BACTERIOLOGICAL EVALUATION OF FAST FOODS AT RESTAURANTS LEVEL IN CAIRO GOVERNORATE

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ABSTRACT

A grand total of 90 random samples of fast foods(ready to eat) represented by beef kofta, beef sausage and hawawshi as meat products and chicken pane, shiesh tawook and chicken shawerma as chicken meat products (15 of each) were collected from different restaurants in Cairo government, Egypt, for bacteriological evaluation. The mean values of APC, coliform and *Staphylococcal* counts in the examined samples of fast food were 1.83×104 + 0.39×104, 7.91×102 + 1.48×102& 9.35×102 + 2.08×102 (cfu/g) for beef kofta, 8.61×104 + 2.07×104, 1.54×103+ 0.33×103 & 2.76×103+ 0.51×103 (cfu/g) for beef sausage, 2.24×105 + 0.52×105 , 6.62×103 + 1.09×103& 8.12×103 + 1.29×103 (cfu/g) for hawawshi, 7.35×104 + 1.17×104, 1.18×103 + 0.26×103& 3.01×103 + 0.46×103 (cfu/g) for chicken pane, 1.92×105 + 0.46×105, 5.08 x 104 ± 1.17 x 104, 4.32×103 + 0.85×103& 9.84×103 + 1.68×103 (cfu/g) for shiesh tawook, 4.58×105 + 0.74×105, 9.97×103 + 2.53×103 and 1.75×104 + 0.31×104 (cfu/g) for chicken shawerma, respectively.

Keywords: Fast foods, APC, coliform, *Staphylococcal* counts

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1. INTRODUCTION

Fast food is the term given to food that can be prepared and served very quickly. While any meal with low preparation time can be considered to be fast food, typically the term refers to food sold in a restaurant or store with low quality preparation and served to the customer in a packaged form for takeout/take-away. The aerobic plate count indicates the level of microorganisms in a product and provides general estimate of live aerobic bacteria, indicating the quality, shelf life and post heat processing contamination (Maturin and Peeler, 1998). Processed meats are subjected to be contaminated with several types of microorganisms from different sources during the period elapsed from the time of slaughtering, preparation, processing and cooking to consumption. These microorganisms varied according to the method of manufacture, quality of used non-meat ingredients, and contamination level during the processing chain, packaging and storage (Narasimha and Ramesh, 1988). *Staphylococcus aureus* plays a great role in bacterial contamination of fast foods, because workers during preparation and processing may touch fast foods which are usually eaten without sufficient cooking or heating (Soliman, 1988). *Staphylococcus aureus* have been implicated in cases of severe diarrhea as well as the main cause of food poisoning gastroenteritis among consumers (Davies and Board, 1998). Therefore, the present study was conducted to evaluate the bacteriological examination of fast foods at restaurants level in Cairo governorate.

2. MATERIALS AND METHODS

2.1. Collection of samples:

A grand total of 90 random samples of fast foods (ready to eat) represented by beef kofta, beef sausage and hawawshi as meat produts and chicken pane, shiesh tawook and chicken shawerma as chicken meat products (15 of each) were collected from different restaurants in Cairo governorate, Egypt. Each collected sample was kept in a separate sterile plastic bag and preserved in an ice box then transferred to the laboratory under complete aseptic conditions without undue delay and examined as quickly as possible. The collected samples were subjected to bacteriological examinations to evaluate their safety and fitness for human consumption.

2.2. Bacteriological Examination

*2.2.1. Preparation of samples (*ICMSF, 1996*)*

To 25 grams of the examined sample, 225 ml of sterile peptone water (0.1%) were aseptically added and thoroughly homogenized (1/10 dilution). One ml from the original dilution was transferred to another sterile tube containing 9 ml of sterile buffered peptone water and mixed well to make the next dilution, from which further decimal serial dilution were prepared. The prepared dilutions were subjected to the following examinations.

