Bacteriological Examination of Cooked Meat and Chicken Meals

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Abstract

Sixty random samples (15 of each) were collected from different restaurants to evaluate their bacteriological quality. The mean values of APC, Enterobacteriaceae, coliform counts (cfu/g) were 6.03×103 ±1.45×103, 3.16×102±0.72×102, 7.43×102±1.05×102 for meat, 8.58×102±1.65×102, 6.53×102 ±1.24×102 for beef kofta, 9.18×102±2.07×102 for chicken, 9.91×102±2.18×102 for meat, 5.25×102±0.86×102, 1.06×103±1.9×102 for beef kofta and 2.03×102±0.43×102, 9.14×102±2.06×102, 3.32×102±0.45×102 for chicken kofta, respectively. The results showed that 12 isolates of Escherichia coli were identified from examined ready to eat chicken and meat meals with different percentages (O:11:H1,H2,H3,H4,H5:H2,111,O:12: H6), Escherichia coli strains were serologically identified from such examined meals, there are 6 isolates of salmonella were identified from examined samples. Also, there are 21 isolates of staph aureus were isolated from examined samples represented as 20% from meat, 40% from beef kofta, 33.33% from chicken and 46.67% from chicken kofta [1-4].

Introduction

Cooked meat and chicken meals due to their high nutritive value and agreeable taste. Meat meals have an excellent source of high-quality protein vitamin and mineral. Raw materials of bad microbial quality, bad personal hygiene and consumption at room temperature lead to contamination of foods with pathogenic bacteria especially Salmonellae and coliforms, causing potential risk to human. Incorrect habits responsible for microbial food borne illness reported and typically involve cross contamination of raw and cooked foods, poor cooking and storage at unsuitable temperature. Staphylococcal food poisoning has rapid onset and its symptoms include nausea and strong vomiting with or without diarrhea. Salmonella spp can persist on final raw products. Disease can result when these products are handled without good hygienic practices, not properly cooked and/or subjected to temperature abuse. It is considered that the presence of Salmonella spp in products makes it unsafe for human consumption. Escherichia coli is an important organism involved in food-borne disease, it is considered as a good indicator of possible fecal contamination. Therefore, the present study was planned out for determination of APC, Enterobacteriaceae & coliforms counts, isolation and identification of Escherichia coli, salmonella and staph aureus for ready to eat meat and chicken meals including meat, chicken, beef kofta and chicken kofta [5-10].

Materials and Methods

Collection of samples

Sixty random samples of cooked chicken and meat meals including meat, chicken, beef kofta and chicken kofta (15 of each) were collected from different restaurants. Each sample was kept in a separate sterile plastic bag, put in an ice box then transferred to the laboratory under complete aseptic condition without any regard for the examination bacteriologically.

Preparation of samples (ICMSF, 1996):

To 25 grams of the sample, 225 ml of sterile peptone water were added thoroughly mixed sterile blender for 2.5 minutes, from which tenth fold serial dilution was prepared. The prepared samples were subjected to the following bacteriological investigations:

a) Determination of APC (ICMSF, 1996).
b) Determination of total enterobacteria count (Grok, 1976) using Violet Red Bile Glucose agar.

c) Determination of total coliform count (ICMSF, 1996) using Violet Red Bile agar medium.

d) Isolation and identification of Enteropathogenic Escherichia coli (ISO,2001); it was applied by using MacConkey broth as enriched broth and EMB as plating media.

e) Isolation and Identification of salmonellae (ISO,2002).

f) Isolation and identification of staph aureus (ICMSF, 1996).

Results

The results of bacteriological examination of cooked chicken and meat meals samples revealed that APC and coliform were highest in chicken kofta followed by beef kofta then chicken then meat. While enterobacteria were highest in chicken kofta followed by chicken then beef kofta then meat. Isolation and identification of Escherichia coli in the examined samples revealed that the incidence of Escherichia coli was 26.67% in chicken, 20% in both of beef kofta and 13.33 in meat, 12 isolates of Escherichia coli represented as 13.33% from meat with serotypes O\textsubscript{6}:H\textsubscript{11}(6.67%) and O\textsubscript{12}:H\textsubscript{11}(6.67%) 20% from beef kofta with serotypes O\textsubscript{0}:H\textsubscript{11}(13.33%) and O\textsubscript{11}:H\textsubscript{11}(6.67%).20% from chicken with serotypes O\textsubscript{4}:H\textsubscript{11}(6.67%), O\textsubscript{12}:H\textsubscript{11}(6.67%) and O\textsubscript{16}:H\textsubscript{11}(6.67%). 26.67% from chicken kofta with serotypes O\textsubscript{2}:H\textsubscript{11}(13.33%), O\textsubscript{4}:H\textsubscript{11}(6.67%) and O\textsubscript{16}:H\textsubscript{11}(6.67%). Isolation and identification of salmonella in the examined samples revealed that the incidence of salmonella was equal in meat, beef kofta and chicken (6.67%) while in chicken kofta was the highest (20%). 6.67% from meat with serotype S. Heidelberg 6.67% from beef kofta with serotype S. Montevideo 6.67% from chicken with serotype S. Kentucky 20% from chicken kofta with serotypes S. anatum (6.67%), S. Infantis is (6.67%) and S. Typhimurium (6.67%).

