with food poisoning bacteria particularly, *E. coli*, *Salmonella*, *Staphylococcus aureus* and *Clostridium perfringens*. Consequently, food poisoning outbreaks are prevalent in all regions of the world. In industrial countries, up to 10% of the population may suffer in a year. While, surveillance is not available in developing countries but the fragmentary information indicates that the prevalence is higher than that in developed countries [3].

Microbiological safety of sausages is one of the most important issues for industry and consumers. Therefore, understanding the microbial profile of luncheon is crucial to help food retailers to use high hygienic standards for serving safe food. It has been concluded previously that the microbial load of ready to eat foods can serve as a tool for promotion of awareness and prerequisite for improvement of the sanitary and hygienic practices and for efficient cleaning and sanitation procedures to reduce or eliminate contamination or cross-contamination of ready to eat foods [4]. Sausages may be contaminated with different microorganisms during processing from meat, non-meat additives as well as from environment, equipments and handlers. This contamination affects the microbiological safety of the product.

In Egypt, luncheon is produced as industrially vacuum packaged loaves and afterwards is sliced for consumers

at retail stores. This practice may introduce additional hazards of contamination, the main objective of this study was to evaluate total bacterial counts, total coliform and fecal coliform counts (MPN), coagulase-positive staphylococci counts (CPS), and the occurrence of *Escherichia coli* and *Salmonella* sp. in sliced luncheon samples collected from different supermarkets and grocery stores.

MATERIALS AND METHODS

Collection of samples

One hundred and twenty sliced luncheon samples (250g each) were obtained from different super markets and grocery stores in Beni-Suef governorate in the period from June to December, 2016. The collected samples were transferred to the laboratory of Food hygiene and Control department at the Faculty of Veterinary medicine, Beni-Suef University in an ice-box to be examined for their bacterial load.

Microbiological examination

Preparation of homogenate and serial dilution

Ten grams from each luncheon sample were taken under aseptic condition using sterile scissor and forceps. The samples were homogenized in sterile homogenizer (Universal laboratory aid-made in Poland) with 90-ml sterile of Ringers' solution (Merck, Germany) for 2 min to provide dilution of 10^{-1}. From the original homogenate, ten-fold serial dilution was prepared [5].

Analysis of different microbial loads

The samples were analyzed for their bacterial load using standard procedure [5]. Total viable count (TVC) was performed using pouring technique in which1 ml of each dilution were transferred to sterile plates then 15 ml of sterile plate count agar (PCA Oxoid CM0463B, Hampshire, England) poured over the food homogenate. The plates were incubated at 35^{o}C for 48 h. Fore numeration and isolation of *Staphylococcus aureus*, aliquot (0.1ml) was streaked onto Baird Parker Agar and typical colonies (black to dark gray with an opaque zone surrounded by a clear halo) were selected and biochemically identified. Coliforms, facecal coliforms and *E.coli* were determined using Most Probable Number technique "MPN". The isolated *E.coli* were identified biochemically and serologically. For isolation of salmonellae [6], twenty five grams from each sample were homogenized with 225 ml of buffered peptone water (Oxoid, CM 509) and incubated at 35^{o}C for 18 h then 0.1ml of the pre.enrichment broth were inoculated into Rappaports Vassiliad is broth

(Oxoid, CM 669) and incubated for 48 h at 42°C.A loopful from each enrichment broth was streaked onto Plates of XLD (Oxoid, CM469) and S.S agar (Oxoid,CM109).

Statistical analysis

Microbial counts (cfu g^{-1}) were log transferred before statistical analysis. Statistical data analysis was carried out using SPSS 17.0 for windows (SPSS Inc, Chicago, IL, USA).

RESULTS AND DISCUSSION

The maximum, minimum and mean values for total bacterial counts (log cfu/g) in the examined luncheon samples were 6.77, 3.48 and 4.33±0.09, respectively (Table 1). These counts were in good agreement with those recorded previously [7, 8, 9]. However, higher counts were obtained by other authors [10, 11, 12]. The Egyptian Specification organization [13] determined the maximum limit for total bacterial counts (log cfu/g) of luncheon to be not more than 4. According to ESO, 44.66 % of the examined sliced luncheon samples are not conformed to the standard (Table 2).

The higher bacterial counts may be due to contaminated machines, containers, cutting tables and knifes as well as higher bacterial counts of raw materials which decreased the efficacy of cooking temperature in lowering the bacterial counts. Slicing of luncheon constitutes a high risk of contamination as slicing is normally undertaken after cooking, therefore posing a microbiological risk because of the potential for recontamination via the slicing blade and subsequent handling.

