The Bacteriological Quality 0f Some Chicken Meat Products

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A B S T R A C T

The chicken meat is one of the main sources of animal protein all over the world; and the volume of their production, marketing and consumption is increasing to satisfy the public demand worldwide within the last decades (Lyon et al., 2007). A total of 90 random samples of chicken meat products (nuggets, luncheon and frozen shawerma) (25 g, 30 of each), were collected from different supermarkets at El- Menufia governorates. The mean values of aerobic plate, coliforms and Staphylococci counts were $1.99 \times 10^5 \pm 0.62 \times 10^5$, $1.14 \times 10^3 \pm 0.35 \times 10^3$ and $4.3 \times 10^2 \pm 1 \times 10^2$ (cfu/g) in chicken luncheon, $3.83 \times 105 \pm 9.6 \times 10^4$, $5.0 \times 10^3 \pm 1.2 \times 10^3$, $1.6 \times 10^3 \pm 0.42 \times 10^3$cfu/g, in chicken nuggets and $2.77 \times 10^6 \pm 1.4 \times 10^6$, $6.33 \times 10^3 \pm 1.7 \times 10^3$and $1.97 \times 10^3 \pm 0.52 \times 10^3$ (cfu/g) in shawerma, respectively. The incidence of *Staphylococcus aureus* in the examined samples of chicken luncheon, nuggets, and shawerma wad 7 (23.3%), 9 (30%) and 14 (46.6%), While the incidence of *E. coli* was 4 (13.3%), 5 (16.6%) and 7 (23.3%), in the examined samples of luncheon, nuggets, and shawerma, respectively. Most of the examined chicken meat products were contaminated with *E. coli and Staphylococcus aureus* and this is considered objectionable.

Key words: Chicken meat products, APC, *E.coli*, *S.aureus.*

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1. INTRODUCTION

In Egypt, chicken meat products are gaining popularity because they represent quick easily prepared meat meals and solve the problem of the shortage in fresh meat of high price which is not within the reach of large numbers of families with limited income.

The chicken meat is one of the main sources of animal protein all over the world; and the volume of their production, marketing and consumption is increasing to satisfy the public demand worldwide within the last decades (Lyon *et al*., 2007).

In processing plants, contamination of poultry meat products can occur throughout processing, packaging and storage until the product is sufficiently cooked and consumed (Mensah *et al*., 2002).

In recent years, food borne infections and intoxication have assumed significance as a health hazard. Epidemiological reports suggest that chicken meat is still the primary cause of human food poisoning (Ruban and Fairoze, 2011).

Amongst the food borne pathogens, *Staphylococcus aureus* and *E. coli* are the most common and frequent pathogens

responsible for food poisoning and food related infections (Pires *et al*., 2012).

Staphylococcus aureus is an important pathogen and has been indicated as the fifth causative agent of food-borne human illness throughout the world. Staphylococcal enterotoxins (SEs) are toxic compounds excreted mainly by strains of *Staphylococcus aureus* (Soriano *et al*., 2012).

E. coli is a major component of the normal intestinal flora of human and other mammals which are usually harmless to the host and only cause diseases in immunocompromised hosts or when the gastrointestinal barriers are breached. However, some specific *E.coli* strains represent primary pathogens with enhanced potential to cause disease after acquiring specific virulence attributes (Li *et al*., 2005).

Therefore, the present study was planned out to throw a light on the bacteriological quality of some chicken meat products and the isolation, identification and serotyping of some food poisoning microorganisms mainly *E.coli* and *Staphylococcus aureus* in locally manufactured chicken meat products (luncheon, nuggets and shawerma)

2. MATERIALS AND METHODS

2.1 Collection of samples:

A total of 90 random samples of chicken meat products classified into chicken nuggets, chicken luncheon and frozen chicken shawerma (25g, 30 of each) which were collected from different supermarkets at El-Menufia governorates. The collected samples were transferred directly to the laboratory in an ice box under complete aseptic conditions without undue delay and then subjected to the following examination.

2.2 Aerobic Plate Count:

It carried out according to (APHA, 1992). Plate count agar media is used and incubation at 37 ºC for 48 hours.

2.3 Coliforms count:

It carried out according to (ICMSF, 1996). Violet red bile (VRB) agar was used and incubation at 37 ºC for 24 hours.

2.4 Staphylococci count:

It carried out according to (ICMSF, 1996). Baired Parker agar media was used and incubation at 37 ºC for 48 hours.

2.5 Isolation and Identification of Staphylococcus aureus

It carried out according to (ICMSF, 1996). Baired Parker agar media was used and 37 ºC for 48 hours. Suspected colonies of *Staph. aureus* appeared as black shiny with narrow white margin and surrounded by clear zone.

