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STUDIES ON MARKET HEN EGGS IN KAFR EL-SHEIKH AND EL-GHARBIA GOVERNORATES.

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SUMMARY

A total of 135 egg samples were collected from Kafr EL-Sheikh and EL-Gharbia Governorates markets (80 and 55 samples, respectively) for determination of their quality. The obtained results showed higher mean T.C.C. and yeast count values in egg shell samples collected from Kafr EL-Sheikh Governorate than those in EL-Gharbia Governorate, while, the mean mould count values were higher in EL-Gharbia Governorate. Moreover, the egg content samples collected from Kafr EL-Sheikh Governorate showed lower mean T.C.C. and mould count values and higher mean yeast count values than those in EL-Gharbia Governorate.

Serological typing of the 8 salmonella isolates, 4 from each Governorate, revealed the presence of two serotypes; with an incidence percentage ranging from 25% to 75% .

Residues of inhibitory substance were detected in 5 % and 9.1 % of the examined egg samples collected from Kafr EL-Sheikh and EL-Gharbia Governorates, respectively.

Total aflatoxin content residues were detected in 16 samples (9 and 7 from Kafr EL-Sheikh and EL-Gharbia Governorates, respectively).

INTRODUCTION

Egg are one of the few food that are used excessively throughout the world; thus, egg industry is an important segment of the world food industry. Eggs have been an important part of human diet since the down of recorded history. Recently, eggs have been an important commodity in international trade. Moreover, eggs provides a 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 (Burley and Vadehra, 1989).

Fresh eggs usually contain less than 10 organisms / g. and seldom 100 / g. (Speck, 1976). Deterioration of hen's egg may be due to the action of different types of organisms that find their way to the egg content as a result of faulty production, handling or storage. Beside the economic losses due to such spoilage, such eggs may constitute a public health hazard.

Several salmonella food poisoning outbreaks due to consumption of contaminated eggs have been reported (Hayes, 1992; Caffer and Giguery, 1994; Boyce et al., 1996 and Arnedo et al., 1998).

Antibiotics and sulphonamides residues may be retained in eggs after veterinary medication of laying hens, which may cause allergic reaction, toxicity and skin rashes in human (Rivere and Spoo, 1995).

Aflatoxins are toxic and carcinogenic secondary metabolites produced by some Aspergillus flavus and Aspergillus parasiticus strains during their growth on feed. Aflatoxin contaminated feed may affect on the growth and health of poultry and the possible transmission of such toxic residues to edible eggs resulting in potential hazard to human health (Martin et al., 1998). The rapid developments in immunoassay techniques over the past two decades have been directed towards increasing specificity, sensitivity and reliability of the various techniques.The ELISA technique is the most common immunodiagnostic technique used for rapid detection of aflatoxins in eggs (Baltse, 1990).

Owing to the continous consumers demand for fresh eggs and egg products, periodical assessment of eggs is required to offer good, safe and clean eggs for consumption. Therefore, this investigation was planned to secure the microbial contamination of market hen eggs in Kafr El-Sheikh and El-Gharbia Governorates, as well as inhibitory substances and total aflatoxin content residues.

MATERIAL AND METHODS

Collection of samples:

A total of 135 random (Farm and Balady) egg samples (every sample is a batch of 5 eggs) were collected from Kafr El- Sheikh and EL-Gharbia Governorats markets (80 and 55 samples, respectively). Every egg sample was placed in a sterile plastic bag and transferred to the laboratory where they prepared for examination.

Preparation of samples:

A-Egg shells: Egg shells were tested by a surface rinse method (Moats, 1979). The rinse solution obtained from the batches of five eggs was mixed and subjected for examination.

B-Egg contents : The egg shell was sterilized using few drops of alcohol then ignited. Using ster-

ile scissors, the egg shell was cutout around the air cell and the content was removed aseptically and homogenized (Speck, 1976), and then subjected for examination.

I-Bacteriological examination:

Serial dilutions were prepared from the rinse solution as well as the homogenate of each batch using sterile 0.1% peptone water, and then subjected for the following examinations:

1-Total colony count was performed according to Richardson (1985).

2-Yeast and mould count was determined according to Finegold and Martin (1982).

3-Isolation and biochemical identification of salmonella was done according to IDF (1995).Serological typing of the isolated strains was done in the Minister of health, Cairo, ARE.

