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MICROBIOLOGICAL STATUS OF FARMS AND BALADI HENS' EGGS

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ABSTRACT

This study was done to determine the microbiological status of farms and baladi hens' eggs and isolation of some pathogens of public health hazard. A total of 300 farms and baladi eggs samples (150 eggs of each) and every five eggs from each sample were represented as one egg pooled sample (N = 60 pools from farms and baladi hens' eggs representing 30 pools for each) were microbiologically examined. The incidences of aerobic bacteria, Enterococci, coliforms, faecal coliforms, *E. coli* and yeats and molds in farms hens' eggs shell were 90, 36.7, 10, 6.7, 6.7 and 63.3%, respectively; while, for baladi hens' eggs shell, the incidences were 100, 80, 86.7, 73.3, 53.3 and 76.7%, respectively. In farms hens' eggs content, the incidences of aerobic bacteria, Enterococci, coliforms, faecal coliforms, *E. coli* and yeasts and molds were 36.7, 13.3, 0, 0, 0 and 26.7%, respectively; while, for baladi hens' eggs shell, the incidences were 80, 10, 20, 10, 6.7 and 36.7, respectively. For pathogenic microorganisms, the incidences of *Staphylococcus aureus* in farms and baladi hens' eggs shell were 33.3 and 40%, respectively; while, for egg content, the incidences were 10 and 13.3%, respectively. Coagulase negative Staphylococci (CNS) were isolated from farms and baladi hens' eggs shell in incidences of 3.3 and 46.7%, respectively; while, in eggs content, the incidences were 13.3 and 43.3%, respectively. *Listeria monocytogenes* was isolated only from baladi hens' eggs shell in an incidence of 3.3%. *Salmonella spp.* couldn't be isolated from the shell and content from both types of eggs in this study. The public heath significance and hygienic control measures were discussed in this study.

Key words: *Farms eggs, Baladi eggs, Staphylococcus aureus, Listeria monocytogenes, Salmonella*

INTRODUCTION

Eggs are one of the few foods that are used excessively throughout the world; thus egg industry is an important segment of the world food industry. Eggs are an important part of human diet since the dawn of recorded history. Recently, eggs have been an important commodity in international trade. Moreover, eggs provide unique well balanced nutrients for persons of all ages. Their high nutrient content, low caloric value and ease of digestibility make eggs valuable in many therapeutic diets for adults (Heranz *et al.*, 2007; Ebubekir *et al.*, 2008).

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Freshly laid eggs are generally devoid of organisms. However, following exposure to environmental conditions (for example, soil, dust and dirty nesting materials), eggs become contaminated with different types of microorganisms (Ellen *et al.*, 2000). Furthermore, these microorganisms may contaminate the egg contents either by penetration or withdrawal through pores of the shells (Schoeni *et al.*, 1995), and also through the transovarian route (Bruce and Drysdale, 1994). Some other factors such as environmental temperature and humidity influence the bacterial penetration and thus, enhance the infection and spoilage (Theron *et al.*, 2003).

Food-borne diseases caused by microorganisms are a large and growing public health problem. Contamination of eggs and egg products with microorganisms can affect egg quality, which may lead to spoilage and pathogen transmission. This may induce cases of food-borne infection or intoxication to consumers, which constitute public health hazards.

Several pathogenic microorganisms have been isolated from the surface of egg shells and contents. Among them, *Listeria monocytogenes*, *Yersinia enterocolitica*, *Escherichia coli*, Salmonella and Campylobacter were detected (Adesiyun *et al.*, 2005).

Owing to the continuous consumers' demand for fresh eggs, and egg products, it is extremely necessary, not only to increase egg production, but also to safeguard consumers against health hazards. Therefore, the aim of this study is to evaluate the microbial status of edible hen's eggs and also, trail to isolate some pathogens causing food-borne infection and intoxication to the consumers.

MATERIALS AND METHODS

A total of 300 white shell hens' eggs representing 60 pooled samples (each sample is 5 eggs) of farms and baladi eggs (30 pooled samples of each) were collected from different poultry farms' supermarkets and farmers' houses from Assiut city and its surrounding villages, Egypt, from the period from January 2015 to August 2015. Eggs samples were collected in clean and sterile bag and transferred as son as possible to the laboratory for microbiological examination:-

A- Preparation of eggs samples for microbiological examination:

1- Egg shell was prepared by surface rinse method according to Moats (1980).

2- Egg content was evacuated for microbiological examination according to Speck (1976).

B- Preparation of serial dilution:
Ten fold serial dilutions was done from the rinse solution obtained from each group (five eggs) as well as ten fold serial dilution was done from the content of each group (five eggs) according to A.P.H.A. (2001).

