1. INTRODUCTION

Chicken meat is the most palatable easily prepared meat meals, and it is main source of protein, vitamins, fat, essential amino acids and minerals (Biesalski, 2005). Moreover, it is considered as a perfect media for growth of different microorganisms due to its relative humidity, the high level of nitrogenous compounds, minerals, glycogen and suitable pH for different microorganisms (Al-Mutairi, 2011). Food borne diseases are still occurring despite the improvement in food technology. The food which prepared in hospital plays important role in increasing or decreasing the risk of disease as food free from contamination fast patient recovery (Custovic and Ibrahimagic, 2005). This risk of contamination of food differ according to nature of the microorganism, the level of contamination, the nature of food and especially the physiological state of consumer. Chicken meats need many processes to be ready to eat so the risk of contamination may increase during processing from hands, worker's clothes, knives or from the surrounding environment resulting in an inferior or unfit for human. The level of contamination can be measured using the aerobic plate count, Total Enterobacteriaceae, Total Coliforms and Escherichia coli biotype 1, which used as indicator for fecal contamination (Paulsen et al., 2006). E. coli, Salmonellae and coagulase positive S. aureus are the most pathogens detected in chicken meat. (Abdaslam et al., 2014; Ezzat et al., 2014). Some strains of E. coli have pathogenic or toxigenic virulence factors that make them virulent to human. So, it considered as a serious food borne pathogen which responsible for many outbreaks of disease (Gi et al., 2009). Food contaminated by S. aureus due to excessive handling of food during or after cooking or due to ingestion of raw meat contaminated with this organism. Staphylococcal food poisoning characterized by nausea, vomiting, diarrhea lasting from 24 to 48 h and complete recovery occur within 1-3 days. The cooking method should be carefully applied to produce a temperature enough to kill all these microorganisms as most of them destroyed between 72°C to 83°C (Murphy et al., 2001). Therefore, the aim of present study was to evaluate the bacteriological status of chicken meat meals at governmental hospital.

2. MATERIAL AND METHODS

2.1. Collection of Samples:
Ninety random samples of boiled, grilled and fried chicken meat meals (30 of each) with 250 gm weight of each sample were collected from a governmental hospital at various times in Kalyobia governorate, Egypt. Each sample was kept in a separated sterile plastic bag and preserved in an ice box then transferred to the laboratory under complete aseptic conditions without undue delay and then subjected to following examination.

2.2. Methods:
2.2.1. Preparation of Samples:
Under complete aseptic conditions, 25 grams of the sample were weighed and transferred into a sterile homogenizer flask containing 225 ml of sterile peptone water (0.1%). The content of the flask was homogenized for 3 minutes at 14000 rpm then allowed to stand for 5 minutes at room temperature. One ml of the homogenate was transferred into a separate tube containing 9 ml of sterile peptone water (0.1%) from
which tenfold serial dilution were prepared. The prepared samples were subjected to the following examination, was prepared:

2.2.1. Determination of aerobic plate count (ISO, 2002).
2.2.2. Determination of Enterobacteriaceae count (ISO, 2004).
2.2.3. Determination of coliform count (FDA, 2002).
2.2.4. Determination of total Staphylococcus count (FDA, 2001).
2.2.5. Serological Screening for Enteropathogenic Escherichia coli (Kok et al., 1996).

2.3. Statistical Analysis:

The obtained results were statistically evaluated by application of ANOVA test according to Feldman et al. (2003).

3. RESULTS

It is clear from the results recorded in table (1) that APC cfu/g in the examined samples differ from 6.3x10³ to 2.0x10⁶ with an average 4.81x10⁴ ± 0.65x10⁴ /cfu/g in boiled chicken meat meals, 5.8x10³ to 4.1x10³ with an average 9.97x10² ± 2.18x10² /cfu/g in grilled chicken meat meals and 1.2x10³ to 1.5x10³ with an average 6.02x10² ± 1.33x10² /cfu/g in fried chicken meat meals.

Table (2) showed high significant differences in APC in the examined samples (p < 0.01). Moreover, the results recorded that the higher average of Aerobic Plate Counts was recorded in the examined boiled chicken meat meals samples (4.81x10³ ± 0.65x10³ /cfu/g) and the lower one was in the examined fried chicken meat samples which was (6.02x10² ± 1.33x10² /cfu/g).

