

Chemical Contaminants in Table Eggs

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Abstract

A total of 153 farm, native and organic table hen's egg samples were collected randomly from different places in Ismailia city. These samples were divided into 51 groups (17eggs each group). Each sample composed of (3 pooled eggs) were prepared to measure the levels of heavy metal contents (lead and cadmium) and estimation of some antibiotic residues (Tetracycline and erythromycin). The mean values of lead in farm, native and organic table egg samples were 0.010 ± 0.002 , 0.019 ± 0.003 and 0.036 ± 0.004 ppm, respectively. While mean levels of cadmium content of farm, native and organic table hen's egg samples were 0.004 ± 0.001 , 0.012 ± 0.001 and 0.016 ± 0.002 ppm, respectively. All the examined hen's eggs samples were within permissible limit for lead and cadmium. Tetracyclines and Erythromycin couldn't be detected from any of the examined table hen's egg samples.

Keywords: Table egg, Heavy metals, Antibiotic residues.

Introduction

Fresh hen eggs are an important food in human diet because of their nutritional components with high protein content, vitamins, and other components (*Pazmiño et al., 2018*). Eggs are one in every of most nutritious and economical foods in human daily diet and included in several food products for various functions. However, they're used as evidence for environmental

pollution since they can accumulate the heavy metals from diet and from the surrounding environment. Although heavy metals remain in ground water and soil but in certain areas their level increases and tends to accumulate to toxic levels in human and animal tissues deriving from polluted food and water (*Ahmed et al., 2017*). Heavy metals are may be a serious threat due to their toxicity, bioaccumulation and

biomagnifications in the food chain (*Humaeda, 2018*). Antibiotics in poultry industry are used for prevention and treatment of disease likewise Increase feed conversion rate by chicken for growth, product outputs, and for increased production performance. To overcome the high level of stress, poor nutrition and disease onset, farmer uses excessively antibiotics which could result as drug residue in meat and egg of chicken (*Asad, 2012 and Hakimzadegan et al., 2014*). Foodstuffs contaminated with biological and chemical hazards can cause widespread illness outbreaks after they are consumed by human. One of the chemical hazards exist in animal-derived foodstuffs is antibiotic residues. Antibiotic residues in food become problematic by many aspects like bacterial resistance against antibiotic, food allergy and food poisoning (*Tribudi et al., 2020*). Therefore, this study was planned out to estimate some heavy metals level and antibacterial drug residues in table eggs collected from Ismailia Governorate.

Material and Methods

1. Detection of Heavy metals:

1.1. Samples Collection: A total of 153 raw farm, native and organic hen's table egg samples were collected randomly from different places in Ismailia city. These samples were divided into 51 groups (17eggs each group). Each sample composed of (3 pooled

eggs) were prepared for chemical estimation.

1.2. Preparation of samples (digestion):

Eggs samples were digested according to method recorded by *Agemian et al. (1980)* as follows: Weighted portion of each sample (1g) was put into a kjeldahl flask containing 5 ml of conc. nitric acid and 1ml perchloric acid (80%). A blank of 10 ml digestion mixture was prepared in a second Teflon beaker. The mixture was heated until the solution become colourless. The samples were diluted to 50 ml with Bi-distilled water.

Detection of heavy metals in the examined samples were made by Atomic Absorption Spectrometry (AAS) (Perkin Elmer 2380) (*AOAC,1990*) at Animal Health Research Institute, Dokki, Giza, Egypt.

2. Evaluation of antibiotic residues:

2.1. Detection, identification and quantitation of antimicrobial residues Tetracycline and Macrolide group (*USDA, 2011*).

• Sample Preparation (*Witoko et al., 2019*):

The number of samples used in this study was 51 pooled Egg samples were taken from retailers of Ismailia governorate in clean vessels.

- Use filter stomacher bags. Label a bag with the sample identification, and buffer pH. Two bags will be required for each egg sample

represent two classes of antibiotics named Tetracycline and Macrolide.

- Weigh 10 ± 0.2 g of egg sample + 20 ± 1.0 ml of the appropriate buffer into each bag, homogenize using a homogenizer then centrifuge 3,000 rpm for 10 minutes. The supernatant was taken and used as a test solution.
- Fill one well on each of the three plates with $200 \pm 4 \mu\text{l}$ of the appropriate buffered sample extract. Repeat for additional samples. Make sure that a record is kept of the sample placement in the wells.

Use the following antibiotic SRs in one well each day the screen test is run: Plate 1, tetracycline; Plates 5 and 6, erythromycin. Pipette $200 \pm 4 \mu\text{l}$ of the SR concentration into the test well.

Incubate plates 1, 5 and 6 at $29^\circ \pm 1^\circ\text{C}$ for 16 to 18 hours.

Record the diameter to the nearest tenth of a millimeter of each zone of inhibition for both the unknown and the standard reference antibiotic. Also, make the appropriate entry if no zone is produced, Use the appropriate standard curve to calculate the sample test results for quantitative determination.

Results

Table (1): Lead residues (ppm) in examined samples of farm, native and organic egg.

Egg type	No. of samples	Min.	Max.	Mean \pm S.E.
Farm	17	N. D	0.021	0.010 ± 0.002^c
Native	17	N. D	0.035	0.019 ± 0.003^b
Organic	17	N. D	0.061	0.036 ± 0.004^a

Means that do not share a letter are significantly different.