C- Microbiological examination of the prepared egg shell solution as well as egg content by the flowing:-

1- Aerobic plate count according to A.P.H.A. (2001).

2- Enterococci count according to Deible and Hartman (1976).

3- Total yeasts and molds count according to Mislivec *et al.* (1992).

4- Total coliforms, faecal coliforms and *E. coli* count by MPN technique according to FAO (1992).

5- Isolation and identification of *Staphylococcus aureus* according to A.P.H.A. (2001).

6- Isolation and identification of *Listeria monocytogenes* according to Fiengold and Martin (1982).

7- Isolation and identification of *Salmonella spp.* according to Cox (1988).

The resulting data were analyzed using SPSS (2007) for Windows (SPSS, version 16, Inc., Chicago, IL). Chi-square test and t-test analysis were performed, differences were considered significant at values of P < 0.05.

RESULTS

Table 1: Statistical analytical results of microbiological examination of farms and baladi hens' eggs shell.

Microbial examination	Farms eggs counts (cfu/shell)					Baladi eggs counts (cfu/shell)				
	Positive samples		Min.	Max.	Average	Positive samples		Min.	Max.	Average
	No./30	%				No./30	%			
APC	27	90[a]	$2.0x10^2$	$1.0x10^4$	$2.4x10^{3**}$	30	100[a]	$1.6x10^3$	$7.5x10^5$	$1.1x10^{5**}$
Enterococci	11	36.7[a]	$1.0x10^2$	$2.0x10^3$	$3.6x10^{2*}$	24	80[b]	$1.0x10^2$	$1.5x10^5$	$1.2x10^{4*}$
Yeasts & Molds	19	63.3[a]	$1.0x10^2$	$1.0x10^3$	$4.0x10^{2*}$	23	76.7[a]	$1.8x10^2$	$1.0x10^6$	$4.7x10^{4*}$

[a,b]Percentages in the same raw with different letters indicate having significance difference by using Chi-square test.
[**]Indicates averages in the same raw having significance difference by using t test.

Table 2: Statistical analytical results of microbiological examination of farms and baladi hens' eggs content.

Microbial examination	Farms eggs counts (cfu/ml)					Baladi eggs counts (cfu/ml)				
	Positive samples		Min.	Max.	Average	Positive samples		Min.	Max.	Average
	No./30	%				No./30	%			
APC	11	36.7[a]	$1.0x10^2$	$2.3x10^3$	$7.9x10^{2*}$	24	80[b]	$1.0x10^2$	$5.7x10^4$	$4.6x10^{3*}$
Enterococci	4	13.3[a]	$2.0x10^2$	$1.1x10^3$	$5.8x10^{2*}$	3	10[a]	$1.0x10^2$	$9.0x10^2$	$5.0x10^{2*}$
Yeasts & Molds	8	26.7[a]	$1.0x10^2$	$5.0x10^2$	$3.0x10^{2*}$	11	36.7[a]	$1.0x10^2$	$1.0x10^5$	$9.2x10^{3*}$

[a,b]Percentages in the same raw with different letters indicate having significance difference by using Chi-square test.
[**]Indicates averages in the same raw having significance difference by using t test.

Table 3: Incidence of coliforms, faecal coliforms and *E. coli* recovered from farms and baladi hens' eggs shell using MPN/shell.

Types of eggs samples	Positive samples recovered coliforms		Positive samples recovered faecal coliforms		Positive samples recovered *E. coli*	
	No./30	%	No./30	%	No./30	%
Farms eggs	3	10[a]	2	6.7[a]	2	6.7[a]
Baladi eggs	26	86.7[b]	22	73.3[b]	16	53.3[b]

[a,b]Percentages in the same column with different letters indicate having significance difference by using Chi-square test.

Table 4: Frequency distribution of positive eggs shells based on coliforms, faecal coliforms and *E. coli* count using MPN/shell.

Range	farms eggs samples (No./30)						baladi eggs samples (No./30)					
	Coliforms		Faecal coliforms		*E. coli*		Coliforms		Faecal coliforms		*E. coli*	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< 3*	27	90	28	93.3	28	93.3	4	13.3	8	26.7	14	46.7
3 - < 10	2	6.7	1	3.3	1	3.3	2	6.7	7	23.3	6	20
$10 - < 10^2$	0	0	0	0	0	0	7	23.3	8	26.7	5	16.7
$10^2 - < 10^3$	1	3.3	1	3.3	1	3.3	4	13.3	1	3.3	3	10
$\geq 10^3$	0	0	0	0	0	0	13	43.3	6	20	2	6.6
Total	30	100	30	100	30	100	30	100	30	100	30	100

< 3* means negative results

Table 5: Incidence of coliforms, faecal coliforms and *E. coli* recovered from farms and baladi hens' eggs content using MPN/ml.