2.2.2. Determination of Aerobic plate count.

It was carried out acc. to ICMSF, 1996.

2.2.3. Determination of Coliform count.

It was carried out acc. to ICMSF, 1996.

2.2.3.1.Isolation and Identification of Enterobacteriaceae.

Members belonging to *Enterobacteriaceae* were further identified according to Cowan and Steel (1974).

2.2.3.1.1. Morphological examination.

Films of pure suspected cultures were stained with Gram stain and examined microscopically (Cruickshank et al., 1975).

2.2.3.1.2. Biochemical identification.

- Motility test (Collins and Lyne, 1984).
- Citrate utilization test (Simmon, 1926).
- Gelatin hydrolysis test (Collins and Lyne 1984).
- Indole production test (Kovacs, 1928).
- Methyl Red Test (Ljutov, 1961).
- Voges – Praskauer test (Ljutov, 1963).
- Hydrogen sulphide production test (MacFaddin, 1976).
- Oxidation–Fermentation test (Hugh and Leifson, 1953).
- Urease test (Edwards and Ewing, 1972).
- Eijkman test (Collins and Lyne, 1984).
- Nitrate reduction test (Collins and Lyne, 1984).
- Fermentation of sugars (MacFaddin, 1976).

2.2.4. Determination of total Staphylococci count.

It was carried out acc. to ICMSF, 1996.

2.2.4.1. Morphological examination.

Films of pure suspected cultures were stained with Gram stain and examined microscopically (Cruickshank et al., 1975).

2.2.4.2. Biochemical identification.

- Catalase activity test (MacFaddin, 1976).
- Detection of haemolysis.
- Mannitol test (Bailey and Scott, 1978).
- Coagulase test (APHA, 1984).
- Thermostable nuclease test "D-Nase activity" (Lachia et al., 1971)

3. RESULTS

3.1. Aerobic plate count of the examined fast food samples

It is evident from the results recorded in table (1), that the APC/g of the examined samples of fast food ranged from 9.3×102to 2.0×105 with an average of 1.83×104 + 0.39×104/(cfu/g) for beef kofta, 2.7×103to 1.1×106with an average 8.61×104 + 2.07×104/(cfu/g) for Sausage, 8.2×103to 4.9×106with an average 2.24×105 + 0.52×105/(cfu/g) for Hawawshi, 1.6×103to 5.3×105with an average 7.35×104 + 1.17×104 (cfu/g) for Pane, 4.4×103to 3.0×106with an average 1.92×105 + 0.46×105 (cfu/g) for Shiesh tawook and 1.3×104 to 7.8×106with an average 4.58×105 + 0.74×105 (cfu/g) for Shawerma.

3.2. Total coliform count of the examined fast food samples

From the results given in table (2) it is obvious that the mean values of total coliform counts/(cfu/g) in the examined samples of fast food were 7.91×102 + 1.48×102/(cfu/g) for beef kofta, 1.54×103+ 0.33×103 (cfu/g) for sausage, 6.62×103 + 1.09×103/(cfu/g) for hawawshi, 1.18×103 + 0.26×103 (cfu/g) for pane, 4.32×103 + 0.85×103 (cfu/g) for shiesh tawook and 9.97×103 + 2.53×103 (cfu/g) for shawerma.

3.3. Enteric bacteria of the examined fast food samples

Moreover, *Proteus mirabilis* (46.67%), *Proteus vulgaris, Enterobacter aerogenes* (33.33% of each), *Klebsiella ozaenae* (26.67%), *Citrobacter freundii* (20%) and *Klebsiella pneumoniae* (13.33%),*Serratia marcescens* and *Enterobacter cloacae* (6.67% of each) were isolated from the examined beef kofta samples. (Table 3).

Concerning beef sausage, *Proteus vulgaris* was isolated at the highest level (53.33%) ,followed by *Enterobacter aerogenes* (46.67%), *Klebsiella pneumoniae* (40%), *Klebsiella ozaenae* (33.33%), *Citrobater diversus* and *Proteus mirabilis* (26.67% of each), *Enterobacter cloacae* , and *Serratia marcescens* (20% of each), and *Serratia liquefaciens* and *Citrobacter freundii* (13.33% of each) (Table 3).

