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Original Research Article

Microbiological risk assessment in ready to eat processed meat

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ABSTRACT

A total of (120) sample of ready to eat (RTE) meat;(20) each of cooked luncheon, frankfurter, hot dog, pasterma, shawrma and smoked luncheon were collected from different shops and grocery stores in Beni-Suef City. To be examined for their microbial load for aerobic plate count (APC), most probable number (MPN) of coliforms, fecal coliforms and E.coli as well as Staphylococcus aureus and enterococci were enumerated. Additionally E.coli, salmonella and Listeria were isolated and identified biochemically. Aerobic plate count (APC) had the highest mean value in shawerma ($1 \times 10^7 \pm 5 \times 10^6$ CFU/g), shawerma also showed the highest most probable number (MPN) of coliforms and fecal coliforms (11 and 6 CFU/g) mean while pasterma was the highest contaminated with Staphylococcus aureus (3×10^4 CFU/g) and the highest count of enterococci was detected in hot dog (3×10^5 CFU/g). On the other hand each of E.coli, Salmonella and Listeria species were failed to be detected in any of the examined samples.

The public health significance as well as the recommendations to produce safe and high quality ready to eat (RTE) meat products were mentioned.

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1. Introduction

Ready to eat foods can be described as foods being ready for immediate consumption at the point of sale. They may be sold raw or cooked, hot or chilled and could be consumed without further heat treatment.

Ready to eat foods could be contaminated from poor quality water and unacceptable levels of airborne microorganisms in the processing environment (Kirby et al., 2003; and Salustiano et al., 2003). The use of high temperatures during production diminishes the ability of microorganisms to grow and replicate.

The microbial load of ready to eat (RTE) meat were investigated by many researchers as cooked luncheon (Hassanien, 2004; and Samaha et al., 2016), frankfurter (Afshin et al., 2011; Gómez et al., 2015; and Melngaile et al., 2014), hot dog (Melngaile et al., 2014; Ruiz et al., 2015 and Kotheet al., 2016), pasterma (Rivas et al., 2017), shawrma (Alhaddad et al., 2013; Nimri et al., 2014), smoked luncheon (Melngaile et al., 2014).

In developed countries, up to 30% of the population suffers from food borne diseases or illnesses each year, while in developing countries up to two (2) million deaths are estimated per year. Studies revealed that, *Campylobacter jejuni*, *Salmonella*, *Escherichia coli* O₁₅₇:H₇, *Listeria* and *Staphylococcus aureus* are the important food-related pathogens.

The purpose of this study was to examine some ready to eat meat collected from different super markets and grocery stores in Beni-Suef city for aerobic plate count, most probable number of coliforms and fecal coliforms, *Staphylococcus aureus* and enterococci count as well as for isolation of salmonella, listeria and *E.coli* to assess the microbiological hazards associated with consumption of these foods as well as their comparison with international and local microbiological standards.

2. Materials and methods

1. Collection of Samples:

A total of 120 random samples (250 g weight of each) of ready to eat meats were collected from different shops and grocery stores in Beni-Suef City. Twenty samples each of cooked luncheon, frankfurter, hot dog, pasterma, shawrma and smoked luncheon.

The samples were separately put in clean sterile plastic bags, identified and transferred in an insulated ice box to the laboratory of food hygiene department, faculty of veterinary medicine, Beni-Suef University under complete aseptic conditions. The collected samples were subjected to microbiological examination.

2. Preparation of samples for microbiological examinations:-

The collected samples were prepared according to the technique described by APHA (1992) as 25 g of each sample was separately homogenized in a sterile homogenizer flask containing 225 ml of 0.1% sterile buffered peptone water and serial dilutions were made up to (10⁻⁶).

3. Bacteriological examination techniques:

Techniques for enumeration of aerobic plate count (APC), most probable number (MPN) of coliforms, fecal coliforms and *E.coli*, *Staphylococcus aureus* and enterococci were carried out according to methods described by APHA (1992) were applied.

The isolation of *E.coli*, *Salmonella*, *Staphylococcus aureus* and *Listeria* species were done according to APHA (1992).

3. Results

Table1. Microbial load of examined samples

Type of product	Aerobic plate count	Coliforms MPN	Fecal coliforms MPN	E.coli MPN	Staph.aureus	Enterococci
Cooked luncheon	$2 \times 10^7 \pm 6 \times 10^6$	<3	<3	<3	$2 \times 10^3 \pm 2 \times 10^2$	$6 \times 10^3 \pm 4 \times 10^2$
Frankfurter	$2 \times 10^6 \pm 5 \times 10^5$	5 ± .5	3 ± .3	<3	$2 \times 10^3 \pm 4 \times 10^2$	$2 \times 10^4 \pm 4 \times 10^3$
Hot dog	$3 \times 10^6 \pm 1 \times 10^6$	8 ± .9	4 ± .5	<3	$8 \times 10^3 \pm 1 \times 10^3$	$3 \times 10^5 \pm 2 \times 10^4$
Pasterma	$3 \times 10^6 \pm 2 \times 10^6$	3 ± .6	3 ± .5	<3	$3 \times 10^4 \pm 2 \times 10^4$	$2 \times 10^4 \pm 5 \times 10^3$
Shawrma	$1 \times 10^7 \pm 5 \times 10^6$	11 ± 1	6 ± .78	<3	$2 \times 10^3 \pm 4 \times 10^2$	$8 \times 10^3 \pm 3 \times 10^3$
Smoked luncheon	$3 \times 10^6 \pm 1 \times 10^6$	4 ± .3	2 ± .3	<3	$2 \times 10^3 \pm 3 \times 10^2$	$3 \times 10^3 \pm 3 \times 10^2$

