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Research Article

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, Enterobacteriacae, coliform counts (cfu/g) were $6.03\times10^3 \pm 1.45\times10^3$, $3.16\times10^3 \pm 0.72\times10^3$, $7.43\times10^2 \pm 1.05\times10^2$ for meat, $8.58\times10^3 \pm 1.65\times10^3$, $6.53\times10^3 \pm 1.24\times103$, $9.18\times10^2 \pm 2.07\times10^3$ for chicken, $9.91\times10^3 \pm 2.18\times10^3$, $5.25\times10^3 \pm 0.86\times10^3$, $1.06\times10^3 \pm 0.19\times10^2$ for beef kofta and $2.03\times10^4 \pm 0.43\times10^4$, $9.14\times10^3 \pm 2.06\times10^3$, $3.32\times10^3 \pm 0.45\times10^3$ for chicken kofta, respectively.

The results showed that 12 isolates of *E.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}) *E.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.

Keywords: APC; Coliforms; *E. coli*; Meat meals; *Staph.aureus*

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 [1,2].

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 [3].

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Incorrect habits responsible for microbial food borne illness reported [4] 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 [5].

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 [6]. It is considered that the presence of *Salmonella spp* in products makes it unsafe for human consumption [7,8].

E. coli is an important organism involved in food – borne disease, it is considered as a good indicator of possible fecal contamination [9].

Therefore, the present study was planned out for determination of APC, Enterobacteriaceae & coliforms counts, isolation and identification of *E. coli*, *Salmonella* and *Staph.aureus* for ready to eat meat and chicken meals including meat, chicken, beef kofta and chicken kofta.

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 [10]:

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:

1. Determination of APC [10]
2. Determination of total Enterobacteriaceae count [11] using Violet Red Bile Glucose agar
3. Determination of total coliform count [10] using Violet Red Bile agar medium
4. Isolation and identification of Enteropathogenic *E. coli.* [12] it was applied by using MacConkey broth as enriched broth and EMB as plating media.
5. Isolation and Identification of *Salmonellae* [13]
6. Isolation and identification of *Staph.aureus* [10]

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, enterobacteriaceae was highest in chicken kofta followed by chicken then beef kofta then meat.

Isolation and identification of *E.coli* in the examined samples revealed that the incidence of *E.coli* was 26.67% in chicken , 20% in both of beef kofta and 13.33 in meat,12 isolates of *E.coli* represented as 13.33% from meat with serotypes O_{26} : H_{11} (6.67%) and O_{111} : H_4 (6.67) 20% from beef kofta with serotypes O_{26} : H_{11} (13.33%) and O_{124} (6.67%) 20% from chicken with serotypes O_{78} (6.67%), O_{127} : H_6 (6.67%) and O_{146} : H_{21} (6.67%) 26.67% from chicken kofta with serotypes O_{26} : H_{11} (13.33%), O_{91} : H_{21} (6.67%) and O_{121} : H_7 (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. kentuckey*

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.

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 from10^5 to 10^7 microbes /g. [14].

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 2.1×10^3 to 1.7×10^4 with an average of $6.03\times10^3 \pm 1.45\times10^3$/(cfu/g) for meat, 4.6×10^3 to 2.9×10^4 with an average $9.91\times10^3 \pm 2.18\times10^3$/(cfu/g) for meat kofta, 3.5×10^3 to 3.9×10^4 with an average $8.58\times10^3 \pm 1.65\times10^3$/(cfu/g) for chicken and 6.0×10^3 to 7.7×10^4 with an average $2.03\times10^4 \pm 0.43\times10^4$ (cfu/g) for chicken kofta. The current results nearly similar to the results recorded by [15] found that the mean value of RTE kofta was 1.83×10^4cfu/gm, while higher results was recorded by [16] who found that the mean value of APC of RTE kofta was 8.51×10^5 cfu/g, also higher results was recorded by [17] found that the mean APC of RTE chicken meals was 1.9×10^4 cfu/g and in RTE meat meals was 1.2×10^4 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 [18].

Meals	Min	Max	Mean ± S.E*
Meat meals:			
Meat	2.1×10^3	1.7×10^4	$6.03\times10^3 \pm 1.45\times10^3$
Kofta	4.6×10^3	2.9×10^4	$9.91\times10^3 \pm 2.18\times10^3$
Chicken meat meals:			
Chicken meat	3.5×10^3	3.9×10^4	$8.58\times10^3 \pm 1.65\times10^3$
Kofta	6.0×10^3	7.7×10^4	$2.03\times10^4 \pm 0.43\times10^4$

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

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.

Meals	APC /g	Accepted Samples		Unaccepted Samples	
		No.	%	No.	%
Meat meals *					
Meat	104	13	86.67	2	13.33
Kofta		11	73.33	4	26.67
Chicken meat meals **					
Chicken	104	12	80	3	20
Kofta		9	60	6	40

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

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

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 $3.16\times10^3 \pm 0.72\times10^3$/(cfu/g) for meat, $5.25\times10^3 \pm 0.86\times10^3$/(cfu/g) for meat kofta, $6.53\times10^3 \pm 1.24\times10^3$/(cfu/g) for chicken and $9.14\times10^3 \pm 2.06\times10^3$/(cfu/g) for chicken kofta. the current results was nearly similar to recorded by [16] who found that the mean values of enterobacteriacea of RTE kofta was 7.15×10^3/(cfu/g), while higher results recorded by [19] who found the mean value of enterobacteriacae of street vended kofta samples was 1.5×10^7cfu/g.