Table 1 Statistical analysis of Aerobic Plate Counts "APC" (cfu/g) in the examined chicken meat meal samples (n=30).

| Chicken meals | Min     | Max     | Mean ± S.E |
|---------------|---------|---------|------------|
| Boiled       | 6.3x10³ | 2.0x10³ | 4.81x10⁴ ± 0.65x10⁴ |
| Grilled      | 5.8x10³ | 4.1x10³ | 9.97x10² ± 2.18x10² |
| Fried        | 1.2x10³ | 1.5x10³ | 6.02x10² ± 1.33x10² |

Table 2 Analysis of variance (ANOVA) of APC in the examined chicken meat meals.

| Source of variance | D.F | S.S | M.S | F.value |
|--------------------|-----|-----|-----|---------|
| Total              | 89  | 251641.15 |     |         |
| Between Meals (M)  | 2   | 73616.48  | 36580.72 | 17.87** |
| Error              | 87  | 176492.67 | 2051.64 |         |

It is appeared from the result recorded in table (3) that Enterobacteriaceae counts in the examined samples differ from 4.3x10⁴ to 8.5x10⁶ with an average 2.16x10⁵ ± 0.41x10⁴ /cfu/g in boiled chicken meat meals, 1.9x10⁵ to 2.3x10⁵ with an average 5.73x10⁴ ± 0.96x10⁴ /cfu/g in grilled chicken meat meals and 7.0x10³ to 6.1x10³ with an average 1.81x10³ ± 0.27x10³ /cfu/g in fried chicken meat meals. Table (4) showed high significant differences in Enterobacteriaceae count in the examined samples (p < 0.01). The higher average of Enterobacteriaceae counts /g was recorded in the examined boiled chicken meal meat samples (2.16x10⁵ ± 0.41x10⁴ /cfu/g) and the lower one was in the examined fried chicken meat meal samples which was (1.81x10³ ± 0.27x10³ /cfu/g).

The results given in table (5), it is obvious that the total coliform counts (cfu/g) in the examined samples of boiled, grilled and fried chicken meat meal at hospital restaurant ranged from 1.0x10⁴ to 6.2x10⁵ /cfu/g with an average of 1.45x10⁵ ± 0.36x10⁴ /cfu/g for boiled chicken meat meal, 1.0x10⁵ to 3.5x10⁵ /cfu/g with an average of 9.74x10⁴ ± 2.07x10⁴ /cfu/g for grilled chicken meat meal and 1.0x10⁴ to 9.0x10³ /cfu/g with an average of 4.19x10² ± 0.53x10² /cfu/g for fried chicken meal. Table (6) showed high significant differences in total coliform counts in the examined samples (p < 0.01). Results in table (7) indicated that the mean values of total staphylococcal count (cfu/g) in the examined samples of boiled, grilled and fried chicken meat meals at hospital restaurant were 3.1x10⁴ ± 0.48x10³ /cfu/g in boiled chicken meat meal, 1.26x10⁵ ± 0.19x10⁴ /cfu/g in grilled chicken meat, 7.58x10⁴ ± 1.25x10⁵ /cfu/g in fried chicken meat meals.

Table 3 Statistical analysis of Enterobacteriaceae counts (cfu/g) in the examined chicken meat meal samples (n=30).

| Chicken meals | Min     | Max    | Mean ± S.E |
|---------------|---------|--------|------------|
| Boiled       | 4.3x10³ | 8.5x10³ | 2.16x10⁴ ± 0.41x10⁴ |
| Grilled      | 1.9x10³ | 2.3x10³ | 5.73x10⁴ ± 0.96x10⁴ |
| Fried        | 7.0x10³ | 6.1x10³ | 1.81x10³ ± 0.27x10³ |

Table 4 Analysis of variance (ANOVA) of Enterobacteriaceae counts in the examined samples of chicken meat meals.

| Source of variance | D.F | S.S | M.S | F.value |
|--------------------|-----|-----|-----|---------|
| Total              | 89  | 147127.90 |     |         |
| Between Meals (M)  | 2   | 30889.81  | 15444.84 | 11.56++ |
| Error              | 87  | 116238.09 | 1336.07 |         |

It is appeared from the result recorded in table (3) that Enterobacteriaceae counts in the examined samples differ from 4.3x10³ to 8.5x10³ with an average 2.16x10⁴ ± 0.41x10⁴ /cfu/g in boiled chicken meat meals, 1.9x10⁵ to 2.3x10⁵ with an average 5.73x10⁴ ± 0.96x10⁴ /cfu/g in grilled chicken meat meals and 7.0x10³ to 6.1x10³ with an average 1.81x10³ ± 0.27x10³ /cfu/g in fried chicken meat meals. Table (4) showed high significant differences in Enterobacteriaceae count in the examined samples (p < 0.01). The higher average of Enterobacteriaceae counts /g was recorded in the examined boiled chicken meal meat samples (2.16x10⁵ ± 0.41x10⁴ /cfu/g) and the lower one was in the examined fried chicken meat meal samples which was (1.81x10³ ± 0.27x10³ /cfu/g).

