

A COMPARISON BETWEEN ORGANIC AND CONVENTIONALLY PRODUCED EGGS

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ABSTRACT

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A study on eggs from both organic and conventional was conducted in order to compare between them. The eggs were evaluated for their physical quality, microbial load, and presence of antibiotic residues. The study revealed that eggs from organic system were smaller (47.8 vs. 64.3 g) with yolk, albumen, and egg shell weights significantly lower than eggs from conventional system (15.2 vs. 19.2g), (25.3 vs. 34.1 g), and (7.12 vs. 9.5 g) respectively. The Yolk/albumen ratio being higher in the organic eggs (0.60 vs. 0.56). The percentage of egg shell was not affected by the housing system (14.8 vs. 14.7%). The overall defects in conventional eggs was higher (40% vs. 16%). The microbiological examination showed that total bacterial and total mold counts were significantly higher in organic eggs, with the shell having the highest and albumen having the lowest microbial load. Monitoring of antibiotic showed zero residues of antibiotics in organic eggs while 8% of conventional eggs had antibiotics residues.

Key words: Organic eggs, conventional eggs, antibiotic residues, microbial contamination.

INTRODUCTION

In recent years, raising demand for organic food has been noticed. According to the majority of consumers it is safe for the health and its benefits are nutritional values and tastefulness. Because the majority of consumers have lost some trust in food derived from conventional production due to the use of developing technology and policies providing for the intensive input use for the supply of food necessities. Furthermore, the production of organic food based on special standards is considered as environmentally friendly and devoid of artificial fertilizers (Kouba, 2003; Newerli-Guz and Śmiechowska, 2004).

Organic poultry cannot be given growth-producing hormones (which are prohibited in conventional systems as well) or antibiotics. The poultry may receive preventive medical care, such as vaccines, and dietary supplements of vitamins and minerals. They must be fed certified organic feed, free of animal byproducts, or feed on certified organic pasture if raised on a pastured system. Animals must have access to the outdoors, shade, exercise areas, fresh air, and direct sunlight suitable to their species and stage of production. Organic eggs must be processed in plants that are certified to process organic eggs (Henry, 2002 and USDA 2009). In case of conventional production. Poultry producers routinely use medications such as antibiotics in feed

or drinking water to treat disease or to prevent disease outbreak and as a growth promoter (Donoghue, 2003).

Use of Antibiotic that might result in deposition of residues in meat and eggs must not be permitted in food intended for human consumption. If use of antibiotics is necessary as in prevention and treatment of animal diseases, a withholding period must be observed until the residues are negligible or no longer detected. The use of antibiotics to bring about improved performance in growth and feed efficiency, to synchronize or control of reproductive cycle and breeding performance also often lead to harmful residual effects (Nisha, 2008).

Most organic products sell for a premium over comparable conventional products, due in part to higher production, processing, procurement, and distribution costs relative to those of conventional products. In addition, organically produced foods have extra costs associated with product certification and segregation that carry all the way through the food chain. High costs and shortages of organic feed grains, along with a lack of processing capacity, are limiting the short-term expansion of the organic egg sector (USDA, AMS, 2003). At the same time, a growing number of consumers cite concerns regarding health issues, the environment, and animal welfare as factors influencing their decisions to purchase organic eggs, and these individuals are

willing to pay the price premiums demanded in the marketplace. The aim of this study is to compare between the organic and conventionally produced eggs from the points of: Physical quality of eggs, microbiological status, and the presence of antibiotic residues.

MATERIALS and METHODS

1- Sampling:

One hundred and fifty of freshly laid organic and conventional eggs (75 of each) were obtained from big supermarkets in Port-Said City. Freshly laid eggs means, not more than 24 hours from production. Twenty five batches of eggs from each type were examined. Each batch comprised 3 eggs (one for each of) physical quality examination, microbiological examination, and detection of antibiotic residues.

2 - Physical quality of egg assessment:

Egg quality was measured following standard procedures as described by (Monira *et al.*, 2003 and Fayeye *et al.*, 2005). The external egg quality traits investigated were, egg weight(g), shell texture, shell cleanness, and shell soundness. The shell texture was examined through palpation. Egg weight was examined using an electronic weight scale. Similarly, internal egg parameters which were measured included, shell weight (g), general appearances of internal egg parts, smell, albumen weight(g), and yolk weight(g). Any abnormality or defects observed in the albumen and yolk were recorded.

3 - Microbiological examination:

3-1- Egg shells were tested by surface rinse method as described by (Moats, 1980).

