

Bacteriological Examination of Cooked Meat and Chicken Meals

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ISSN: 2578-0190



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 $6.03 \times 10^3 \pm 1.45 \times 10^3$, $3.16 \times 10^3 \pm 0.72 \times 10^3$, $7.43 \times 10^2 \pm 1.05 \times 10^2$ for meat, $8.58 \times 10^3 \pm 1.65 \times 10^3$, $6.53 \times 10^3 \pm 1.24 \times 10^3$, $9.18 \times 10^2 \pm 2.07 \times 10^3$ for chicken, $9.91 \times 10^3 \pm 2.18 \times 10^3$, $5.25 \times 10^3 \pm 0.86 \times 10^3$, $1.06 \times 10^3 \pm 0.19 \times 10^2$ for beef kofta and $2.03 \times 10^4 \pm 0.43 \times 10^4$, $9.14 \times 10^3 \pm 2.06 \times 10^3$, $3.32 \times 10^3 \pm 0.45 \times 10^3$ 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 ($O_{26}:H_{11}$, $O_{111}:H_4$, O_{124} , O_{78} , $O_{91}:H_{21}$, $O_{121}:H_7$, $O_{127}:H_6$, $O_{146}:H_{21}$) *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:

- Determination of APC (ICMSF, 1996).

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Submission:  April 01, 2020

Published:  July 01, 2020

Volume 3 - Issue 5

How to cite this article: Fahim A Shaltout, Hanan M Lamada, Ehsan AM Edris. Bacteriological Examination of Cooked Meat and Chicken Meals. Cohesive J Microbiol Infect Dis. 3(5). CJMI.000575. 2020. DOI: [10.31031/CJMI.2020.03.000575](https://doi.org/10.31031/CJMI.2020.03.000575)

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- b) Determination of total entero-bacteriaceae 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 entero-bacteriaceae was 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 O₂₆:H₁₁ (6.67%) and O₁₁₁:H₄ (6.67) 20% from beef kofta with serotypes O₂₆:H₁₁ (13.33%) and O₁₂₄ (6.67%). 20% from chicken with serotypes O₇₈ (6.67%), O₁₂₇:H₆ (6.67%) and O₁₄₆:H₂₁ (6.67%). 26.67% from chicken kofta with serotypes O₂₆:H₁₁ (13.33%), O₉₁:H₂₁ (6.67%) and O₁₂₁:H₇ (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 (6.67%) and S. Typhimurium (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].

Discussion

APC is very important for evaluation of sanitary condition of cooked meat meals limit is suggested for total aerobic bacterial count I in various foods range from 10⁵ to 10⁷ 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 2.1×10³ to 1.7×10⁴ with an average of 6.03×10³ ± 1.45×10³ (cfu/g) for meat, 4.6×10³ to 2.9×10⁴ with an average 9.91×10³ ± 2.18×10³ / (cfu/g) for meat kofta, 3.5×10³ to 3.9×10⁴ with an average 8.58×10³ ± 1.65×10³ / (cfu/g) for chicken and 6.0×10³ to 7.7×10⁴ with an average 2.03×10⁴±0.43×10⁴ (cfu/g) for chicken kofta. The current results nearly similar to the results found that the mean value of RTE kofta was 1.83×10⁴cfu/gm, while higher results was recorded who found that the mean value of APC of RTE kofta was 8.51×10⁵cfu/g, also higher results was recorded found that the mean APC of RTE chicken meals was 1.9×10⁴ cfu/g and in RTE meat meals was 1.2×10⁴ 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 3.16×10³±0.72×10³/(cfu/g) for meat, 5.25×10³±0.86×10³ / (cfu/g) for meat kofta, 6.53×10³±1.24×10³ / (cfu/g) for chicken and 9.14×10³±2.06×10³/(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 7.15×10³/(cfu/g) while higher results recorded who found the mean value of Enterobacteriaceae of street vended kofta samples was 1.5×10⁷cfu/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 7.43×10² ± 1.05×10²/(cfu/g) for meat, 1.06×10³±0.19×10² / (cfu/g) for meat kofta, 9.18×10²±2.07×10³/(cfu/g) for chicken and 3.32×10³±0.45×10³/(cfu/g) for chicken kofta the current results were nearly similar to the results recorded who found that the mean values of coliform was 5.17×10²±1.2×10²cfu/g. while higher results was recorded who found the mean value of coliform count of koftas and a witches was 1.8×10⁵/(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 O₂₆:H₁₁ (6.67%) and O₁₁₁:H₄ (6.67) 20% from beef kofta with serotypes O₂₆:H₁₁ (13.33%) and O₁₂₄ (6.67%). 20% from chicken with serotypes O₇₈ (6.67%), O₁₂₇:H₆ (6.67%) and O₁₄₆:H₂₁ (6.67%). 26.67% from chicken kofta with serotypes O₂₆:H₁₁ (13.33%), O₉₁:H₂₁ (6.67%) and O₁₂₁:H₇ (6.67%). From Tables 7&8 showed the incidence and serotyping of *salmonella* isolated from cooked meat and chicken meals is 6.67% from meat identified serologically as S. Heidelberg O_{4,5,12}:H_{r,1,2} 6.67% from beef kofta identified serologically as S. Montevideo O_{6,7,14}:H_{g,m,s:1,7,2} 6.67% from chicken identified serologically as S. Kentucky O_{8,20}:H_{i:26} 20% from chicken kofta identified serologically as S. Anatum O_{1,9,12}:H_{g,m:1,7} (6.67%), S. Infantis O_{6,7,14}:H_{r:1,5} (6.67%) and S. Typhimurium O_{1,4,5,12}:H_{i:1,2} (6.67%). *Salmonella* microorganisms were previously isolated from cooked meat meals also *salmonella* failed to be isolated from cooked meat meals. The symptoms of salmonellosis include diarrhea, nausea, vomiting, fever and abdominal cramps [15-25]. The results in Tables 9&10 reported that staph. aureus was isolated from 20% of meat, 40% of meat kofta, 33.33% of chicken and 46.67% of chicken kofta. such organism was isolated previously from ready to eat meat meals who isolated staph aureus from cooked samples. The presence of staph. aureus in RTE meat meals may be due to their contamination from food handlers, bad cleaned equipment's or post processing contamination.