N.D: not detected

Table (2): Acceptability of examined samples according to the Egyptian Standards for lead residues (ES: 3169/ 2007):

metal Egg Type	No. of samples	Permissible Limits (ppm)	Lead			
			Within Permissible Limits		Over Permissible Limits	
			No.	%	No.	%
Farm	17	0.1	17	100	0	0.0
Native	17	0.1	17	100	0	0.0
Organic	17	0.1	17	100	0	0.0

Table (3): Cadmium residues (ppm) in examined samples of farm, native and organic egg:

Egg type	No. of samples	Min.	Max.	Mean \pm S.E.
Farm	17	N. D	0.011	0.004 ± 0.001^b
Native	17	N. D	0.012	0.012 ± 0.001^a
Organic	17	0.010	0.035	0.016 ± 0.002^a

Means that do not share a letter are significantly different. N.D: not detected

Table (4): Acceptability of examined samples according to the Egyptian standards for cadmium residues (*ES: 3169/ 2007*):

metal Egg Type	No. of samples	Cadmium				
		Permissible Limits (ppm)	Within Permissible Limits		Over Permissible Limits	
			No.	%	No.	%
Farm	17	0.05	17	100	0	0.0
Native	17	0.05	17	100	0	0.0
Organic	17	0.05	17	100	0	0.0

Table (5): Mean levels of Tetracyclines and Erythromycin in the examined table hen's egg samples.

Egg type	No. of samples	Tetracyclines	Erythromycin
Farm	17	N.D	N.D
Native	17	N.D	N.D
Organic	17	N.D	N.D

N.D: not detected

Discussion

Lead:

Data presented in Table (1) showed that, the mean levels of lead content in farm, native and organic table hen's egg samples were 0.010 ± 0.002 , 0.019 ± 0.003 and 0.036 ± 0.004 ppm, respectively. Lower levels were obtained by (*Pazmiño et al., 2018*). However, higher levels were detected by (*Azza and Hanaa, 2011; Hashish et al., 2012 and Sobhan Ardakani, 2017*).

According to *ES (3169/ 2007)* the permissible limits of lead is 0.1 ppm. All (100%) of the examined samples were not exceed the permissible limits (table 2).

Lead ingested by chicken is deposited in bones, soft tissues and eggs, so contaminated egg yolk represents a possible public hazard especially to children repeatedly consuming eggs. Moreover, children have high gastrointestinal

uptake and permeable blood-brain barrier (*Ahmed et al., 2017*).

Cadmium:

Data presented in Table (3) showed that, the mean values of cadmium content in farm, native and organic table hen's egg samples were 0.004 ± 0.001 , 0.012 ± 0.001 and 0.016 ± 0.002 ppm, respectively. These results are nearly similar to those obtained by (*Ahmed et al., 2017*) while higher levels were obtained by (*Fakayode and Olu-Owolabi, 2003; Van Overmeire et al., 2006 and Pazmiño et al., 2018*) On contrary, Cadmium could not detect by (*Azza and Hanaa, 2011 and Al-Ashmawy, 2013*).

Table (4) illustrated the permissible limits of cadmium 0.05 ppm *ES (3169/ 2007)*. 100% of the examined egg samples were lied within the permissible limits.

Lead and cadmium are heavy metals that occur naturally within the environment and as pollutants released from industrial and agricultural industries. Food is considered the main source for human exposure to those elements, being responsible for the accumulation within the body, having serious effects within the central nervous system and kidneys. (*Pazmiño et al., 2018*)

Tetracyclines and Erythromycin:

Tetracyclines and Erythromycin could not be detected in 100% of the examined eggs samples (Table 5). These results are nearly similar to those obtained by (*Kabir et al., 2004; Hafez et al., 2013; Ehsani and Hashemi, 2015; Mashot, 2016 and Tribudi et al., 2020*) On contrary, Tetracyclines and Erythromycin could be detected by (*Hakimzadegan et al., 2014*).

The absence of any form of antibiotic in the eggs signifies its safety for human consumption and ensure associated risk reduction.

Good practice protocols of the utilization of veterinary drugs include the use of officially authorized products, the acquisition of veterinary drugs with prescription, the drugs' application within the recommended productive stage with respecting withdrawal and re-entry periods (*Clokie et al., 2011*).

Conclusion

The presence of heavy metal contaminants could be a serious

issue and need a great concern because these metals are highly toxic in nature and had adverse effects on human health. Clean and pure environment with clean food and pure water must be provided to avoid heavy metals contamination. The use of antimicrobial drugs for growth promotion in poultry should be terminated which may lead to resistance to antimicrobials used in human medicines. Antibiotic residue in chicken eggs must be monitored as routine test due to their side effects on human health.

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الملخص العربي

بقايا بعض الملوثات الكيميائية في بيض المائدة

أجريت هذه الدراسة على 153 عينة من بيض المائدة (عينات مجمعة) من بيض المزارع و البيض البلدي والبيض العضوي جمعت من محافظة الاسماعيلية و تم تقييمها جميعا طبقا لمعايير الفحص الكيميائي وأوضحت النتائج ان متوسط نسبة الرصاص في عينات بيض المزارع والبلدي والعضوي جميعها في المستوى المسموح به طبقا للمواصفات القياسية المصرية. ووجد ان متوسط نسبة الكاديوم في عينات بيض المزارع والبلدي والعضوي 0.001 ± 0.004 ، 0.001 ± 0.012 و 0.002 ± 0.016 جزء في المليون على التوالي , وكانت جميعها في الحدود المسموح به طبقا للمواصفات القياسية المصرية. ولم يتم الكشف عن التتراسيكلين والإريثروميسين في أي من عينات بيض المزارع والبلدي والعضوي التي تم فحصها.