Types of eggs samples	Positive samples recovered coliforms		Positive samples recovered faecal coliforms		Positive samples recovered *E. coli*	
	No./30	%	No./30	%	No./30	%
Farms eggs	0	0	0	0	0	0
Baladi eggs	6	20	3	10	2	6.7

Table 6: Frequency distribution of positive eggs content based on coliforms, faecal coliforms and *E. coli* count using MPN/ml.

Range	farms eggs samples (No./30)						baladi eggs samples (No./30)					
	Coliforms		Faecal coliforms		*E. coli*		Coliforms		Faecal coliforms		*E. coli*	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< 3*	30	100	30	100	30	100	24	80	27	90	28	93.3
3 - < 10	0	0	0	0	0	0	2	6.7	1	3.3	1	3.3
$10 - < 10^2$	0	0	0	0	0	0	4	13.3	2	6.7	1	3.3
$10^2 - < 10^3$	0	0	0	0	0	0	0	0	0	0	0	0
$\geq 10^3$	0	0	0	0	0	0	0	0	0	0	0	0
Total	30	100	30	100	30	100	30	100	30	100	30	100

< 3* means negative results

Table 7: Incidence of *Staph. aureus*, CNS, *Listeria monocytogens* and *Salmonella spp.* on egg shell of farms and baladi hens' eggs.

Microorganisms	Farms eggs		Baladi eggs	
	No./30	%	No./30	%
Staph. aureus	10	33.3	12	40
CNS	1	3.3	14	46.7
Listeria monocytogens	Nil	Nil	1	3.3
Salmonella spp.	Nil	Nil	Nil	Nil

CNS means coagulase negative Staphylococci

Table 8: Incidences of *Staph. aureus*, CNS, *Listeria monocytogens* and *Salmonella spp*. in egg content of farms and baladi hens' eggs

Microorganisms	Farms eggs		Baladi eggs	
	No./30	%	No./30	%
Staph. aureus	3	10	4	13.3
CNS	4	13.3	13	43.3
Listeria monocytogens	Nil	Nil	Nil	Nil
Salmonella spp.	Nil	Nil	Nil	Nil

CNS means coagulase negative Staphylococci

DISCUSSION

The illustrated results in Table 1 revealed that, the incidence of aerobic bacteria in the examined farms hens' eggs shell samples was 90% with a count ranged from $2.0x10^2$ to $1.0x10^4$ and with an average count of $2.4x10^3$ cfu/shell. Nearly similar incidence (92%) but with higher average count ($4.52x10^5$ cfu/shell) were reported by El-Leboudy *et al.* (2011), while, lower incidences (80 and 58.82%) with an averages count ($2.4x10^4$ and $8x10^3$ cfu/shell) were reported by Abouzeid and Ashour (2002); El-Kholy *et al.* (2014), respectively. On the other hand, higher incidences (100%) with averages count ($3.7x10^7$, $6.16x10^3$ and $7.4x10^2$ cfu/shell) were estimated by Ahmed *et al.* (1985); El-Malt (2015); Wafy (2015), respectively. The incidence of aerobic bacteria in the examined baladi hens' eggs shell was 100% with a count ranged from $1.6x10^3$ to $7.5x10^5$ and with an average count of 1.1x10^5 cfu/shell (Table 1). Lower incidences (80 and 97.1%) but with nearly similar averages count of (2.07x10^5 and 9.9x10^5 cfu/shell) were detected by Abouzeid and Ahour (2002); Refaat (2009), respectively.

The using of statistical analysis between the percentages of incidences of aerobic bacteria between farms and baladi hens' eggs shell by using SPSS program, the Pearson Chi-square test revealed that, there was no significance difference between the two types of eggs ($\chi 2$ = 3.158 and $P > 0.05$). While, there was high significance difference in the average count/shell between farms and baladi hens' eggs by using t-test (t = 2.994 and $P < 0.01$). This findings indicated that, hens housed in cages (farms eggs) produce more eggs with higher quality and lesser bacterial contamination than hens housed in floors laying systems (baladi eggs). It is known that, eggs from caged birds are less likely to be contaminated with various microorganisms; this because the droppings fall through the cage floor doesn't come in contact with the eggs. Also, birds that are allowed to range outdoors are more likely to become contaminated from soil, insects, and rodents. Moreover, the concentration of dust accumulated in the floor housing system, contributes to higher contamination of eggs with bacteria compared to hens raised in the cage systems. Therefore, baladi eggs are more likely to be contaminated than eggs from farms. Moreover, isolation of the hens from faecal material in floor operation is essential to provide clean eggs with less bacterial contamination. Furthermore, high levels of external shell contamination can adversely affect the shelf life and food safety of eggs.