Meals	Min	Max	Mean ± S.E*
Meat meals:			
Meat	2.2×10^2	8.1×10^3	$3.16\times10^3 \pm 0.72\times10^3$
Kofta	5.7×10^2	1.5×10^4	$5.25\times10^3 \pm 0.86\times10^3$
Chicken meat meals:			
Chicken	4.5×10^2	1.6×10^4	$6.53\times10^3 \pm 1.24\times10^3$
Kofta	7.8×10^2	2.8×10^4	$9.14\times10^3 \pm 2.06\times10^3$

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

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 $7.43\times10^2 \pm 1.05\times10^2$/(cfu/g) for meat, $1.06\times10^3 \pm 0.19\times10^2$/(cfu/g) for meat kofta, $9.18\times10^2 \pm 2.07\times10^3$/(cfu/g) for chicken and $3.32\times10^3 \pm 0.45\times10^3$/(cfu/g) for chicken kofta. the current results was nearly similar to the results recorded by [20] who found that the mean values of coliform was $5.17\times10^2 \pm 1.2\times10^2$/cfu/g. while higher results was recorded by [21] who found the mean value of coliform count of kofta sandwiches was 1.8×10^5/(cfu/g).

From the results in (Tables 5 & 6) showed that there are 12 isolates of *E.coli* represented as 13.33% from meat with serotypes O_{26} : H_{11} (6.67%) and O_{111} : H_4 (6.67) 20% from beef kofta with serotypes O_{26} : H_{11}(13.33%) and O_{124} (6.67%) 20% from chicken with serotypes O_{78}

(6.67%), O_{127} : H_6 (6.67%) and O_{146} : H_{21} (6.67%) 26.67% from chicken kofta with serotypes O_{26} : H_{11} (13.33%), O_{91} : H_{21} (6.67%) and O_{121} : H_7 (6.67%).

Meals	+ve samples		Min	Max	Mean ± S.E*
	No.	%			
Meat meals:					
Meat	7	46.67	1.0×10^2	2.3×10^3	$7.43\times10^2 \pm 1.05\times10^2$
Kofta	8	53.33	1.0×10^2	4.9×10^3	$1.06\times10^3 \pm 0.19\times10^2$
Chicken meat meals:					
Chicken	8	53.33	1.0×10^2	3.7×10^3	$9.18\times10^2 \pm 2.07\times10^3$
Kofta	9	60	1.0×10^2	7.0×10^3	$3.32\times10^3 \pm 0.45\times10^3$

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

Meat meals	Meat		Kofta		Strain Characteristics
E. coli strains	No.	%	No.	%	
O_{26}: H_{11}	1	6.67	2	13.33	EHEC
O_{111}: H_4	1	6.67	-	-	EHEC
O_{124}	-	-	1	6.67	EIEC
Total	2	13.33	3	20	

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

EIEC = Enteroinvasive *E. coli* EHEC= Enterohaemorrhagic *E. coli*

Meat meals	Meat		Kofta		Strain Characteristics
E. coli strains	No.	%	No.	%	
O_{26}: H_{11}	-	-	2	13.33	EHEC
O_{78}	1	6.67	-	-	EHEC
O_{91}: H_{21}	-	-	1	6.67	EIEC
O_{121}: H_7	-	-	1	6.67	
O_{127}: H_6	1	6.67	-	-	
O_{146}: H_{21}	1	6.67	-	-	
Total	3	20	4	26.67	

Table 6: Incidence and serotyping of Enteropathogenic *E. coli* isolated from the examined samples of cooked chicken meals (n=15).

EPEC = Enteropathogenic *E. coli* ETEC = Enterotoxigenic *E. coli* EHEC= Enterohaemorrhagic *E. coli*

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 $O_{8,20}$: $H_{i:Z6}$ 20% from chicken kofta identified serologically as S. Anatum $O_{1,9,12}$: $H_{g,m:1,7}$ (6.67%), S. Infant is $O_{6,7,14}$: $H_{r:1,5}$ (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 by [22,23] also salmonella failed to be isolated from cooked meat meals by [24] the symptoms the symptoms of salmonellosis include diarrhea, nausea, vomiting, fever and abdominal cramps [25].

Salmonella serotypes	Meat	Kofta		Group	Antigenic Structure	
	No.	No.	No.	%	O	H
S. Heidelberg	1	6.67	-	-	B	4,5,12	r: 1,2
S. Montevideo	-	-	-	6.67	C1	6,7,14	g,m,s : 1,2,7
Total	1	6.67	-	6.67		

Table 7: Incidence and serotyping of *Salmonellae* isolated from the examined samples of cooked meat 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. Kentuckey	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 8: Incidence and serotyping of *Salmonellae* isolated from the examined samples of cooked chicken meals (n=15).

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 by [22,24] 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 [26].

Meat meals	Positive samples	
	No.	%
Meat	3	20
Kofta	6	40
Total (30)	9	30

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

Chicken meals	Positive samples	
	No.	%
Chicken	5	33.33
Kofta	7	46.67
Total (30)	12	40

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

Conclusion

The current results in this study allowing concluding that all examined samples were contaminated with different bacteria as *E. coli*, *Salmonella* and *Staph.aureus* and the highest APC was in chicken kofta followed with beef kofta, chicken and meat.

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