Table 2 :Incidence of isolated microorganisms:-

	No. of examined samples	E.coli		Staph.aureus		Salmonella		Listeria	
		No.	%	No.	%	No.	%	No.	%
Cooked luncheon	20	0	0	8	40	0	0	0	0
Frankfurter	20	0	0	6	30	0	0	0	0
Hot dog	20	0	0	8	40	0	0	0	0
Pasterma	20	0	0	8	40	0	0	0	0
Shawrma	20	0	0	14	70	0	0	0	0
Smoked luncheon	20	0	0	11	55	0	0	0	0

4. Discussion

From the present data in table (1,2) it was found that the mean of aerobic plate count (APC), most probable number (MPN) of each coliforms, fecal coliforms and E.coli, Staphylococcus aureus and enterococci were $2 \times 10^7 \pm 6 \times 10^5$, $<3 \pm 0$, $<3 \pm 0$, $<3 \pm 0$, $2 \times 10^3 \pm 2 \times 10^2$ and $6 \times 10^3 \pm 4 \times 10^2$ CFU/g, respectively in cooked luncheon ; $2 \times 10^6 \pm 5 \times 10^5$, $5 \pm .5$, $3 \pm .3$, $<3 \pm 0$, $2 \times 10^3 \pm 4 \times 10^2$, $2 \times 10^4 \pm 4 \times 10^3$ CFU/g, respectively in frankfurter. Each of constituting $3 \times 10^6 \pm 1 \times 10^6$, 8 ± 1 , $4 \pm .5$, $<3 \pm 0$, $8 \times 10^3 \pm 1 \times 10^3$, $3 \times 10^5 \pm 2 \times 10^4$ CFU/g, respectively in hot dog and $3 \times 10^6 \pm 2 \times 10^6$, $3 \pm .6$, $3 \pm .5$, $<3 \pm 0$, $3 \times 10^4 \pm 2 \times 10^4$ and $2 \times 10^4 \pm 5 \times 10^3$ CFU/g,

respectively in pasterma as well as $1 \times 10^7 \pm 5 \times 10^6$, 11 ± 1 , $6 \pm .78$, $<3 \pm 0$, $2 \times 10^3 \pm 4 \times 10^2$ and $8 \times 10^3 \pm 3 \times 10^3$ CFU/g, respectively in shawrma . In smoked luncheon they were $3 \times 10^6 \pm 1 \times 10^6$, $4 \pm .3$, $<3 \pm .3$, $<3 \pm 0$, $2 \times 10^3 \pm 3 \times 10^2$ and $3 \times 10^3 \pm 3 \times 10^2$ CFU/g, respectively.

Each of E.coli, Salmonella and Listeria were not detected in the examined any sample.

High figure of salmonella and E.coli and similar figure of listeria were detected by **Nimri et al. (2014)** in shawerma.

High figure of each Staphylococcus aureus, coliforms and fecal coliforms were detected by **Kothe et al. (2016)** in hot dog.

In this respect **Samaha et al., (2016)** reported low figure for aerobic plate count (APC) in each of luncheon, frankfurter and hot dog and high figure of coliforms, E.coli and salmonella mean while nearly similar results of Staphylococcus count was detected.

Nearly similar results for both Salmonella and Staphylococcus aureus were obtained by **Hassanien (2004)** in luncheon.

The presence of aerobic microorganisms in ready to eat meat may be attributed to inadequate sanitary practices or insufficient heat treatment exposure to microorganisms also microbial levels present in raw meat and other ingredient could be a source of aerobic microorganisms in ready to eat (RTE) meat. This is in agreement with that reported by **Calleja et al., (2004)**; **Elmali et al.,(2005)** and **Gibbons et al., (2006)**.

The incidence of coliforms and fecal coliforms may occur due to fecal contamination through poor food handling and sanitation practices. This agreed with this reported by **Carrasco et al., (2012)** and **Zhao et al., (2012)**.

The high Staphylococcus aureus load in the present study may be attributed to cross contamination of ready to eat (RTE) meat from the throat, nasal area and fingernails of the food handlers. This agrees with that reported by **Le Loir et al.,(2003)** ; **Ghosh et al.,(2004)**; **Colombari et al., (2007)** and **Hennekinne, (2012)**.

Enterococci in food usually indicate poor bacteriological quality and poor hygiene during manufacture as well as it is highly heat resistant. This agreed with that reported by **Gelsomino et al., (2002)** and **Franz et al., (1999)**

The failure of listeria, salmonella and E.coli isolation may be contributed to the ready to eat (RTE) meat products specific temperature-cooking time combinations which may lead to elimination of these pathogens .(**Food Safety and Inspection Services (FSIS), (2011)**) .

High aerobic plate count values were due to presence of enterococci with high number, Staphylococcus aureus, coliforms and also fecal coliforms.

Provision of hygiene training and improved direct access to municipal tap water, has the potential to improve on the safety of RTE foods. Control of temperature is another effective measure to prevent food poisoning was recommended.

From the present data it could be concluded that: Aerobic plate count had the highest value in shawrma (1×10^7 CFU/g). The highest value of coliforms and fecal coliforms most probable number was present also in shawrma (11, 6CFU/g), respectively. Pasterma recorded the highest value in staphylococcus aureus count which was (3×10^4 CFU/g).The highest enterococci score was in hot dog samples which was (3×10^5 CFU/g).

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