The external shell contamination could be important for the shelf life and the food safety of consumption eggs and egg products. It is hypothesized that, bacterial contamination of internal egg content could be the result of penetration of the shell by bacteria deposited on the surface of the egg after it has been laid (Smith *et al*., 2000).

The incidence of aerobic bacteria in farms hens' eggs content was 36.7% with a count ranged from 1.0x10^2 to 2.3x10^3 and with an average count of 7.9x10^2 cfu/ml (Table 2). Higher incidences (52, 82.9, 78, 50, 100, and 100%) with various averages count (1.42x10^4, 2.3x10^3, 1.04x10^3, 1.1x10^3, 1.14x10^3 and 1.5x10 cfu/ml) were estimated by Abouzeid and Ashour (2002); Refaat (2009); El-Leboudy *et al.* (2011); El-Kholy *et al.* (2014); El-Malt (2015); Wafy (2015), respectively. While, in baladi hens' eggs content; the incidence of aerobic bacteria was 80% with a count ranged from 1.0x10^2 to 5.7x10^4 and with an average count of 4.6x10^3 cfu/ml (Table 2). Lower incidences (76 and 68.6%) with averages count of 2.68x10^4 and 2.3x10^3 cfu/ml were detected by Abouzeid and Ashour (2002); Refaat (2009), respectively.

The statistical analysis revealed that, there was high significance difference between incidence of aerobic bacteria of farms and baladi hens' eggs content by using Pearson Chi-square test ($\chi 2$ = 11.589 and $P < 0.01$). While, there was no significance difference between averages count of both types of eggs by using t-test (t = 0.984 and $P > 0.05$). From the obtained results it is concluded that, the wide range of aerobic bacterial incidences between farms and baladi hens' eggs may be due to the variation in methods of production, handling and storage.

The results listed in Table 1 revealed that, the incidence of *Enterococci* in farms hens' eggs shell was 36.7% with a count ranged from 1.0x10^2 to 2.0x10^3 and with an average count of 3.6x10^2 cfu/shell. Lower incidences (11.4 and 4.4%) with averages count of (1.3x10^5 and 1.6x10^2 cfu/shell) were recorded by Refaat (2009); El-Malt (2015), respectively. On the other hand, higher incidences (64 and 72%) with relatively higher averages count (1.6x10^3 and 1.33x10^3 cfu/shell) were reported by Ahmed *et al.* (1985); Abouzeid and Ashour (2002), respectively. Furthermore, the incidence of *Enterococci* in baladi hens' eggs shell was 80% with a count ranged from 1.0x10^2 to 1.5x10^5 and with an average count of 1.2x10^4 cfu/shell (Table 1). Lower incidence (17.1%) with higher average count (1.6x10^5 cfu/shell) was detected by Refaat (2009). In contrary, higher incidence (100%) with higher average count (8.05x10^5 cfu/shell) was found by Abouzeid and Ashour (2002).

Results of the statistical analysis revealed that, there was highly significance difference between incidences of *Enterococci* in farms and baladi hens' eggs shell by using Pearson Chi-square test ($\chi 2$ = 11.589 and $P < 0.01$). In contrast, there was no significance difference between averages count of both types of eggs by using t-test (t = 1.276 and $P > 0.05$).

The incidence of *Enterococci* in farms hens' eggs content was 13.3% with a count ranged from 2.0x10^2 to 1.1x10^3 and with an average count of 5.8x10^2 cfu/ml (Table 2). Lower incidences (2.66 and 5.7%) with various averages count (1.25x10^5 and 2.0x10^2 cfu/ml) were estimated by El-Leboudy and El-Mossalami (2006); Refaat (2009), respectively. While, for baladi hens' eggs content, the incidence of *Enterococci* was 10% with a count ranged from 1.0x10^2 to 9.0x10^2 and with an average count of 5.0x10^2 cfu/ml (Table 2). Lower incidences (6 and 8.6%) with averages count of 1.12x10^5 and 2.3x10^2 cfu/ml were obtained by El-Leboudy and El-Mossalami (2006); Refaat (2009), respectively. On the other hand, higher incidence (84%) with an average count of $6.5x10^3$ cfu/ml was recorded by Abouzeid and Ashour (2002). Statistical analysis revealed that, there was no significance difference between incidences of *Enterococci* in farms and baladi hens' eggs content by using Pearson Chi-square test ($\chi2$ = 0.162 and P> 0.05). Also, t-test showed no significance difference between the averages count of both types eggs (t = 0.254 and P > 0.05).