From hawawshi, *Citrobacter freundii* was isolated at the highest level (66.67%) ,followed by *Klebsiella ozaenae* (53.33%), *Proteus vulgaris* (46.67%), *Proteus mirabilis* (40%), *Enterobacter cloacae* and *Serratia marcescens* (26.67% of each), *Enterobacter aerogenes* and *Kelebsiella pneumoniae* (20% of each), *Proteus rettgeri* (13.33%), *Citrobacter diversus* and *Serratia liquefaciens* (6.67% of each) (Table 3).

From shish tawook, *Enterobacter cloacae* was isolated at the highest level (66.67%), followed by Proteus mirabilis (46.67%), *Proteus vulgaris* (40%), *Citrobacter diversus, Enterobacter aerogenes* (33.33% of each), *Citrobacter freundii*, *Kelebsiella pneumoniae* (26.67% of each). *Proteus rettgeri* (20%), *Klebriella ozaena* and *Serratia liquefaciens* (13.33% of each) and *Serratia marcescens* (6.67%) (Table 4).

Concerning shawerma, *Proteus mirabilis* was isolated at the highest level (73.33%), followed by *Proteus vulgaris* and *Enterobacter cloacae* (53.33%) of each, *Citobacter diversus* and *Klebsiella pneumoniae* (46.67% of each), *Enterobacter aerogenes , Serratia marcescens* (40% of each), *Klebsiella ozaenae* (33.33%), *Citrobacter freudii* and *Serratia liquefaciens* (26.67% of each) and *Proteus rettgeri* and *Providencia alcalifaciens* (13.33% of each).(Table 4).

3.4. Total staphylococcal count of the examined fast food samples

From the results given in table (5), it is obvious that the total *staphylococcal* count in the examined samples of fast food ranged from 1.0×102to 8.0×103with an average of 9.35×102 + 2.08×102/(cfu/g) for beef kofta,

2.0×102to 1.1×104with an average 2.76×103+ 0.51×103/(cfu/g) for sausage, 5.0×102to 4.0×104with an average 8.12×103 + 1.29×103/(cfu/g) for hawawshi, 1.0×102to 2.0×104with an average 3.01×103 + 0.46×103 (cfu/g) for pane, 4.0×102to 1.0×105with an average 9.84×103 + 1.68×103 (cfu/g) for shiesh tawook and 6.0×102to 1.8×105with an average 1.75×104 + 0.31×104 (cfu/g) for shawerma.

Table (1): Statistical analytical results of Aerobic plate count/g (APC) in the examined samples of fast foods at restaurants in Cairo governorate (n=15).

Fast Foods	Min.	Max.	Mean ± S.E*
Meat Products:			
Kofta	9.3×102	2.0×105	1.83×104 + 0.39×104
Sausage	2.7×103	1.1×106	8.61×104 + 2.07×104
Hawawshi	8.2×103	4.9×106	2.24×105 + 0.52×105
Chicken Products:			
Pane	1.6×103	5.3×105	7.35×104 + 1.17×104
Shiesh tawook	4.4×103	3.0×106	1.92×105 + 0.46×105
Shawerma	1.3×104	7.8×106	4.58×105 + 0.74×105

S.E* = standard error of mean.

Table (2): Statistical analytical results of total coliform count/g in the examined samples of fast foods at restaurants in Cairo governorate (n=15).