Discussion

APC is very important for evaluation of sanitary condition of cooked meat meals limit is suggested for total aerobic bacterial count in various foods range from 10\textsuperscript{3} to 10\textsuperscript{5} microbes/g (EEC,2005). It is evident from the results recorded in Table 1 that the APC/g of the examined samples of cooked chicken and meat meals ranged from 2.1×10\textsuperscript{3} to 1.7×10\textsuperscript{4} with an average of 6.03×10\textsuperscript{3} ± 1.45×10\textsuperscript{3} (cfu/g) for meat, 4.6×10\textsuperscript{3} to 2.9×10\textsuperscript{4} with an average 9.91×10\textsuperscript{3} ± 2.18×10\textsuperscript{3} (cfu/g) for meat kofta, 3.5×10\textsuperscript{3} to 3.9×10\textsuperscript{3} with an average 8.58×10\textsuperscript{3} ± 1.65×10\textsuperscript{3} / (cfu/g) for chicken and 6.0×10\textsuperscript{3} to 7.7×10\textsuperscript{3} with an average 2.03×10\textsuperscript{3} ± 0.43×10\textsuperscript{3} (cfu/g) for chicken kofta. The current results nearly similar to the results found that the mean value of RTE kofta was 1.83×10\textsuperscript{3} cfu/gm, while higher results was recorded who found that the mean value of APC of RTE kofta was 8.51×10\textsuperscript{3} cfu/g, also higher results was recorded found that the mean APC of RTE chicken meals was 1.9×10\textsuperscript{3} cfu/g and in RTE meat meals was 1.2×10\textsuperscript{3} cfu/g high incidence of APC , may indicate that the cooking process was inadequate, or post cooking contamination had occurred, or the length of time and temperature control in storage or display facilities was inadequate to prevent bacterial contamination, or that a combination of these factors was involved. Results given in Table 2 revealed that the Acceptability of the examined samples of cooked meat and chicken meals based on their APC was (86.67%) of meat samples were accepted samples but (13.33%) of meat samples were unaccepted, (73.33%) of beef kofta samples were accepted but (26.67%) of beef kofta samples were unaccepted.(80%) of chicken samples were accepted but (20%) of chicken samples were unaccepted and (60%) of chicken kofta were accepted but (40%) of chicken kofta were unaccepted. Results achieved in Table 3 showed that the mean values of total Enterobacteriaceae counts/g in the examined samples of cooked chicken and meat meals were 3.16×10\textsuperscript{3} ± 0.72×10\textsuperscript{3} (cfu/g) for meat, 5.25×10\textsuperscript{3} ± 0.86×10\textsuperscript{3} (cfu/g) for meat kofta, 6.53×10\textsuperscript{3} ± 1.24×10\textsuperscript{3} (cfu/g) for chicken and 9.14×10\textsuperscript{3} ± 2.06×10\textsuperscript{3} (cfu/g) for chicken kofta. The current results were nearly similar to recorded who found that the mean values of Enterobacteriaceae of RTE kofta was 7.15×10\textsuperscript{3} (cfu/g) while higher results recorded who found the mean value of Enterobacteriaceae of street vended kofta samples was 1.5×10\textsuperscript{3} cfu/g. From the results in Table 4, it is obvious that the mean values of total coliform counts/(cfu/g) in the examined samples of cooked chicken and meat meals were 7.43×10\textsuperscript{3} ± 1.05×10\textsuperscript{3} (cfu/g) for meat, 1.06×10\textsuperscript{3} ± 0.19×10\textsuperscript{3} (cfu/g) for meat kofta, 9.18×10\textsuperscript{2} ± 2.07×10\textsuperscript{2} (cfu/g) for chicken and 3.32×10\textsuperscript{2} ± 0.45×10\textsuperscript{2} (cfu/g) for chicken kofta the current results was nearly similar to the results recorded who found that the mean values of coliform was 5.17×10\textsuperscript{2} ± 1.2×10\textsuperscript{2} cfu/g, while higher results was recorded who found the mean value of coliform count of koftas and a witches was 1.8×10\textsuperscript{2} (cfu/g). From the results in Tables 5&6 showed that there are 12 isolates of Escherichia coli represented as 13.33% from meat with serotypes O\textsubscript{2}:H\textsubscript{11}(6.67%) and O\textsubscript{111}:H\textsubscript{1}(6.67%)20% from beef kofta with serotypes O\textsubscript{4}:H\textsubscript{11}(13.33%) and O\textsubscript{16}:H\textsubscript{11}(6.67%)20% from chicken with serotypes O\textsubscript{2}:H\textsubscript{11}(13.33%), O\textsubscript{4}:H\textsubscript{11}(6.67%) and O\textsubscript{16}:H\textsubscript{11}(6.67%). Isolation and identification of staphylococcus aureus revealed that there are 21 isolates of staph-aureus were isolated from examined samples represented as 20% from meat,40% from beef kofta,33.33% from chicken and 46.67% from chicken kofta (10-15).