The presence of *Enterococcus faecalis* in food is linked with a wide variety of human infections such as endocarditis, urinary and genital tract infections, meningitis and septicemia (Mannu *et al.*, 2003) and the high contamination of eggs by *Enterococci* in this study indicated that, eggs may represent a hazard for human being by accidental contamination of eggs based products by *Enterococci* during food preparation. Therefore, hygienic quality of eggs is very important to safeguard human from infection.

The incidence of yeasts and molds in farms hens' eggs shell was 63.3% with a count ranged from $1.0x10^2$ to $1.0x10^3$ and with an average count of $4.0x10^2$ cfu/shell (Table 1). Nearly similar incidence (65%) was found by Salihu *et al.* (2015) and also, similar average count of $2.7x10^4$ cfu/shell was detected by Salem *et al.* (2009). While, lower incidences (53 and 44.12%) with averages count of $1.31x10^3$ and $5.9x10^2$ cfu/shell were estimated by El-Leboudy *et al.* (2011); El-Kholy *et al.* (2014), respectively. In contrary, higher incidences (94.3 and 66.6%) with averages count of $1.5x10^4$ and $2.5x10^2$ cfu//shell were recovered by Refaat (2009); El-Malt (2015), respectively. For baladi hens' eggs shell, the incidence of yeasts and molds was 76.7% with a count ranged from $1.8x10^2$ to $1.0x10^6$ and with an average count of $4.7x10^4$ cfu/shell (Table 1). Higher incidence (94.3%) with nearly similar an average count of $2.5x10^5$ cfu/shell was recorded by Refaat (2009).

The statistical analysis revealed that, there was no significance difference between incidences of yeasts and molds in farms and baladi hens' eggs shell by using Pearson Chi-square test ($\chi2$ = 1.270 and P> 0.05). Also, t-test showed no significance difference between averages count of both types eggs (t = 0.976 and P > 0.05). In spite of statistical analysis results, the relatively higher incidences and count of yeasts and molds in baladi hens' eggs shell than that of farms eggs obtained in this study may attributed to that, the breeding system of hens in farms' houses where birds come in contact with the ground, spoiled food materials and animal faeces may give a chance to fungal contamination of eggs shell.

Concerning yeasts and molds in farms hens' eggs content, the incidence was 26.7% with count ranged from $1.0x10^2$ to $5.0x10^2$ and an average count of $3.0x10^2$ cfu/ml (Table 2). Lower incidence (23.53%) with nearly similar average count of $2.6x10^2$ cfu/ml was found by El-Kholy *et al.* (2014). While, higher incidences (38, 85.7, 29 and 46.6%) with various averages counts of $3.4x10^3$, 4.2x10, $4.0x10^2$ and 5.14x10 cfu/ml were estimated by Neamatallah *et al.* (2009); Refaat (2009); El-Leboudy *et al.* (2011); El-Malt (2015), respectively. On the other hand, the incidence of yeats and molds in baladi hens' eggs content was 36.7% with count ranged from $1.0x10^2$ to $1.0x10^5$ and with an average count of $9.2x10^3$ cfu/ml (Table 2). Higher incidence (71.4%) but with lower average count (3.8x10 cfu/ml) was recorded by Refaat (2009). The results of statistical analysis revealed that, there was no significance difference between incidences of yeasts and molds in farms and baladi hens' eggs content by using Pearson Chi-square test ($\chi2$ = 0.693 and P> 0.05). Also, t-test showed no significance difference between averages count of both types eggs (t = 0.834 and P > 0.05).

From the public health point of view, certain strains of molds were implicated in food poisoning outbreaks due to production of aflatoxins, as well as, some strains of molds are capable of forming toxins that cause mycotoxicosis in man and neoplastic diseases including leukemia and other cancers among consumers (Bullerman, 1980).