II- Detection of inhibitory substance residues:

Inhibitory substance residues in eggs was detected by modification of the methods described by (Freres and Vatdeboaze, 1969 and Gudding, 1976). Two ml of each egg sample homogenate was mixed with phosphate buffer solvent then centrifuged at 3000 r.p.m. for 10 min. The supernatant was tested for residues using Bacillus subtilis test strain.

III- Detection of total aflatoxin content (TAC) residues:

TAC were extracted and detected in eggs using Ridascreen Aflatoxin Total Kit.

a) ELISA Kit :

The Ridascreen Aflatoxin Total Kit was purchased from R-Biopharm GmbH (Darmstadt, Germany). The kit, a competitive enzyme immunoassay for the quantitative analysis of aflatoxins in food, came with specific antibodies immobilized on a 96-well microtiter plate (12 strips with 8 removable wells each).

b) Extraction:

Egg samples were extracted for TAC according to the instructions provided with the kit. Each egg sample (2g.) was homogenized with 15 ml of methanol / water (70 / 30) for 10 min., then filtered using a filter paper.100 ul of the filtrate was diluted with 600 ul dilution buffer.The extracts were assayed within 3 hr. using ELISA technique.

c) ELISA technique:

The ELISA procedure was followed according to the instructions provided with the kit. 50 ul of negative control, each standard (C1 to C4) and each sample (S1 to S8) were added to their respective wells and incubated with equal volumes of the enzyme conjugate and antibody solutions for 30 min. at room temperature in the dark, followed by 3 rinses using distilled water.The substrate and chromogen were allowed to stand for 30 min. before the stop reagent was added. Absorbance values were obtained at 450 nm using a microtiter plate reader.

RESULTS AND DISCUSSION

Freshly laid eggs are mostly sterile. However, in a relatively short period of time after laying, numerous microorganisms may be found on the surface, and under certain conditions may penetrate into the egg and grow causing spoilage (Speck, 1976).

Results recorded in Table (1) show that, all the examined egg shell samples collected from Kafr EL-Sheikh Governorate were positive for T.C.C, and mould count. While, 77.5% (84.4% and 68.6% for Farm and Balady egg samples, respectively) proved to be contaminated with yeast. Moreover, Balady egg shell samples showed higher mean mould counts and lower mean T.C.C. and yeast counts than those of Farm eggs. The highest frequency distribution (37.5% and 27.42%) of T.C.C. and yeast count respectively, lies within the range of 10^3-< 10^4. While, that of mould count (33.75%) lies within the range of 10^4-< 10^5 (Table 7).

Most eggs receive their first load of contamination at oviposition and it may be considered, therefore, that the major (but not all) contamination of the egg is of external origin. Once the egg has been laid, it is usually moistened and become soiled at the same time. The presence of dirt in the surrounding environment add to the number of contaminating organisms (Mayer and Takeballi, 1983).

Table (2) reveal that, all the examined egg shell samples collected from EL-Gharbia Governorate were positive for T.C.C. In addition, 98.2% of the examined samples (100% & 93.3% for Farm and Balady) were contaminated with moulds. While, yeasts could be detected in 81.8% (80% & 86.7% for Farm and Balady) of the examined samples. Furthermore, Balady egg shell samples showed higher mean yeast count and lower mean T.C.C. and mould counts than those of Farm eggs. The highest frequency distribution (41.8% & 50%) of T.C.C. and mould count respectively, lies within the range of 10^4-< 10^5. While, that of yeast count (24.44%) lies within the range of 10^5-< 10^6 (Table 7).

Nearly similar results on egg shell were reported by Ahmed et al. (1985) and AL-Ashmawy et al. (1988). While, lower findings were reported by Board (1977) and Aman et al. (1993).

The microbiological criteria of the 135 egg shell samples collected from both Governorates showed higher mean mould count and lower mean T.C.C. and yeast count values in EL-Gharbia Governorate than those in Kafr EL-Sheikh Governorate (Table 3).

Three Salmonella isolates (2.2%) were isolated from the egg shell samples examined. Two (2.5%) from Kafr EL-Sheikh Governorate (S. konstanz

and S. senftenberge), and one (1.8%) from EL-Gharbia Governorate (S. konstanz) (Tables 3&9). Nearly similar findings were reported by Telo et al. (1999) who isolated Salmonella from the egg shell, but not from the egg content.