Fast Foods	Min.	Max.	Mean ± S.E*
Meat Products:			
Kofta	1.0×102	5.6×103	7.91×102 + 1.48×102
Sausage	3.0×102	9.5×103	1.54×103+ 0.33×103
Hawawshi	7.0×102	3.8×104	6.62×103 + 1.09×103
Chicken Products:			
Pane	2.0×102	1.7×104	1.18×103 + 0.26×103
Shiesh tawook	6.0×102	3.2×104	4.32×103 + 0.85×103
Shawerma	1.4×103	8.0×104	9.97×103 + 2.53×103

S.E* = standard error of mean

Table (3): Incidence of Enteric bacteria isolated from the examined samples of fast meat products at restaurants in Cairo governorate (n=15).

Isolated Enterobacteria	Kofta		Sausage		Hawawshi	
	No.	%	No.	%	No.	%
Citrobacter diversus	-	-	4	26.67	1	6.67
Citrobacter freundii	3	20.00	2	13.33	10	66.67
Enterobacter aerogenes	5	33.33	7	46.67	3	20.00
Enterobacter cloacae	1	6.67	3	20.00	4	26.67
Klebriella ozaenae	4	26.67	5	33.33	8	53.33
Klebriella pneumoniae	2	13.33	6	40.00	3	20.00
Proteus mirabilis	7	46.67	4	26.67	6	40.00
Proteus rettgeri	-	-	-	-	2	13.33
Proteus vulgaris	5	33.33	8	53.33	7	46.67
Serratia liquefaciens	-	-	2	13.33	1	6.67
Serratia marcescens	1	6.67	3	20.00	4	26.67

Table (4): Incidence of Enteric bacteria isolated from the examined samples of fast chicken products at restaurants in Cairo governorate (n=15).

Isolated Enterobacteria	Pane		Shish tawook		Shawerma	
	No.	%	No.	%	No.	%
Citrobacter diversus	1	6.67	5	33.33	7	46.67
Citrobacter freundii	2	13.33	4	26.67	4	26.67
Enterobacter aerogenes	2	13.33	5	33.33	6	40.00
Enterobacter cloacae	4	26.67	10	66.67	8	53.33
Klebriella ozaenae	3	20.00	2	13.33	5	33.33
Klebriella pneumoniae	5	33.33	4	26.67	7	46.67
Proteus mirabilis	6	40.00	7	46.67	11	73.33
Proteus rettgeri	1	6.67	3	20.00	2	13.33
Proteus vulgaris	8	53.33	6	40.00	8	53.33
Providencia alcalifaciens	-	-	-	-	2	13.33
Serratia liquefaciens	1	6.67	2	13.33	4	26.67
Serratia marcescens	3	20.00	1	6.67	6	40.00

Table (5): Statistical analytical results of total Staphylococci count/g in the examined samples of fast foods at restaurants in Cairo government (n=15)

Fast Foods	Min.	Max.	Mean ± S.E*
Meat Products:			
Kofta	1.0×102	8.0×103	9.35×102 + 2.08×102
Sausage	2.0×102	1.1×104	2.76×103+ 0.51×103
Hawawshi	5.0×102	4.0×104	8.12×103 + 1.29×103
Chicken Products:			
Pane	1.0×102	2.0×104	3.01×103 + 0.46×103
Shiesh tawook	4.0×102	1.0×105	9.84×103 + 1.68×103
Shawerma	6.0×102	1.8×105	1.75×104 + 0.31×104

S.E* = standard error of mean.

4. DISCUSSION

4.1. Aerobic plate count of the examined fast food samples

Table (1) showed that shawerma was the most contaminated fast food followed by hawawshi, shiesh tawook, sausage, pane and then beef kofta. This could be attributed to the fact that shawerma and hawawshi may receive more handling during preparation as well as addition of spices, which may be contaminated with larger number of microorganisms. The obtained results were nearly similar to those reported by Hassan (1986), who found that APC in the examined samples of kofta was 3.6 x 10^4 (cfu/g). While lower results were recorded by El-Daly et al. (1987) who found that the mean value of APC in the examined samples of cooked spiced minced meat (hawawshy) was 7 x 103 (cfu/g). However higher findings were obtained by Nassar (1988), who found that the APC in examined samples of cooked meat was 2.1 x 10^7 (cfu/g). Also, Rafaie and Mostafa (1990) found that the mean APC in examined samples of shawerma collected from various fast food restaurants was 2.46 x 10^7 (cfu/g).