The recorded results in Tables 3 & 4 revealed that, 10% of farms hens' eggs shell had coliforms organisms with highest frequency distribution of 6.7% and laid in the range of 3 - < 10 cfu/shell. Higher results of 64, 33.3, 37.1, 30 and 47.06% were estimated by Ahmed *et al.* (1985); El-Leboudy and El-Mossalami (2006); Refaat (2009); El-Leboudy *et al.* (2011); El-Kholy *et al.* (2014), respectively. For baladi hens' eggs shell, the incidence of coliforms was 86.7% with highest frequency distribution of 43.3% and laid in the range of $\geq 10^3$ cfu/shell (Table 3 & 4). Lower incidences of 69.3 and 51.4% were detected by El-Leboudy and El-Mossalami (2006); Refaat (2009), respectively. The Pearson Chi-square result revealed that, there was higher significance differences between the incidences of coliforms organisms in farms and baladi hens' eggs shell ($\chi2$ = 35.306 and P < 0.01). These results go parallel with Jones *et al.* (2011) as the authors revealed that, shell contamination by coliforms was greater in free-range floor system than of conventional cage eggs. Furthermore, coliforms organisms couldn't be detected in farms hens' eggs content in this study (Table 4), while, the incidence of coliforms in baladi hens' eggs content was 20% (Table 5) with highest frequency distribution of 13.3% and laid in the rage of 10 - < 10^2 cfu/ml (Table 6). Higher incidence of 58.66% was found by El-Leboudy and El-Mossalami (2006), while, Refaat (2009) couldn't find coliforms organisms in baladi hens' eggs content. From the obtained results, it is concluded that, higher superiority of farms hens' eggs than baladi hens' eggs based on incidence of coliforms organisms; this may be attributed to the good hygienic measures that applied in poultry farms.

Concerning faecal coliforms, the incidence in farms hens' eggs shell was 6.7% (Table 3) with highest frequency distribution of 3.3% and laid in the range of 3 - < 10 and 10^2- < 10^3 (Table 4). Higher incidences of 11.4 and 20.59% were estimated by Refaat (2009); El-Kholy *et al.* (2014), respectively. In baladi hens' eggs shell, the incidence of faecal coliforms was 73.3% with highest frequency distribution of 26.7% and laid in the range of 10 - < 10^2 cfu/shell (Tables 3 & 4). Lower incidence of 22.9% was obtained by Refaat (2009). In regard to Pearson Chi-square test, there was higher significance difference between incidences of faecal coliforms in farms and baladi hens' eggs shell ($\chi2$ = 27.778 and P < 0.01). Faecal coliforms couldn't be detected in farms hens' eggs content in this study, while, in baladi eggs the incidence was 10% with highest frequency distribution of 6.7% and laid in the range of 10 - < 10^2 cfu/ml (Tables 5 & 6). Detection of faecal coliforms in eggs content at this study; give an indication to presence of some intestinal pathogens which may lead to foodborn infection and intoxication.

The results recorded in Tables 1, 2, 3 and 5 revealed that, the incidence of *Enterococci* in farms hens' eggs was more than that of coiforms and faecal coliforms. This may be attributed to the higher resistance of *Enterococci* to environmental conditions than faecal coliforms (Bordalo *et al.*, 2002) or due to other factors which need further investigations.

The results tabulated in Tables 3 & 4 revealed that, *E. coli* was isolated from farms hens' eggs shell in incidence of 6.7% with highest frequency distribution of 16.7% and laid in the range of 10 - < 10^2 cfu/shell. Nearly similar result 6.1% was detected by Mahdavi *et al.* (2012), while, lower incidence of 4% was found by Al-Ashmawy (2013). In contrast, higher incidences of 48, 48.89, 28.3, 14.71, 27.5 and 26.67% were reported by Ahmed *et al.* (1985); Bastawrows *et al.* (1997); Adesiyun *et al.* (2005); El-Kholy *et al.* (2014); Ibrahim *et al.* (2014); Fardows and Shamsuzzaman (2015), respectively. For baladi hens' eggs shell, the incidence of *E. coli* was 53.3% with highest frequency distribution of 20% and laid in the range of 3 - < 10 cfu/shell (Tables 3 & 4). Lower incidences of 32 and 44% were revealed by Al-Ashmawy (2013); Ibrahim *et al.* (2014), respectively. Concerning to Pearson Chi-square test, there was higher significance difference between incidences of *E. coli* in farms and baladi hens' eggs shell ($\chi2$ = 15.556 and P < 0.01).

The farms hens' eggs content were negative for *E. coli* isolation (Table 5) and this result coincided with Refaat (2009); Al-Ashmawy (2013); El-Malt (2015) as the authors failed to isolate *E. coli* from farms hens' eggs content. While, for baladi hens' eggs content, the incidence of *E. coli* was 6.7% with frequency distribution of 3.3% and laid in the ranges of 3 -< 10 and 10-< 10^2 cfu/ml (Tables 5 & 6). Higher incidences of 23 and 19% were found by Al-Ashmawy (2013); Ibrahim *et al.* (2014), respectively. Moreover, *E. coli* is a known causative agent of diarrhea and other food-borne related illnesses through the ingestion of contaminated foodstuffs; and also, presence of *E. coli* in eggs is a good indicator to faecal pollution of eggs and the possibility to presence of some enteric pathogens which constitute public health hazards to consumers. From the obtained results in this study; it is concluded that, farms hens' eggs have better hygienic measures during production and handling than baladi hens' eggs.