The difference between the maximum and minimum total bacterial counts observed on the luncheon samples analyzed in this study may resulted from variable levels of exposition to contaminants during handling and slicing procedures at the different supermarkets and grocery stores. Cleaning and disinfection of surfaces in the food processing environment may affect the quality and safety of the processed food products [14]. Specifically, the cleaning of equipment surfaces represents a challenge for sanitation programs, since most equipment is not hygienically designed and must be unassembled prior to sanitization procedures. This fact may lead to the decrease of cleaning and disinfection frequency and to the hazard of biofilm formation. Consequently, products that touch or pass over contaminated surfaces will potentially pick up microorganisms from the microbial consortium that may have developed on the surfaces [15]. Besides the improper cleaning and

sanitizing of equipment and surfaces, the difference found on counts may also reflect the processing practices adopted by each supermarket in terms of extent of manipulation and contact of products with the environment during processing [16].

Table 1: Bacterial load of examined sliced luncheon samples (n=120)

	Maximum	Minimum	Mean	SE
TBC (log cfu/g)	**6.77**	**3.48**	**4.33**	**0.09**
***Staph aureus*(log cfu/g)**	**5.60**	**< 2**	**2.73**	**0.13**
Total coliforms (MPN/g)	**2100**	**< 3**	**241.72**	**34.80**
Fecal coliforms (MPN/g)	**1100**	**< 3**	**89.70**	**18.44**

Table 2: Conforming of analyzed sliced luncheon samples to the Egyptian Organization for standardization

Bacterial profile	No of examined samples	# of conformed samples	% of conformed samples	# of non-conformed samples	% of non-conformed samples
TBC (log cfu/g)	**120**	**70**	**58.33**	**50**	**41.66**
Coagulase positive *Staph aureus*(log cfu/g)	**120**	**96**	**80.00**	**24**	**20.00**
Total coliforms (MPN/g)	**120**	**85**	**70.83**	**35**	**29.16**

The total *Staph aurous*counts (log cfu/g) in examined samples ranged from < 2 to 5.60 with a mean value of 2.73±0.13. However, coagulase positive *Staph aureus* was isolated from 20 % of the examined samples.

The high incidence of *Staph aureus* may be attributed to cross-contamination from the skin, mouth or nose of food handlers during the traditional slicing of luncheon. In this respect Ouf [9] isolated *Staph aureus* from 15 % of examined luncheon samples. *Staph aurous* counts of 2.78 log cfu/g were obtained by Hassanien [17]. El-Hadedy and Abu El-Noor [18] obtained average count (log cfu/g) of 2.78 for *Staph aurous* in luncheon. Lower counts (0.7 log cfu/g) in sliced packaged Brazilian luncheon were recorded [16]. Incidence rates of 32, 18, 24, 15, and 26 % for *Staph aurous*were obtained by previous authors [19, 20, 21, 22, 23]. Moreover, incidence rate of 10 % was also recorded [24].

The results revealed that coagulase *Staph aureus* isolated from 20 % of examined samples which does not comply with the EOS [13], which stated that the luncheon should be free from coagulase positive *Staphaureus*.

Salmonellae could not be isolated from any of the examined sample. Several investigators failed to isolate salmonellae from luncheon meat [25, 26, 27, 11, 12, 9]. However,

Salmonellae were isolated from 16.7 and 10 % of luncheon samples [29, 30].

The mean value of the coliforms count (MPN) was 241.72±34.80 with minimum of < 3 and maximum of 2100 (Table 1). Lower values were obtained by Yassien [8], however, higher values were reported by Fathi et al. [25], Mousa et al. [27], Tolba [11] and Ouf [9]. The MPN of fecal coliforms was 89.70±18.44 with minimum of < 3 and maximum 1100 (Table 1). Lower values were recorded by Yassien [8]. The ESO [13] determined the standard limit of the acceptable count of coliforms; in this respect, it was observed that 29 % of samples showed values exceeded the standard limit of coliforms (10^2).

The presence of higher values of coliforms in processed meat products indicates inadequate processing, and/or post processing contamination, dirty equipments and inadequate sanitary condition during handling and preparation [31].

Escherichia coli were isolated from 14 of the 120 examined sliced luncheon samples (11.66%). Higher percentages were recorded for *E. coli*[27, 12, 32, 24], meanwhile, lower percentages were recorded by another author [17]. However, the microorganism could not be isolated by Hemeida et al. [7] and Ouf[9]. Pathogenic serovars of *E. coli* isolated from sliced luncheon samples were serologically identified as O128: K67 (5 %), O124 : K72 (4.2 %) and O55 : K59 (3.33 %) which categorized as Enterotoxigenic *E. coli* (ETEC), Enteroinvasive *E. coli* (EIEC) and Enteropathogenic *E. coli* (EPEC), respectively [33], Typically EPEC strains were implicated in many cases of gastroenteritis, cystitis colitis, pyelonephritis, peritonitis and puerperal sepsis as well-as food poisoning outbreaks [34].

CONCLUSION

In the present study, it can be concluded that the source of contamination of traditional sliced luncheon by different bacterial groups may be inadequate processing or mishandling and bad hygienic measures applied during preparation of sliced luncheon. Therefore, strict hygienic measures should be adopted in all supermarkets and grocery stores during preparation of these products.

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