Furthermore, table (8) declared that the incidence and serotyping of Enteropathogenic E. coli isolated from the examined samples of boiled, grilled and fried chicken meat at hospital were O₁ : H₁ : EPEC (6.67%), O₁5 : EPEC (10%), O₁ : H₁ : EPEC (3.33%), O₁28 : H₁ : ETEC (6.67%), O₁5 : H₂ : EPEC (3.33%) and O₁5 : EPEC (3.33%) were isolated in grilled chicken meat O₁ : H₁ : EPEC (3.33%), O₁5 : H₁ : EPEC (6.67%), O₁28 : H₁ : ETEC (3.33%) and O₁5 : EPEC (3.33%) were isolated in fried chicken meal O₁ : H₁ : EPEC (3.33%), O₁5 : EPEC (6.67%), O₁28 : H₁ : ETEC (3.33%) and O₁5 : H₁ : EPEC (3.33%).

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4. DISCUSSION

The result recorded in table (1) recorded that the total APC in examined samples high than that obtained by Omokhtar (2000) who mentioned that the mean value of aerobic plate count in chicken meat was 2.9x10^4 cfu/g. Meanwhile, they lower than that recorded by Kirralla (2007) (2.20x10^4± 2.12x10^3); El-Taher (2009) (9.05x10^3±2.51x10^3); Arab (2010) (6.3x10^4±0.35x10^4); Ali (2011) (4.78x10^3 ±0.96 x 10^3); Ibrahim et al. (2014) (7.35x10^4±1.17x10^4); Abd El-Aal (2015) 9.64x10^4±2.25x10^4 in boiled chicken meat and 7.18x10^4±1.44x10^4 in fried ones at hospital restaurant. Accordingly, the boiled chicken meat was the most contaminated examined food followed by grilled chicken meat. This could be attributed to the fact that chicken meat may receive more handling during processing as well as scaling which may be source of contamination with larger number of microorganisms. Also, frying done at very high temperature which my reach to 220ºC while boiling reach maximally to 100ºC.

The obtained results may be explained as cooking cannot destroy all microorganisms, therefore, the holding of cooked foods at ambient temperature for several hours is the primary contributory factor for the growth and multiplication of such organisms (Bryan et al., 1997).

The result recorded in table (3) recorded that Enterobacteriaceae counted in examined samples agree with those of Ibrahim (2005) in Assuit and El-Azhar universities. Meanwhile, the counts in boiled samples were higher than those recorded by Abd El-Daim and Aisam (2004) (4.2x10^3); Meanwhile, the counts in samples were lower than those recorded by Abbass (2011) (2.84x10^3 ±0.35 x10^3); Saad et al., (2011) (9.81x10^3±2.66 x 10^3) and Abd El-Aal (2015) (2.21x10^3±0.38x10^3). Enterobacteriaceae have a great resistance to the environment than coliforms also they can be colonized in an inadequate sanitation so they can be used be as indicators of sanitation (GMP). (Kornacki and Johnson, 2001).

The high Enterobacteriaceae counts in food indicates improper processing/or recontamination due to cross contamination which occur through raw materials, contaminated equipment or unclean handling (Ikeme, 1990).

5. CONCLUSIONS

The obtained results in this study allow to know that boiled, grilled and fried chicken meat meals at hospital restaurant Presence of Enterobacteriaes in the food is an indication of improper hygienic measures (Gill and Landers, 2004). Regarding the epidemiological importance, some of members Enterobacteriaes are pathogenic and cause serious infections and food poisoning outbreaks to human. Furthermore, the Enterobacteriaes count can be taken as an indicator of possible enteric contamination in the absence of coliform organisms (Mosupy and Van Holy, 2000). The result recorded in table (5) recorded that coliform count In chicken meat samples were nearly similar to those of El-Taher (2009) which was (7.95x10^3 ±1.59 x10^3)and Raphael et al.(2014) (8.85 x10^3) but much lower than that of Saad et al.(2011) (4.85x10^3±0.77 x 10^3); Ibrahim et al.(2014) was (1.18x10^3 ±0.26 x10^3) and Abd El-Aal (2015) (1.06x10^4 ± 0.17x10^4) for boiled chicken meat and (6.40x10^3 ± 1.23x10^3) for fried ones. High coliform count indicated inferior quality of meat. The contamination with coliforms may occur during slaughtering, or dressing of carcasses, shopping blocks, soiled hands or knives used for handling and cutting or contaminated water (Yadav et al., 2006). The result recorded in table (7) recorded that staphylococci count in examined samples were lower than those obtained by El-Taher (2009) (3.59x10^4±0.76 x10^4) in chicken meat; Arab (2010) (2.60x10^4±1.05 x10^4) in chicken meat; Ibrahim et al. (2014) (3.01x10^4±0.26 x10^4) in cooked chicken meat and Abd El-Aal (2015) (4.42x10^3 ± 0.75x10^4) for boiled chicken meat and 2.10x10^3 ± 0.32x10^3 for fried chicken meat. Comparing to the safe permissible limits stipulated by Center for Food Safety (2014) for the total staphylococcal count (not exceed 10^4 cfu/g), Higher count obtained by Farag (2009) found Staphylococcus count were 5.9% more than permissible limit.