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	2.1×10 ³	1.7×10 ⁴	6.03×10 ³ ±1.45×10 ³
Kofta	4.6×10 ³	2.9×10 ⁴	9.91×10 ³ ±2.18×10 ³
Chicken meat meals:			
Chicken meat	3.5×10 ³	3.9×10 ⁴	8.58×10 ³ ±1.65×10 ³
Kofta	6.0×10 ³	7.7×10 ⁴	2.03×10 ⁴ ±0.43×10 ⁴

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	
		No.	%	No.	%
Meat meals*	104	13	86.67	2	13.33
Meat		11	73.33	4	26.67
Kofta					
Chicken meat meals**	104	12	80	3	20
Chicken		9	60	6	40
Kofta					

*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:	2.2×10 ²	8.1×10 ³	3.16×10 ³ ±0.72×10 ³
Meat			
Kofta	5.7×10 ²	1.5×10 ⁴	5.25×10 ³ ±0.86×10 ³
Chicken meat meals:	4.5×10 ²	1.6×10 ⁴	6.53×10 ³ ±1.24×10 ³
Chicken			
Kofta	7.8×10 ²	2.8×10 ⁴	9.14×10 ³ ±2.06×10 ³

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

Meals	+ve samples		Min	Max	Mean ± S.E*
	No.	%			
Meat meals:	7	46.67	1.0×10 ²	2.3×10 ³	7.43×10 ² ± 1.05×10 ²
Meat					
Kofta	8	53.33	1.0×10 ²	4.9×10 ³	1.06×10 ³ ± 0.19×10 ²
Chicken meat meals:	8	53.33	1.0×10 ²	3.7×10 ³	9.18×10 ² ± 2.07×10 ³
Chicken					
Kofta	9	60	1.0×10 ²	7.0×10 ³	3.32×10 ³ ± 0.45×10 ³

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

Meat Meals	Meat		Kofta		Strain Characteristics
	No.	%	No.	%	
<i>E. coli</i> strains					
O ₂₆ :H ₁₁	1	6.67	2	13.33	EHEC
O ₁₁ :H ₄	1	6.67	-	-	EHEC
O ₁₂₄	-	-	1	6.67	EIEC
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	Chicken		Kofta		Strain Characteristics
	No.	%	No.	%	
O ₂₆ :H ₁₁	-	-	2	13.33	EHEC
O ₇₈	1	6.67	-	-	EPEC
O ₉₁ :H ₂₁	-	-	1	6.67	EHEC
O ₁₂₁ :H ₇	-	-	1	6.67	EHEC
O ₁₂₇ :H ₆	1	6.67	-	-	ETEC
O ₁₄₆ :H ₂₁	1	6.67	-	-	EPEC
Total	3	20	4	26.67	

EPEC: Enteropathogenic *E. coli*; ETEC: Enterotoxigenic *E. coli*; EHEC: Enterohaemorrhagic *E. coli*

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	
	No.	%	No.	%		O	H
S. Heidelberg	1	6.67	-	-	B	4,5,12	r: 1,2
S. Montevideo	-	-	1	6.67	C1	6,7,14	g,m,s: 1,2,7
Total	1	6.67	1	6.67			

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	
	No.	No.	No.	%		O	H
S. Anatum	-	-	1	6.67	D1	1,9,12	g,m: 1,7
S. Kentucky	1	6.67	-	-	C3	8,20	i: Z6
S. Infantis	-	-	1	6.67	C1	6,7,14	r: 1,5
S. Typhimurium	-	-	1	6.67	B	1,4,5,12	i: 1,2
Total	1	6.67	3	20			

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

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