3-2- After rinsing, egg surface was sterilized with sterile cotton wool soaked in ethanol (70%). Sterile

forceps were used to puncture the egg at the tip to create a small opening from where the albumen was carefully drained out leaving behind the yolk which was transferred into a sterile beaker and examined as described by Idowu *et al.* (2010).

3-3-Total bacterial count was performed according to (FDA, 2001a) and Total mould count was performed following (FDA, 2001b).

4 - Detection of antibiotic residues:

The antimicrobial screening of eggs was carried out using the disc diffusion method where *Bacillus cereus* (obtained from the Animal Health Research Institute, Agriculture Center, Egypt) was used as the test organism. An 18 hours culture of the test organism in 10 ml nutrient broth was used to inoculate Mueller Hinton agar plates. The eggs were prepared as mentioned in (3-2) then sterile filter paper disc 0.6 cm in diameter was dipped into the homogenized egg yolk and placed gently on the Mueller Hinton agar plate that has already been inoculated with the test organism according to the method of (Shahid *et al.*, 2007). This was incubated at 37°C for 24h after which the plates were viewed for the presence or absence of zone of inhibition of the test organisms around the test and control discs. The difference between the diameter of zone of inhibition and that of the disc were calculated. Any disc with a difference of 1 mm or more was considered positive for the presence of antibiotic.

5 - Statistical analysis:

Data were submitted to calculation of means, and the least significant difference test $p \leq 0.05$ (Draper and Smith, 1998). All statistical procedures were computed using the Microsoft Excel 2007 in order to compare the mean values of the investigated parameters.

RESULTS

Table 1: Effect of conventional and organic production on the physical egg quality.

Production system	Egg weight (g)	Egg shell (g)	Egg shell (%)	Albumen (g)	Yolk (g)	Yolk/albumen (%)
Organic	47.8 ^a	7.12 ^a	14.8 ^a	25.3 ^a	15.2 ^a	0.60 ^a
Conventional	64.3 ^b	9.5 ^b	14.7 ^a	34.1 ^b	19.2 ^b	0.56 ^b

Means in the same column with different superscripts are significantly different ($p \leq 0.05$).

Table 2: General appearance and defects recorded external and internal the eggs (n=25).

Production system	Rough shell	Dirty shell	Cracked shell	Off odor	Blood spots	Total
Organic	2(8%)	1(4%)	0(0%)	0(0%)	1(4%)	4(16%)
Conventional	4(16%)	2(8%)	0(0%)	1(4%)	3(12%)	10(40%)

Table 3: Effect of conventional and organic production on egg's microbial load.

Production system	Total aerobic bacterial count			Total mould count		
	Egg shell	Yolk	Albumen	Egg shell	Yolk	Albumen
Organic	7.5x10 ^{5a}	7.7x10 ^{1a}	1.6x10 ^{1 a}	6.1x10 ^{3a}	2.7x10 ^{1a}	1.3x10 ^{1a}
Conventional	5.6x10 ^{4b}	3.5x10 ^{1b}	1.3x10 ^{1a}	3.4x10 ^{3b}	1.5x10 ^{1b}	1.1x10 ^{1a}

Means in the same column with different superscripts are significantly different(p≤ 0.05) .

Table 4: Incidences of antibiotic residues in organic and conventionally produced eggs (n=25).

Production system	No.	%
Organic	0	0
Conventional	2	8

DISCUSSION

The results of the current study gave information on the physical quality characteristics of organic and conventional eggs. The physical appearance of an egg makes the first impression upon the consumer. If the product does not meet perceived expectations, consumer confidence diminishes. Therefore external and internal characteristic of eggs prerequisite for safety, soundness and wholesomeness of the eggs. The data in (Table 1 and Table 2) listed these characteristics. (Table 1) indicated that eggs from organic system were smaller (47.8 vs. 64.3 g) with yolk, albumen, and egg shell weights significantly lower than eggs from conventional system (15.2 vs. 19.2g), (25.3 vs. 34.1 g), and (7.12 vs. 9.5 g) respectively. While the Yolk/albumen ratio being higher in the organic eggs (0.60 vs. 0.56). The percentage of egg shell was not affected by the housing system (14.8 vs. 14.7%). These results are coming in parallel with Cherian *et al.* (2002); Smiechowska and Dmowski (2005); Minelli *et al.* (2007). The overall defects prevalence in the organic eggs was 16%. A higher prevalence of defected eggs was observed in eggs from the conventional system (40%) (Table 2). Rough shell defect, dirty shell, off odor, and blood spots were higher in conventionally produced eggs (16 vs. 8%), (8 vs. 4%), (4 vs. 0%), and (12 vs. 4%) respectively. Rough shell eggs fracture more easily and have poor appearance. This defect may be hereditary Jacob *et al.* (2011). Dirty egg shell decreases the quality of eggs and in some areas as in United states, an egg with manure or adhering material on the shell cannot be marketed. It is classified as dirty and cannot be used for human consumption Jacob *et al.* (2011). Off odor defect was detected in 4% of the examined conventional eggs and not detected in the organic one. Off odor may become from chemicals used for treating parasites in the flocks Jacob *et al.* (2011). Blood spots are caused by rupture of small vessels while the egg is being