2.6 Isolation and identification of E. coli.

It carried out according to (APHA, 1992). Enrichment on Macckonkey broth tube supplemented with inverted Durham's tubes and incubated at 37 °C /24-48 hrs, then 1ml of positive tubes (showed acid and gas production) was taken to MacConkey broth tube with inverted Durham's tubes and incubated at 44±0.5°C /48hrs. Tubes showing gas production and change are positive for true fecal type *E.coli.* Selective Plating on Eosin methylene blue (EMB) agar, incubated at 37°C /24hrs. Typical colonies are greenish metallic with dark purple center.

2.7. Statistical Analysis (SPSS, Version 16).

3. RESULTS

It is evident from the results recorded in Table (1) that the APC (cfu/g) in the examined samples of chicken meat products varied from 6.0×10^3 to 1.7×10^6 with a mean value of $1.99\times10^5 \pm 0.62\times10^5$ cfu/g in chicken luncheon, 9.1×10^3 to 1.9×10^6 with a mean value of $3.83\times10^5 \pm 9.6\times10^4$ cfu/g in chicken nuggets, and 2.1×10^4 to 3.5×10^7 with a mean value of $2.77\times10^6 \pm 1.4\times10^6$ cfu/g in half cooked chicken shawerma.

Clearly, 80%, 93.3% and 100% of the examined samples of chicken luncheon,

nuggets and shawerma were unaccepted based on their limits of APC according to (EOS, 2005) which recommend that APC not exceed 10^4 cfu/g as recorded in Table (2).

From the obtained results recorded in Table (3), it is clear that Coliform count in the examined samples was varied 1.0×10^2 to 9.3×10^3 with a mean value of $1.14\times10^3 \pm 0.35\times10^3$ cfu/g in chicken luncheon, 1.0×10^2 to 2.3×10^4 with a mean value of $5.0\times10^3\pm 1.2 \times10^3$ cfu/g in chicken nuggets, and 1.0×10^2 to 3.5×10^4 with a mean value of $6.33\times10^3\pm 1.7 \times10^3$ cfu/g in half cooked chicken shawerma, respectively.

Nearly about 63.3%, 80% and 96.7% of the examined samples of chicken luncheon, nuggets and shawerma were unaccepted based on their limits of Coliforms according to (EOS, 2005) which recommend that coliforms count not exceed 10^2 cfu/g. Table (4).

Regarding the results recorded in Table (5) revealed that the staphylococci count was ranged from 1.0×10^2 to 2×10^3 with a mean value of $4.3\times10^2 \pm 1\times10^2$ cfu/g in chicken luncheon, 1.0×10^2 to 8×10^3 with a mean value of $1.6\times10^3\pm 0.42\times10^3$ cfu/g in chicken nuggets, and 0.5×10^2 to 1.0×10^4 with a mean value of $1.97\times10^3\pm 0.52\times10^3$ cfu/g in half cooked chicken shawerma, respectively.

Table (6) showed that 66.7 %, 76.7%, 80% for chicken luncheon, nuggets and half cooked chicken shawerma were recorded to be unaccepted based on total staphylococci count according to(EOS, 2005) .

Results achieved in Tables (7) indicated that *Staph. aureus* was detected in 23.3, 30%, and 46.6% of the examined samples of chicken luncheon, chicken nuggets, and half cooked chicken shawerma while *E.coli* was isolated from 13.3%, 16.6% and 23.3%, of examined samples of chicken luncheon, chicken nuggets, and half cooked chicken shawerma.

Results in Tables (8) revealed that 4 *E.coli* (13.3%) isolated from chicken luncheon, two of them (50%) were Enteropathogenic *E.coli* (O_{91}:H_{21} and O_{78}), one of them (25%) was Enterotoxogenic *E.coli* (O_{128}:H_2) and one of them (25%) was Enteroinvasive *E. coli* (O_{124}). Moreover, 5 *E.coli* (16.6%) isolated from chicken nuggets, 4 of them (80%) were Enteropathogenic *E. coli* (O_1:$H_{7\ (2)}$, O_{44}:$H_{18(1)}$ and $O_{78(1),}$ one of them (20%) was Enterhaemorrhagic *E. coli* (O_{26}:H_{11}). also, 7 *E.coli* (23.3%) isolated from half cooked chicken shawerma, 7 of them (100%) were Enteropathogenic *E. coli* (O_{91}:$H_{21\ (1),}$ O_{127}:$H_{6\ (1),}$ O_{153}:$H_{2\ (2),}$ O_{55}:$H_{7\ (1),}$ O_{44}:$H_{18\ (1)}$ and $O_{78\ (2)}$).

Table (1): Statistical analytical results of Aerobic plate count (APC) (cfu/g) in the examined samples of chicken meat products (n = 30).