The tabulated results in Table 7 showed the pathogenic microorganisms that having public health significance isolated from farms and baladi hens' eggs shell. The incidence of *Staph. aureus* in farms hens' eggs shell was 33.3% and this result coincided with El-Malt (2015); while, higher incidences of 80, 84 and 82% were estimated by Ahmed *et al.* (1985); Abouzeid and Ashour (2002); El-Leboudy *et al.* (2011), respectively. In baladi hens' eggs shell, the incidence of *Staph. aureu* was 40% (Table 7). Higher incidence of 96% was reported by Abouzeid and Ashour (2002). Moreover, the incidence of *Staph. aureus* in farms hens' eggs content was 10% (Table 8). Lower incidence of 2.9% was found by Refaat (2009); while, higher incidences of 56 and 20% were estimated by Abouzeid and Ashour (2002); El-Malt (2015), respectively. The baladi hens' eggs content revealed that, the incidence of *Staph. aureus* was 13.3% (Table 8) and this result lower than that detected by Abouzeid and Ashour (2002) and Rfaat (2009) as they revealed incidences of 88 and 17.1%, respectively.

The public health significance of *Staph. aureus* is ranged from a variety of self-limiting to life-threatening diseases. The bacteria are a leading cause of food poisoning, resulting from the consumption of food contaminated with enterotoxins which is characterized by rapid onset of nausea, vomiting, abdominal pain, cramps, and diarrhea. Scalded skin syndrome is caused by exfoliative toxins secreted on the epidermis and mostly affects neonates and young children. Other skin conditions caused by Staphylococcal exfoliative toxins include blisters, skin loss, pimples, furuncles, impetigo, folliculitis, abscesses, poor temperature control, fluid loss, and secondary infection (Le Loir *et al.*, 2003; Murray *et al.,* 2003; Fridkin *et al.,* 2005 and Eisenstein, 2008).

The coagulase negative Staphylococci (CNS) was isolated from farms hens' eggs shell in a percentage of 3.3% (Table 7) and this result lower than that estimated by El-Malt (2015) where the author found incidence of 15.55%. Concerning Baladi hens' eggs shell, the incidence of CNS was 46.7% (Table 7). Moreover, the incidences of CNS in farms and baladi hens' eggs content were 13.3 and 43.3%, respectively (Table 8). El-Malt (2015) showed lower incidence of 8.9% in farms hens' eggs content. From the public health point of view, coagulase negative staphylococci have been identified as the etiological agent in various infections and are among the microorganisms most frequently isolated in nosocomial infections (Cunha *et al.,* 2006). Also, CNS have been implicated in infective endocarditis (Patel *et al.,* 2000), prosthetic joint infections (Trampuz and Zimmerli, 2005), neonatal septiceamia (Ghelbi *et al.,* 2008), Enterotoxins production (Veras *et al.,* 2008) and bacterial eye infections (Ogbolu *et al.,* 2011).

The incidence of *Listeria monocytogenes* in baladi hens' eggs shell in this study was 3.3% (Table 7) and this result lower than that reported by Abouzeid and Ashour (2002) as they found incidence of 32%. The shell and content of farms hens' eggs and content of baladi hens' eggs were negative for *Listeria monocytogenes* in this study (Tables 7 & 8). Several authors failed to detect *Listeria monocytogenes* in shell and in content farms hens' eggs, as Adesiyun *et al.* (2005); Korashy *et al.* (2008); Mahdavi *et al.* (2012). On the other hand, Saad and El-Prince (1995); Abouzeid an Ashour (2002); Sayed *et al.* (2009); El-Malt (2015) detected *Listeria monocytogenes* in farms hens' eggs in percentage of 17.78, 20, 7 and 2.2% for the mentioned authors respectively. Moreover, the low incidence of *Listeria monocytogens* in this study may be attributed to source of eggs, time of sampling or other factors which need further investigations.

The public health effects listeriosis in human include septicemia, meningitis or meningoencephalitis, encephalitis, corneal ulcer, pneumonia, and intrauterine or cervical infection in pregnant women, which may result in spontaneous abortion (second to third trimester) or stillbirth (Gray and Killinger, 1966; Holland *et al.,* 1987; Whitelock-Jones *et al.,* 1989 and Armstrong and Fung, 1993).