Salmonellae had been recognised as causes of enteric disease for many years, and remain the most important reported cause of food poisoning (Varnam and Evans, 1991; Caffer and Giguery, 1994 and Boyce et al., 1996).

Tables (4&5) reveal that, all the examined egg content samples collected from both Governorates were positive for T.C.C. While, 91.3% of the samples collected from Kafr EL-Sheikh Governorate (86.7% and 97.1% for Farm and Balady) and 96.4% collected from EL-Gharbia Governorate (100% and 86.7%) proved to be contaminated with mould. Moreover, yeasts were detected in 72.5% (80% & 62.9%) and 71% (65% & 86.7%) of the samples collected from Kafr EL-Sheikh and EL-Gharbia Governorates, respectively. Nearly similar findings were reported by Ahmed et al. (1987) and Aman et al. (1993) .

The highest frequency distribution of T.C.C. (38.75% & 41.7%) and of yeast count (37.93% & 20.51%) lies within the range of 10^3-$<10^4$. While, those of mould count (39.73% & 49.06%) lies within the range of 10^4-$<10^5$ in Kafr EL-Sheikh and EL-Gharbia Governorates, respectively (Table 8).

Microorganisms are introduced into the egg during formation either in the ovary or oviduct. They may migrate upward to genital organs from cloaca or may reach blood stream from digestive tract, circulating with the blood and localize in the ovary which will be a focus of infection for newly formed eggs. Moreover, contamination of egg from various external sources play an important role in shortening the keeping quality of eggs, the microorganisms may reach egg contents through the pores (Burley and Vadehra, 1989; ACMSF,1993 and Harrigan 1998).

The microbiological criteria of the 135 egg content samples showed higher mean yeast values, and lower T.C.C. and mould count values in Kafr EL-Sheikh Governorate than those in EL-Gharbia Governorate (Table 6).

Salmonella could be isolated from 5 egg content samples (3.7%). Two isolates (2.5%) from Kafr EL-Sheikh Governorate (S. konstanz and S. senftenberge), and three isolates (5.5%) from EL-Gharbia Governorate (S. konstanz and S. senftenberge) (Tables 6&9). Nearly similar findings were repoprted by Humphrey et al. (1991) and Blaszczak and Binek (1999), while lower results was reported by Poppe et al. (1998). Salmonella might gain entrance to egg content as a result of ovarian contamination or through penetration of the egg shell. Inhibition of Salmonella by naturally inhibitory substances present in the albumen may explain the low incidence of Salmonella in eggs

(Humphrey et al., 1991). Moreover, eggs and egg dishes are important vehicles for salmonella infections (Schoeni et al., 1995 and Arnedo et al., 1998).

It was observed that all the examined egg shell and egg content samples proved to be contaminated with T.C.C. Moreover, moulds could be detected in 99.3% and 93.3%, while yeasts could be detected in 79.3% and 71.9 of egg shell and egg content samples, respectively. The mean T.C.C., mould count and yeast count were higher in egg shell samples ($3.1x10^6$, $9.7x10^6$ and $1.3x10^8$ /g., respectively) than in egg content samples ($1.4x10^6$, $1.3x10^6$ and $6.7x10^7$ /g., respectively). (Tables 3&6). Nearly similar findings was reported by Lopez and Manrique (1977).

Soliman et al. (1992) claimed that, refrigeration storage of eggs kept egg quality at higher level and reduce bacterial development than that stored at room temperature.

Inhibitory substance residues were detected in 6.7% (5 % and 9.1 % of the examined egg samples collected from Kafr EL-Sheikh and EL-Gharbia Governorates, respectively). Nearly similar finding was reported by EL-Bassiony, et al. (1985), while higher ones was recorded by (Ahmed et al., 1987). Antibiotics and sulphonamides are widely used for veterinary medication, prevention as well as feed additive to promote growth in laying hens. Due to the extended period of egg formation especially yolk formation, the potential exists for long term release of eggs containing residues even though hens were exposed to contamination for only a short period of time. Inhibitory substance residues in eggs pose human food safety concerns, adversely effect consumers confidence in this poultry product and may cause allergic reaction, toxicity and skin rashes for the consumers (Rivere and Spoo, 1995).