Presence of E. coli in meat indicates a general lack of cleanliness during slaughtering, evisceration, dressing, transportation and handling of meat (ICMSF, 1996c). Moreover, the incidence of serologically identified E. coli as Enteropathogenic E. coli (E. coliO1:H7; E. coliO75 and E. coliO111:H2), Enterotoxigenic E. coli (E. coli O157:H7) Enterohaemorrhagic E. coli (E. coli O26:H11 and E. coli O111:H4) and Enteroinvasive E. coli (E. coli O139). Nearly similar results were obtained by Ali (2011). Higher results obtained by El-Abbasy (2010). These results came in accordance with those obtained by El-Taher (2009) (3.37%; Arab (2010) 6.67%; Marzano and Balzaretti (2011) and El Masry et al. (2015).The same serotypes of E.coli were previously isolated from chicken meat by Maarouf and Nassif (2008); Lamada-Hanoret al. (2012)Windham et al. (2013) and Abd El-Salame (2014).These results coincided with the fact of Wilson et al. (1997) and Woody et al., (1998) who recorded that the same serogroups were Enteropathogenic E.coli and causing infantile enteritis; hemorrhagic colitis; hemorrhagic gastroenteritis and diarrheal illness in different settings.

The presence of E. coli used as an indicator for fecal pollution. Which occur due to improper slaughtering techniques, contaminated surfaces and/or handling of the meat by hands of infected person (Nelet al., 2004). Also, the contamination by E. coli can occur during the meat processing at slaughterhouse or due to the poor handling of the retailers of meat (Kagambega et al., 2011).

were more contaminated with the highest level of microorganisms because such products may receive more handling during preparation as well as addition of spices which act as a source of contamination and during

| E. coli strains | Boiled | Grilled | Fried | Strain Characteristics |
|----------------|--------|---------|-------|------------------------|
| No. %          | No. %  | No. %   |       |                        |
| O1             | 2      | 6.67    | 0     | 1                      | 3.33 | EPEC        |
| H7             |        |         |       |                        |      |             |
| H6             | 1      | 3.33    | 1     | 3.33                   | 0    | EPEC        |
| H7             | 3      | 10      | 2     | 6.67                   | 2    | EPEC        |
| O4              | 0      | 0       | 1     | 3.33                   | 0    | EHEC        |
| H21            |        |         |       |                        |      |             |
| O124           | 1      | 3.33    | 0     | 0                      | 0    | EIEC        |
| H26            | 0      | 0       | 0     | 1                      | 3.33 | ETEC        |
| O126           | 2      | 6.67    | 1     | 3.33                   | 0    | ETEC        |
| H2            |        |         |       |                        |      |             |
| O146           | 1      | 3.33    | 0     | 0                      | 1    | 3.33 | EPEC        |
| O158           | 0      | 0       | 1     | 3.33                   | 0    | EPEC        |

Total 9 30 6 20 4 13.33

EPEC = Enteropathogenic E. coli; EIEC = Enteroinvasive E. coli; ETEC = Enterotoxigenic E. coli; EHEC = Enterohemorrhagic E. coli.
processing (scalding) which consider big source of contamination. Also fried chicken meat meals less contaminated than boiled chick meat meals mainly due to that fried meat firstly boiled then fried so expose to high temperatures for long time which kill most food poisoning microorganism on the other hand I my contaminated by some types of bacteria do not present in boiled one through cross contamination and bad personnel hygiene. This can be controlled by applying Hygiene measures during slaughtering, struggling should be considered. HACCP (Hazard Analysis and Critical Control Points) is a system of preventive control designed to improve the safety of the poultry product.

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