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Table 1: Analytical results of Aerobic plate counts/g (APC) in the examined samples of cooked meat and chicken meals (n=15).

| Meals         | Min       | Max       | Mean±S.E*       |
|---------------|-----------|-----------|-----------------|
|                |           |           | Meat meals:     |
| Meat          | 2.1×10³   | 1.7×10⁴  | 6.03×10²±1.45×10³ |
| Kofta         | 4.6×10³   | 2.9×10⁴  | 9.91×10²±2.18×10³ |
|                |           |           | Chicken meat meals: |
| Chicken meat  | 3.5×10³   | 3.9×10⁴  | 8.58×10²±1.65×10³ |
| Kofta         | 6.0×10³   | 7.7×10⁴  | 2.03×10⁵±0.43×10⁵ |

Table 2: Acceptability of the examined samples of cooked meat and chicken meals based on their APC (n=15).

| Meals           | APC /g | Accepted Samples | Unaccepted Samples |
|-----------------|--------|------------------|--------------------|
| Meat meals*     | 104    |                   |                    |
| Meat            |         | 13                | 96.67              |
| Kofta           |         | 11                | 73.33              |
| Chicken meat meals** | 104 |                   |                    |
| Chicken         |         | 12                | 80                 |
| Kofta           |         | 9                 | 60                 |

*Center for Food Safety (2014) for cooked meat meals
**EOS (2005) for heat treated poultry meat.

Table 3: Analytical results of Enterobacteriaceae counts/g in the examined samples of cooked meat and chicken meals (n=15).

| Meals         | Min       | Max       | Mean±S.E*       |
|---------------|-----------|-----------|-----------------|
|                |           |           | Meat meals:     |
| Meat          | 2.2×10²   | 8.1×10³  | 3.16×10³±0.72×10³ |
| Kofta         | 5.7×10²   | 1.5×10⁴  | 5.25×10³±0.86×10³ |
|                |           |           | Chicken meat meals: |
| Chicken       | 4.5×10²   | 1.6×10⁴  | 6.53×10³±1.24×10³ |
| Kofta         | 7.8×10²   | 2.8×10⁴  | 9.14×10⁵±2.06×10⁵ |

Table 4: Analytical results of coliform counts/g in the examined samples of cooked meat and chicken meals (n=15).

| Meals         | +ve samples | Min       | Max       | Mean ± S.E*       |
|---------------|-------------|-----------|-----------|------------------|
| Meat meals:   |             |           |           |                  |
| Meat          |             | 7         | 46.67     | 1.0×10²          |
| Kofta         |             | 8         | 53.33     | 4.9×10³          |
|                |             |           |           |                  |
| Chicken meat meals: | |     |           |                  |
| Chicken       |             | 8         | 53.33     | 3.7×10³          |
| Kofta         |             | 9         | 60        | 7.0×10³          |

Table 5: Incidence and serotyping of Enteropathogenic Escherichia coli isolated from the examined samples of cooked meat meals (n=15).

| Meat Meals | E. coli strains | +ve samples | %   | Min       | Max       | Mean ± S.E*       | Strain Characteristics |
|------------|-----------------|-------------|-----|-----------|-----------|------------------|------------------------|
|            | O₁₂:H₁₀         |             | 1   | 66.67     | 2         | 13.33            | EHEC                   |
|            | O₁₁:H₄          |             | 1   | 66.7      | -         | -                | EHEC                   |
|            | O₂₁₂           |             | -   | -         | 1         | 6.67             | EHEC                   |
|            | Total           |             | 2   | 13.33     | 3         | 20               |                        |