Although, the APC of any food articles are not a sure indicative of their safety for consumption, yet it is of supreme importance in judging the hygienic condition under which food has been produced, handled and stored (Levine, 1987). Accordingly, the high bacterial counts of some examined samples may be attributed to neglected sanitary measures during their processing, handling, serving of such products. The variation in bacterial counts between different types of

meat products could be attributed to difference of ingredients and steps involved in their formulation and preparation (Hefnawy and Youssef, 1984). The three main routes by which microorganisms enter food are the foodstuff, food handlers and the environments (Roberts, 1990). Early preparation of larger quantities of meat products and holding for hours without control can facilitate the growth of microorganisms, which contaminated such products from numerous sources during handling, transports, processing, storage and serving (Dawson, 1992).

4.2. Total coliform count of the examined fast food samples

The current results given in Table (2) agree with those recorded by Nassar (1988), Yassien (1992) and Elwi (1994) found that the mean values of coliform were 44 x 10^2 and 22 x 10^2 (cfu/g) in the examined samples of cooked meat and cooked kofta, respectively. While, lower results were recorded by Hassan (1986) who found that 55% of the examined samples of kofta were contaminated with coliforms. However, higher findings were obtained by Rafaie and Moustafa (1990), Daif (1996) and Hussien (1996) who found the mean value of coliform was 33.9 x 10^5/g and1.8 x 10^5 /g in the examined shawerma and kofta samples, respectively.

Coliforms were significant organisms in meat as indicator of fecal contamination and had the ability to grow well over wide range of temperature below 10°C up to 46°C (Gill et al., 1996), Also the presence of coliform bacteria in great numbers may be responsible for inferior quality of meat products resulting in economic losses and the possibility of presence of enteric pathogens which constitute public health hazard (Trout and Osburn, 1997). The high incidence of coliforms in the examined fast food as sandwiches indicates inadequate processing or post processing contamination (most probably from workers, dirty instrument, machinery and other contact surfaces), or from raw ingredients before processing which drive their contamination from various sources as human contact, polluted water, soil and manure (NAS, 1985).

4.3. Total Staphylococci count of the examined fast food samples

The current results given in Table (5) were nearly similar to those obtained by Nassar (1988), Yassien EL-Essawy (1990) and Moussa et al. (1992) who found that the mean value of S. aureus count (cfu/g) was 5.8 x 10^4 in the examined samples of ready to eat meat. While, Ahmed (1991), Tolba (1994) and Mohamed (2000) failed to detect and isolate S. aureus from any of the examined samples of heat treated meat products. However, higher findings were obtained by Kirralla (2007) who found that the mean value of S. aureus counts in the examined samples of cooked meat was 2.45 x 10^5/g.

The presence of *S.aureus* in a food indicates its contamination from food handlers & in adequately cleaned equipments (ICMSF, 1996). *Staphylococcus aureus* can be carried on hands, nasal passage or throats. Most food borne illness outbreaks are result from contamination from food handlers and production of heat stable toxins in food. Sanitary food handling and proper cooking and refrigerating should prevent *Staphylococcus* food borne illness (FSIS, 2003).

Staphylococcus aureus intoxication is a worldwide problem where several food poisoning outbreaks were reported due to consumption of meat products contaminated with this organism. Accordingly, the total *S. aureus* count can be taken as index of sanitary conditions under which meat and its products are manufactured and handled (Potter, 2001). Such organisms were previously isolated from ready – to – eat meat products by Soliman et al. (2002) and

Kirralla (2007) isolated *S. aureus* from the examined cooked meat samples. Staphylococcal food poisoning is the result of performed enterotoxins that are produced by certain strains of *S. aureus* resulting in symptoms of intoxication, not infection. The most common symptoms appear approximately 3-8 hrs after ingestion and include nausea, vomiting, abdominal cramps and diarrhea. Generally, symptoms are short in duration (approximately 24 – 48 hrs) (Sandle and Mckillip, 2004).