Concerning *Salmonella spp.,* the microorganism couldn't be isolated from the shell and content of both types of eggs (Tables 7 & 8). This result coincided with Hassan (1995); Abouzeid and Ashour (2002); El-Leboudy *et al.* (2011); Mahdavi *et al.* (2012); Folorunsho and Charles (2013); Al-Iedani *et al.* (2014); El-Kholy *et al.* (2014); El-Malt (2015). The failure of *Salmonella spp.* isolation in this study may be due to competition effect of aerobic contaminant or using of antibiotic as growth promoting and/or for treatment might inhibit Salmonella isolation or due to other factors which need further investigations.

This study revealed that, baladi hens' eggs have higher microbial load than farms hens' eggs. There are higher incidences of coliforms, faecal coliforms and *E. coli* organisms in baladi hens' eggs than those from farms hens' eggs. Eggs may be a source to same human pathogens specially *Staphylococcus aureus* and *Listeria monocytogenes*. Therefore, hygienic measures should be applied in home produced hen for lower bacterial load in egg shell and subsequently in egg content and also, strict hygienic measures to safeguard egg consumes from being infected as well as to safe eggs from being deteriorated should be adopted in the farms. Thorough cooking and preparation of eggs and eggs containing food should be applied to safeguard human being from being infected with pathogenic organisms.

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الحالة الميكروبيولوجية لبيض المزارع والبيض البلدي

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أُجريت هذه الدراسة لمعرفة الحالة الميكروبيولوجية لبيض المزارع والبيض البلدي وكذلك عزل بعض البكتريا الممرضة التي تؤثر عل الصحة العامة فقد تم تجميع عدد ٣٠٠ بيضة بواقع ١٥٠ بيضة لكلاً من بيض المزارع والبيض البلدي ممثلة في مجموعات كل مجموعة مكونة من ٥ بيضات (٦٠ مجموعة علي مجموعتين كل مجموعة مكونة من ٣٠ مجموعة لكل من بيض المزارع والبيض البلدي) لفحصها ميكروبيولوجياً لكل من القشرة والمحتوي. فقد كانت نسبة البكتريا الهوائية ؛ المكورات المعوية ؛ الميكروبات القولونية ؛ الميكروبات القولونية البرازية ؛ الايشيرشيا كولاي والخمائر والفطريات في قشرة بيض المزارع هي ٩٠ ؛ ٣٦.٧ ؛ ١٠ ؛ ٦.٧ ؛ ٦.٧ و ٦٣.٣٪ علي الترتيب ، بينما كانت النسب في قشرة البيض البلدي هي ١٠٠ ؛ ٨٠ ؛ ٨٦.٧ ؛ ٧٣.٣ ؛ ٥٣.٣ و٧٦٪ علي الترتيب. اما بالنسبة لمحتوي بيض المزارع فكانت نسب البكتريا الهوائية ؛ المكورات المعوية ؛ الميكروبات القولونية ؛ الميكروبات القولونية البرازية ؛ الايشيرشيا كولاي والخمائر والفطريات هي ٣٦.٧ ؛ ١٣.٣ ؛ ٠ ؛ ٠ ؛ ٠ و٢٦.٧٪ علي الترتيب بينما كانت النسب في محتوي البيض البلدي هي ٨٠ ؛ ١٠ ؛ ٢٠ ؛ ١٠ ؛ ٦.٧ و٣٦.٧٪ علي الترتيب. اما بالنسبة للميكروبات الممرضة فكانت نسبة المكور العنقودي الذهبي في قشرة بيض المزارع و البيض البلدي علي التوالي هي ٣٣.٣ و ٤٠٪ في حين كانت نسب هذا الميكروب في محتوي بيض المزارع والبيض البلدي هي ١٠ و١٣٪ علي الترتيب. اما بالنسبة للمكورات العنقودية سالبة التجلط للبلازما فكانت نسب عزلها من قشرة بيض المزارع والبيض البلدي هي ٣.٣ و٤٦.٧٪ علي الترتيب ؛ بينما كانت نسب هذه الميكروبات في محتوي كلا النوعين من البيض هي علي التوالي ١٣.٣ و٤٣.٣٪. وتم عزل ميكروب الليستريا مونوسيتوجينز من قشرة البيض البلدي فقط بنسبة ٣.٣٪ ولم يتم عزل ميكروبات السالمونيلا من قشرة ومحتوي كلا النوعين من البيض. وتمت في هذه الدراسة مناقشة الاهمية الصحية وكذلك الاحتياطات الصحية الواجب اتباعها.