Chicken meat products	Min	Max	Mean ± S.E
Chicken luncheon	6.0×10^3	1.7×10^6	$1.99\times10^5 \pm 0.62\times10^5$ a
Chicken nuggets	9.1×10^3	1.9×10^6	$3.83\times10^5 \pm 9.6\times10^4$ a
Chicken shawerma	2.1×10^4	3.5×10^7	$2.77\times10^6 \pm 1.4\times10^6$ a

S.E* = Standard error of mean.

The mean value carrying the same letter in the same column showed non significant difference.

Table (2): Acceptability of the examined samples of chicken products based on their APC/g(n = 30).

Chicken meat products	APC/g	Accepted samples		Unaccepted samples	
		No.	%	No.	%
Chicken luncheon	$\geq 10^4$	6	20	24	80
Chicken nuggets	$\geq 10^4$	2	6.7	28	93.3
Chicken shawerma	$\geq 10^4$	0	0	30	100

Egyptian Organization for Standardization "EOS" (2005)

Table (3): Statistical analytical results of Coliform count/g in the examined samples chicken meat products (n = 30).

Chicken meat products	Min	Max	Mean ± S.E
Chicken luncheon	1.0×10^2	9.3×10^3	$1.14\times10^3 \pm 0.35\times10^{3b}$
Chicken nuggets	1.0×10^2	2.3×10^4	$5.0\times10^3 \pm 1.2\times10^{3\,ab}$
Chicken shawerma	1.0×10^2	3.5×10^4	$6.33\times10^3 \pm 1.7\times10^{3a}$

Means of different products within the same column having different superscripts are significantly different ($P<0.05$).

Table (4): Acceptability of the examined samples of chicken products based on their Coliform count/g (n = 30).

Chicken meat products	APC/g	Accepted samples		Unaccepted samples	
		No.	%	No.	%
Chicken luncheon	$\geq 10^2$	11	36.7	19	63.3
Chicken nuggets	$\geq 10^2$	6	20	24	80
Chicken shawerma	$\geq 10^2$	1	3.3	29	96.7

Egyptian Organization for Standardization "EOS" (2005)

Table (5): Statistical analytical results of Staphylococci count/g in the examined samples chicken meat products (n = 30).

Chicken meat products	Min	Max	Mean ± S.E
Chicken luncheon	1.0×10^2	2×10^3	$4.3\times10^2 \pm 1\times10^{2\,b}$
Chicken nuggets	1.0×10^2	8×10^3	$1.6\times10^3 \pm 0.42\times10^{3\,ab}$
Chicken shawerma	0.5×10^2	1.0×10^4	$1.97\times10^3 \pm 0.52\times10^{3\,a}$

S.E = Standard error of mean

Means of different products within the same column having different superscripts are significantly different ($P<0.05$)

Table (6): Acceptability of the examined samples of chicken products based on their Staphylococci count/g (n = 30).

Chicken meat products	Accepted samples		Unaccepted samples	
	No.	%	No.	%
Chicken luncheon	10	33.3	20	66.7
Chicken nuggets	7	23.3	23	76.7
Chicken shawerma	6	20	24	80

Egyptian Organization for Standardization "EOS" (2005)

Table (7): Prevalence of some food-borne pathogens in the examined samples of chicken meat products (n=30)

Sample types	*Staph. aureus*		*E. coli*	
	No.	%	No.	%
Chicken luncheon	7	23.3	4	13.3
Chicken nuggets	9	30	5	16.6
Chicken shawerma	14	46.6	7	23.3
Total (90)	30	33.3	16	17.7

Table (8): Incidence of identified *E. coli* serotypes isolated from the examined samples of chicken meat products (n=30)

	Lunchon (n=4)		Nuggets (n=5)		Shawerma (n=7)		Strain characteristics
	No	%	No	%	No	%	
E coli O_{91}:H_{21}	1	25	-	-	1	14.3	EPEC
E coli O_{78}	1	25	1	20	2	28.6	EPEC
E coli O_{1}:H_{7}	-	-	2	40	-	-	EPEC
E coli O_{44}:H_{18}	-	-	1	20	-	-	EPEC
E coli O_{127}:H_{6}	-	-	-	-	1	14.3	ETEC
E coli O_{153}:H_{2}	-	-	-	-	2	28.6	EPEC
E coli O_{55}:H_{7}	-	-	-	-	1	14.3	EPEC
E coli O_{128}:H_{2}	1	25	-	-	-	-	ETEC
E coli O_{124}	1	25	-	-	-	-	EIEC
E coli O_{26}:H_{11}	-	-	1	20	-	-	EHEC
Total	4	100	5	100	7	100	

N: number of positive *E.coli* samples in each group of tested products.
The percent is calculated according to number of positive *E.coli* samples in each group.
EPEC: Enteropathogenic *E. coli* EIEC: Enteroinvasive *E. coli*
ETEC: Enterotoxigenic *E. coli* EHEC: Enterohaemorrhagic *E. coli*

4. DISCUSSION

In processing plants, contamination of chicken meat products can occur throughout processing, packaging and storage until the product is sufficiently cooked and consumed. Diseases can also occur when these products are not properly cooked and post-processing contaminated (Zhang et al., 2001).