EIEC: Enter invasive E. coli; EHEC: Enterohaemorrhagic E. coli
Table 6: Incidence and serotyping of Enteropathogenic E. coli isolated from the examined samples of cooked chicken meals (n=15).

| Chicken Meals | E. coli strains | Strain Characteristics |
|---------------|-----------------|------------------------|
|               | O<sub>26</sub>:H<sub>11</sub> | EHEC |
|               | O<sub>31</sub> | EPEC |
|               | O<sub>121</sub>:H<sub>3</sub> | EHEC |
|               | O<sub>127</sub>:H<sub>1</sub> | EHEC |
|               | O<sub>146</sub>:H<sub>21</sub> | EPEC |

**Table 7:** Incidence and serotyping of Salmonellae isolated from the examined samples of cooked meat meals (n=15).

| Salmonella Serotypes | Meat | Kofta | Group | Antigenic Structure |
|----------------------|------|-------|-------|--------------------|
| S. Heidelberg        | 1    | -     | B     | r: 1.2              |
| S. Montevideo        | -    | 1     | C1    | g,m,s: 1.2,7        |

**Table 8:** Incidence and serotyping of Salmonellae isolated from the examined samples of cooked chicken meals (n=15).

| Salmonella Serotypes | Chicken | Kofta | Group | Antigenic Structure |
|----------------------|---------|-------|-------|--------------------|
| S. Anatum            | -       | 1     | D1    | g.12               |
| S. Kentucky          | 1       | -     | C3    | i: 1,2             |
| S. Infantis          | -       | 1     | C1    | r: 1.5             |
| S. Typhimurium       | -       | -     | -     | B                  |

**Table 9:** Incidence of Staphylococcus aureus isolated from the examined samples of cooked meat meals (n=15).

| Meat Meals | Positive Samples |
|------------|-----------------|
|            | No. | %  |
| Meat       | 3   | 20 |
| Kofta      | 6   | 40 |
| Total (30) | 9   | 30 |

**Table 10:** Incidence of Staphylococcus aureus isolated from the examined samples of cooked chicken meals (n=15).

| Chicken Meals | Positive Samples |
|---------------|-----------------|
|               | No. | %  |
| Chicken       | 5   | 33.33 |
| Kofta         | 7   | 46.67 |
| Total (30)    | 12  | 40  |

**References**

1. Agunos A (2007) Effect of dietary beta 1-4 mannobiose in the prevention of *Salmonella enteritidis* infection in broilers. British Poultry Science 48(3): 331-341.
2. Argundin MA, Mendoza MC, Rodico MR (2010) Food poisoning and *staphylococcus aureus* enterotoxins. Toxins 2(7): 1751-1773.
3. Cui S (2004) Detection and characterization of *Escherichia coli* O 157: H7 and *Salmonella* in food. USA.
15. Mosupy FM, Arntzen L, Von Holy (1998) Microbiological survey of street-vended food in the Johannesburg metropolitan area of South Africa. Food Sci 63(7): 842-846.

16. Muth MK (2009) Analysis of Salmonella control performance in US. young chicken slaughter and pork slaughter establishments. J of Food Prot 72(1): 6-13.

17. Richardson IR & Stevens AM (2003) Microbiological examination of ready-to-eat stuffing from retail premises in the north-east of England. J Appl Microbiol 94(4): 733-737.

18. Saad MS, Hemat MI, EnasAMA (2011) Microbial and chemical evaluation of fast foods. USA.

19. Shaltout FA, Amani MS, Mahmoud AH, Elraheem KA (2013) Bacterial aspect of cooked meat and edible offal at street vendors level. J Benha Vet Med 24(1): 320-328.

20. Shaltout FA, Mohamed AH, Shater, Wafaa Mohamed (2015) Bacteriological assessment of street vended meat products sandwiches in kalyobia Governorate. J Benha Vet Med 28(2): 58-66.

21. Shaltout FA, Zakaria IM, Jehan Eltanani, Asmaa SE (2015) Microbiological status of meat and chicken received to University student hostel. J Benha Vet Med 29(2): 187-192, 2015.

22. Soliman MR, Monem KM, Saad SM (2002) Microbiological quality of ready-to-eat meat product and fishes in Urban and rural areas. J Egypt Vet Med Assoc 62(6): 39-51.

23. Synge BA (2000) Verocytotoxin Producing Escherichia Coli a veterinary review. J appl Microbiol Symposium Suppl 88: 315-375.

24. World Health Organization.

25. Poultry-borne pathogens: plant considerations. USA.