The immunoassay of TAC showed a linear relationship from 0 - 450 ppt which was observed between the logarithm of (TAC) concentration and the %CV at 450 nm. (Fig.1). In order to obtain the TAC in ppt actually contained in a sample, the concentration read from the calibration curve was further multiplied by a corresponding dilution factor which is 35 (according to the instructions provided with the kit).

The recovery rates for (TAC) from fortified egg samples at 1.5 & 4.5 and 10 ppb levels (average $\pm$ S.D. of 3 trials) were 80.1% $\pm$ 2.6 ; 83.7 $\pm$ 3.1% and 85.3 $\pm$ 5.01%, respectively.

TAC were detected in 16 (11.85%) out of the 135 egg samples examined (9 &7 from Kafr EL-Sheikh and EL-Gharbia Governorates, respectively), with a minimum level of (0.402 and0.262), a maximum value of (1.540 and 8.750) and a mean value of (1.005 and 2.023) in Kafr EL-Sheikh and EL-Gharbia Governorates, respectively (Table 11). The highest frequency distribution (44.44%)

of TAC in Kafr EL-Sheikh Governorate, lies within the range of 1.200- < 1.600 ppb. While, that of EL-Gharbia Governorate, 28.57% of the samples lies within the range of 1.200- < 1.600 ppb and other 28.57% lies within the range of 0-0.400 ppb (Table 12). All the positive samples do not exceed the maximum residual limit (MRL) of aflatoxin recommended by the FAO / WHO (1996) which is 5 ppb except one sample from EL-Gharbia Governorate. Aflatoxins are responsible for serious public health hazards. They are highly toxic, mutagenic, teratogenic and carcinogenic compounds that have been implicated as causative agents in human hepatic and extrahepatic carcinogens (Massey et al.,1995).

The Ridascreen Aflatoxin Total Kit offers an excellent procedure to determine TAC in eggs. The procedure is sensitive, rapid and inexpensive. In fact, the immunoassay is so simple and could be used in processing plants.

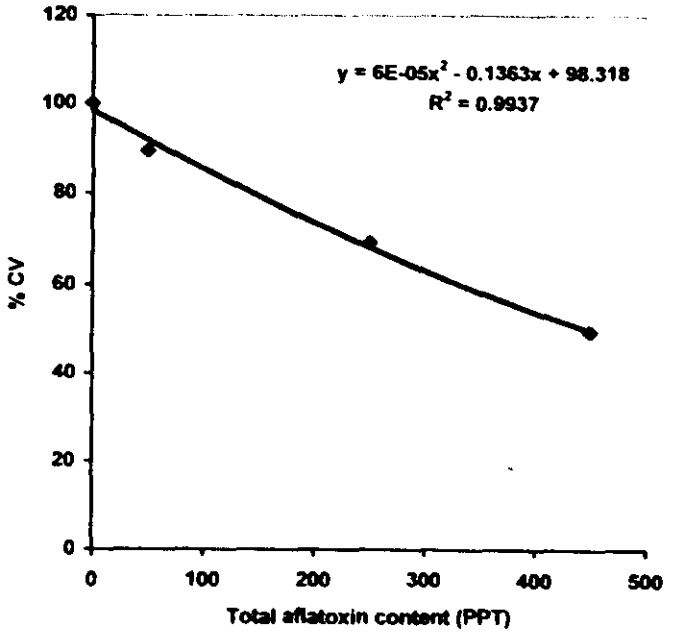

Fig. (1): Standard curve for the determination of total aflatoxin concentration by ELISA. Values are the mean of duplicate determinations.
% CV: % of maximum absorbance.

Table (1): Microbiological criteria of egg shell samples collected from Kafr El-Sheikh Governorate.

Type of egg	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Farm	45	45	100	$1x10^2$	$1x10^8$	$5.3x10^6$	45	100	$1x10^2$	$6x10^7$	$2.8x10^6$	38	84.4	$1x10^2$	$9x10^8$	$1.8x10^8$	0	0
Balady	35	35	100	$1x10^2$	$4x10^7$	$2.7x10^6$	35	100	$1x10^2$	$1x10^8$	$5.2x10^6$	24	68.6	$1x10^2$	$9x10^8$	$9.3x10^7$	2	5.27
Total	80	80	100	$1x10^2$	$1x10^8$	$3.4x10^6$	80	100	$1x10^2$	$1x10^8$	$3.4x10^6$	62	77.5	$1x10^2$	$9x10^8$	$1.5x10^8$	2	2.5

Table (2): Microbiological criteria of egg shell samples collected from El-Gharbia Governorate.