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مجلة بنها للعلوم الطبية البيطرية
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التقييم البكتريولوجي للأغذية في مطاعم الوجبات السريعة في محافظة القاهرة.

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قسم مراقبة الاغذية - كلية الطب البيطرى - جامعة بنها

الملخص العربي

تعتبر الوجبات سريعة الإستهلاك المجهزة من اللحوم ومنتجاتها من أهم الأغذية التي يقبل عليها عدد كبير من المستهلكين في مصر والعالم وذلك لقيمتها الغذائية نتيجة إحتوائها علي نسبة عالية من البروتين الحيواني ولطعمها الشهي وسهولة إعدادها علاوة علي إنخفاض ثمنها. لكنها عرضه للتلوث بالعديد من الميكروبات الممرضه والتي تشكل خطورة علي صحة المستهلك أثناء تجهيزها وطهيها وقبل تناولها. لذا قامت الدراسة بفحص عدد (90) عينة عشوائية جاهزة للأكل من كل من كفته اللحوم، السجق البقري ، حواوشى اللحوم ، بانية الدجاج، شيش طاووق، شاورمة الدجاج بواقع (15) عينة من كل منتج والتي تم جمعها من محلات ومطاعم الأغذية السريعة بمحافظة القاهرة وذلك لتحديد جودتها من الناحية البكتريولوجية وقد دلت نتائج الدراسة علي أن متوسط العدد الكلي للميكروبات الهوائية، ميكروبات القولون والمكور العنقودي هو 1.83 × 410 ± 0.39 ×410، 7.91 × 210 ± 1.48 × 210 ، 9.35 × 210 ± 2.08 × 210 / جم في عينات كفته اللحم، 8.61 × 410 ± 2.07 × 410، 1.54 × 310 ± 0.33 × 310 و 6.62 × 310 ± 1.09 × 310 / جم في عينات السجق البقري ، 2.24 × 510 ± 0.52 × 510 ، 6.62 × 310 ± 1.09 × 310 و 8.12 × 310 ± 1.29 × 310 / جم في عينات الحواوشى، 7.35 × 410 ± 1.17 × 410 ، 1.18 × 310 ± 0.26 × 310 و 3.01 × 310 ± 0.46 × 310 / جم في عينات بانيه الدجاج، 1.92 × 510 ± 0.46 × 510 ، 5.08 × 410 ± 1.17 × 410 و 4.32 × 310 ± 0.85 × 310 / جم في عينات الشيش طاووق ، 4.58 × 510 ± 0.74 × 510 ، 9.97 × 310 ± 2.53 × 310 و 1.57 × 410 ± 0.31 × 410 / جم في عينات شاورما الفراخ وقد وجد أن الإختلافات بين العينات محل الدراسة كانت معنوية هذا وقد تم عزل ميكروبات Citrobacter diversus Citrobacter freuudii, Enterobacter aerogenes, Enterobacter cloacae, kelebsiella ozaenae, klebsiella pheumoniae, Proteus mirabilis. Proteus rettgeri, Proteus vulgaris, Serratia liquefaciens and Serratia marcescens.
في عينات كفتة اللحوم، السجق البقري، الحواوشى، بانيه الدجاج ،الشيش طاووق شاورما الفراخ. هذا وقد تم مناقشة الأهمية الصحية للميكروبات التي تم عزلها من منتجات الأغذية الجاهزة (سريعة الاستهلاك) ومدي تأثيرها على الصحة العامة والمصادر التي تسبب تلوث هذه الأغذية بهذه الميكروبات وكذلك المقترحات التي تؤدي إلي تحسين جودة تلك الأغذية.

(مجلة بنها للعلوم الطبية البيطرية: عدد 26(1):34-42, مارس 2014)