formed this defect may be due to genetic factors, stress during ovulation, vitamin K deficiency, and diseases Jordan and Pattison (1996); Seidler (2003); Jacob *et al.* (2011).

The results of the microbiological examination of the two types of eggs which are shown in (Table 3) reveal that total bacterial and total mold counts are significantly higher in organic eggs. The shell having the highest microbial load (7.5x10⁵ vs. 5.6x10⁴ cfu/g) of TBC and (6.1x10³ vs. 3.4x10³ cfu/g) of TMC. While the albumen having the lowest microbial load (1.6x10¹ vs. 1.3x10¹ cfu/g) and (1.3x10¹ vs. 1.1x10¹ cfu/g) respectively. External eggshell 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 the internal egg content could be the result of the penetration of the shell by bacteria deposited on the surface of the egg after it has been laid (Schoeni *et al.*, 1995; Smith *et al.*, 2000). The interior of the newly laid eggs is usually free from micro-organisms but contamination of egg contents occasionally occurs either before the egg is laid or shortly after (Abdel-Hameed, 2009). The obtained results agreed with those of Schwaiger *et al.* (2008) and De Reu *et al.* (2008) who stated that conventionally produced eggs generally had lower bacterial count than the organic type. 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 do not come in contact with the eggs. Also, birds that are allowed to range outdoors are more likely to become contaminated from soil, insects, and rodent infestation. Therefore, organic eggs are more likely to be contaminated than eggs from conventional system (Board and Fuller 1994; Board and Tranter, 1995 and De Reu *et al.*, 2008).

Antibiotics were used at low levels in poultry feed to enhance the health and productivity of flocks,

facilitate the efficient production of poultry, allowing the consumer to purchase at a reasonable cost high quality meat and eggs Donoghue and Myers (2000); Schneider and Donoghue (2000). Concern over antibiotic residues in food of animal origin occurs in two times; one which produces potential threat to direct toxicity in human, second is whether the low levels of antibiotic exposure would result in alteration of microflora, cause disease and the possible development of resistant strains which cause failure of antibiotic therapy in clinical situations (Nisha, 2008). (Table 4) showed zero residues of antibiotics in organic eggs while 8% of conventional eggs had residues of antibiotics. In studies done by CFIA (2006) and DAFF (2010) eggs from different housing systems including organic and conventional systems were examined for a wide spectrum of antibiotics, zero residues were found. Because in these countries the use of antibiotics in feed is prohibited and its use is permitted only under veterinary supervision to treat clinical disease outbreaks. Eggs from treated hens cannot be offered for sale until the completion of withdrawal period to ensure that no residues are present in the eggs (Blair, 2012).

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مقارنة بين البيض العضوي والبيض المنتج تقليديا

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اجريت دراسة على البيض (العضوي والتقليدي) بهدف المقارنة بينهما من حيث الخواص الطبيعية والمحتوى الميكروبي وكذلك احتوائهما على بقايا المضادات الحيوية. وقد اظهرت الدراسة ان البيض العضوي اقل حجما من البيض التقليدي وكذلك محتواة من الملح و الزلال. بينما كانت العيوب في البيض التقليدي 40% مقابل 16% في البيض العضوي. وقد اوضحت الدراسة ان المحتوى الميكروبي (العدد الكلى للبكتيريا والفطريات) للبيض العضوي اعلى من البيض التقليدي (7.5×10^5 مقابل 5.6×10^4 مستعمرة/ جم) و (6.1×10^3 مقابل 3.4×10^3 مستعمرة/ جم) للقشرة الخارجية على التوالي. هذا وقد اظهرت الدراسة خلو البيض العضوي من بقايا المضادات الحيوية بينما احتوى 8% من البيض التقليدي على بقايا للمضادات الحيوية.