The obtained results in Table (1) come in accordance with those reported by Bkheet et al. (2007) (1×10^5 cfu/g in chicken luncheon) and Shanab (2014) ($4.78\times10^5 \pm 0.51\times10^5$ and $3.89\times10^5 \pm 0.46\times10^5$ cfu/g for chicken nuggets, and shawerma).

Higher APC is obtained by Ahmed (2004) ($2.18 \times 10^6 \pm 1.36 \times 10^6$ and $6.51 \times 10^6 \pm 1.12 \times 10^6$ in chicken luncheon and chicken nuggets.

High APC may be attributed to the contamination of the product from different sources or unsatisfactory processing as well as unsuitable condition during storage (Zahran, 2004).

lower APC obtained by Sharaf and Sabra (2012) and Sobieh (2014) (8.5×10^3 and $4.58 \times10^5 \pm 0.74\times10^5$ in chicken luncheon and shawerma).

Comparing the obtained results in Table (3), higher Coliform count was obtained by Bkheet et al. (2007) (3.9×10^4 and 2.3×10^4 cfu/g in chicken nuggets and chicken luncheon. Moreover, lower Coliform count obtained by El-Kewaiey (2012) ($2.4x10^2 \pm 8.0x10$cfu/g in chicken nugget) and (5.08 x 10 ± 1.61 x 10 cfu/g in luncheon). High coliform count indicated poor hygienic quality of meat. The contamination with Coliforms may occur with soiled hands, shopping blocks or knives used for handling and cutting or contaminated water considered as a source of coliforms in meat (Yadav et al., 2006).

Nearly similar results in Table (5) were obtained by Sharaf and Sabra (2012) and Edris (2015) (4.1×10^2 and $1.81\times10^3 \pm 0.36\times10^3$ in chicken luncheon and chicken nuggets. Higher staphylococci count in chicken luncheon obtained by Shawish (2011) and Al-Ghamdi (2012) who found that the mean value of staphylococci count are$7.15 \times 10^3 \pm 2.24 \times 10^3$ and1.47×10^6 While, higher staphylococci count was obtained by Sobieh (2014) ($1.74\times10^4 \pm 0.31\times10^4$ in chicken shawerma). Lower staphylococci count in chicken shawerma obtained by Edris (2015) ($3.39\times10^2 \pm 0.52\times10^2$ in chicken shawewrma). The high incidence of *Staphylococcus spp.* organisms in chicken products is an indicative of unacceptable level of contamination during handling .

The results in Table (7) were higher than obtained by Edris (2015) who isolated *Staph. aureus* from different chicken meat products as 5%, 15% and 15% for chicken luncheon, chicken nuggets, and half cooked chicken shawerma, while Shanab (2014) failed to detect *Staph. aureus* in the examined samples. The presence of *staph. aureus* in a food indicates its contamination from food handlers and inadequately cleaned equipments (ICMSF, 1996a).

E. coli is a natural inhabitant of the intestinal tracts of humans and warm-blooded animals, its presence reliably reflects fecal contamination. Moreover, it indicates a possible contamination by enteric pathogens. Undercooked or raw foodstuffs gets contamination either during primary production as slaughtering or further processing and handling e.g. cross contamination during processing, human-to-food contamination by food handlers (Adeyanju and Ishola, 2014).

E.coli was previously isolated from chicken meat products by Ahmed (2004), Awadallah *et al.* (2014) and Sobieh (2014) who isolated *E.coli* a in a percent of 26.67% from examined chicken shawerma and Edris (2015) who isolated *E.coli* in a percent of

25% of chicken nuggets and 10% of half cooked chicken shawerma.

Results in table (8) come in accordance to results obtained by Awadallah et al. (2014) who isolated 4 (10%) *E.coli* from 40 samples of chicken luncheon, three of them (7.5%) were enteropathogenic *E.coli* (O_{55}:K_{59}) and one of them (2.5%) were enterohaemorrhagic *E.coli* (O_{111}:K_{58}), they also isolate 4 (10%) of Staph .aureus from examined 40 samples of chicken luncheon.

Achieved results in the present study proved that most of the examined chicken meat products were contaminated with *E. coli and Staphylococcus aureus*, this considered objectionable, not only as they render the product of inferior quality and unfit for consumption but also, is considered a reliable index of fecal contamination and improper handling during processing. It is recommended to apply efficient hygienic measures during different stages of the product handling till consumer consumption.

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