Type of egg	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Farm	40	40	100	$1x10^2$	$1x10^8$	$2.9x10^6$	40	100	$2x10^3$	$2.5x10^8$	$1.9x10^7$	32	80	$1x10^2$	$9x10^8$	$1.1x10^8$	1	2.5
Balady	15	15	100	$1x10^2$	$3.5x10^7$	$2.4x10^6$	14	93.3	$1x10^3$	$1x10^8$	$8x10^6$	13	86.7	$1x10^2$	$9x10^8$	$1.8x10^8$	0	0
Total	55	55	100	$1x10^2$	$1x10^8$	$2.8x10^6$	54	98.2	$1x10^3$	$2.5x10^8$	$1.6x10^7$	45	81.8	$1x10^2$	$9x10^8$	$1.2x10^8$	1	1.8

Table (3): Microbiological criteria of egg shell samples collected from Kafr El-Sheikh and El-Gharbia Governorate.

Governorate	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Kafr El-Sheikh	80	80	100	$1x10^2$	$1x10^8$	$3.4x10^6$	80	100	$1x10^2$	$1x10^8$	$3.4x10^6$	62	77.5	$1x10^2$	$9x10^8$	$1.5x10^8$	2	2.5
El-Gharbia	55	55	100	$1x10^2$	$1x10^8$	$2.8x10^6$	54	98.2	$1x10^3$	$2.5x10^8$	$1.6x10^7$	45	81.8	$1x10^2$	$9x10^8$	$1.2x10^8$	1	1.8
Total	135	135	100	$1x10^2$	$1x10^8$	$3.1x10^6$	134	99.3	$1x10^2$	$2.5x10^8$	$9.7x10^6$	107	79.3	$1x10^2$	$9x10^8$	$1.3x10^8$	3	2.2

Table (4): Microbiological criteria of egg content samples collected from Kafr El-Sheikh Governorate.

Type of egg	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Farm	45	45	100	$1x10^2$	$4x10^7$	$1x10^6$	39	86.7	$1x10^2$	$1x10^6$	$8.2x10^4$	36	80	$1x10^2$	$9x10^8$	$9.3x10^7$	2	4.4
Balady	35	35	100	$1x10^2$	$6.4x10^6$	$1.5x10^6$	34	97.1	$1x10^3$	$2x10^6$	$2.2x10^5$	22	62.9	$1x10^2$	$5x10^8$	$2.8x10^7$	0	0
Total	80	80	100	$1x10^2$	$4x10^7$	$1.2x10^6$	73	91.3	$1x10^2$	$2x10^6$	$1.5x10^5$	58	72.5	$1x10^2$	$9x10^8$	$6.9x10^7$	2	2.5

Table (5): Microbiological criteria of egg content samples collected from El-Gharbia Governorate.

Type of egg	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Farm	40	40	100	$1x10^2$	$1x10^8$	$1.4x10^6$	40	100	$1x10^3$	$9x10^7$	$3.4x10^8$	26	65	$1x10^2$	$9x10^7$	$9.6x10^6$	3	7.5
Balady	15	15	100	$1x10^2$	$2.8x10^7$	$1.8x10^6$	13	86.7	$1x10^2$	$2x10^6$	$3.1x10^5$	13	86.7	$1x10^2$	$9x10^8$	$1.4x10^8$	0	0
Total	55	55	100	$1x10^2$	$1x10^8$	$1.6x10^6$	53	96.4	$1x10^2$	$9x10^7$	$2.6x10^6$	39	71	$1x10^2$	$9x10^8$	$6.5x10^7$	3	5.5

Table (6): Microbiological criteria of egg content samples collected from Kafr El-Sheikh and El-Gharbia Governorates.

Governorate	No. of examined samples	Total Colony Count					Mould count					Yeast count					Salmonella	
		Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples		Min	Max	Mean	Positive samples	
		No.	%				No.	%				No.	%				No.	%
Kafr El-Sheikh	80	80	100	$1x10^2$	$4x10^7$	$1.2x10^6$	73	91.3	$1x10^2$	$2x10^6$	$1.5x10^5$	58	72.5	$1x10^2$	$9x10^8$	$6.9x10^7$	2	2.5
El-Gharbia	55	55	100	$1x10^2$	$1x10^8$	$1.6x10^6$	53	96.4	$1x10^2$	$9x10^7$	$2.6x10^6$	39	71	$1x10^2$	$9x10^8$	$6.5x10^7$	3	
Total	135	135	100	$1x10^2$	$1x10^8$	$1.4x10^6$	126	93.3	$1x10^2$	$9x10^7$	$1.3x10^6$	97	71.9	$1x10^2$	$9x10^8$	$6.7x10^7$	5	

Table (7): Frequency distribution of egg shell samples based on different colony counts.

Intervals	Total Colony Count				Mould count				Yeast count			
	Kafr El-Sheik		El-Gharbia		Kafr El-Sheik		El-Gharbia		Kafr El-Sheik		El-Gharbia	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
10^2 - < 10^3	3	3.75	1	1.8	3	3.75	0	0	5	8.10	3	6.67
10^3- <10^4	30	37.5	11	20	17	21.25	4	7.40	17	27.42	8	17.78
10^4- <10^5	20	25	23	41.8	27	33.75	27	50	11	17.74	3	6.67
10^5- <10^6	11	13.75	14	25.5	16	20	11	20.37	5	8.10	11	24.44
10^6- <10^7	13	16.25	4	7.3	12	15	3	5.56	6	9.57	7	15.56
10^7- <10^8	2	2.50	1	1.8	4	5	6	11.11	5	8.10	5	11.11
10^8- <10^9	1	1.25	1	1.8	1	1.25	3	5.56	13	20.97	8	17.77
Total	80	100	55	100	80	100	54	100	62	100	45	100

Table (8): Frequency distribution of egg content samples based on different colony counts.

Intervals	Total Colony Count				Mould count				Yeast count			
	Kafr El-Sheik		El-Gharbia		Kafr El-Sheik		El-Gharbia		Kafr El-Sheik		El-Gharbia	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
10^2 - < 10^3	6	7.5	4	7.3	4	5.48	1	1.8	6	10.34	7	17.95
10^3- <10^4	31	38.75	23	41.7	22	30.13	6	11.32	22	37.93	8	20.51
10^4- <10^5	24	30	9	16.3	29	39.73	26	49.06	5	8.63	5	12.82
10^5- <10^6	4	5	10	18.2	14	19.18	11	20.75	8	13.79	5	12.82
10^6- <10^7	11	13.75	6	9.1	4	5.48	8	13.22	5	8.63	2	5.13
10^7- <10^8	4	5	2	3.6	0	0	2	3.77	3	5.17	8	20.51
10^8- <10^9	0	0	1	1.8	0	0	0	0	9	15.51	4	10.26
Total	80	100	55	100	73	100	53	100	58	100	39	100

Table (9): Serogrouping of Salmonella strains.

Isolated strains	Kafr El-Sheik				El-Gharbia			
	Shell		Content		Shell		Content	
	No.	%	No.	%	No.	%	No.	%
S. konstanz 0.8 Hb enx	1	25	1	25	1	25	2	50
S.senftenberge 0.1, 3, 19 Hg (s), 1	1	25	1	25	0	0	1	25
Total	2	50	2	50	1	25	3	75

* The percentages were calculated according to the total number of isolates (4) in each Governorate.

Table (10): Incidence of inhibitory substances in hen eggs samples.

Governorate	Total No. of samples	Positive samples	
		No.	%
Kafr El-Sheikh	80	4	5
El-Gharbia	55	5	9.1
Total	135	9	6.7

Table (11): Statistical analytical results of total aflatoxin content residues in the examined egg samples.

Governorate	Total No. of samples	Positive samples		Min. (ppb)	Max. (ppb)	Mean (ppb)
		No.	%			
Kafr El-Sheikh	80	9	11.25	0.402	1.540	1.005
El-Gharbia	55	7	12.75	0.262	8.750	2.023
Total	135	16	11.85	0.262	8.750	1.450

Table (12): Frequency distribution of the examined egg samples based on their total aflatoxin content (in ppb).

Intervals	Kafr El-Sheikh		El-Gharbia	
	No.	%	No.	%
0.00-<0.400	0	0.00	2	28.57
0.400- <0.800	3	33.33	1	14.29
0.800- < 1.200	2	22.22	1	14.29
1.200- < 1.600	4	44.44	2	28.57
1.600- >	0	0.00	1	14.29
Total	9	100	7	100

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