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CONCLUSION AND RECOMMENDATIONS

From this work, it can be concluded that analysis of eggs from layer farm indicate the presence of heavy metal residues in various levels. Especially lead and cadmium were present at high level. These are mainly due to greater pollution of environment, which have resulted in an increased concentration of heavy metals in air, water and soil and subsequently, these metals are taken by plants, birds and animals and take their way into chicken tissues and eggs. Also heavy metal may added to egg product during production and processing. Contamination sources may include, the factory door, plant and equipment, catering operations, ceramic and enameled utensils or metal containers.

On the other hand aspect, continual increasing in the number of industries and agricultural processes producing these pollutants and their participation in increasing the incidence of some chronic disease, throw some light on the necessity of scientific substantiation and urgent solution of the problem.

The experimental study on layer hens revealed that cadmium, lead, copper and zinc had effect on egg production, feed intake and egg shell quality. On other hand, these metals accumulated mainly in yolk more than albumen.

In order to minimize the hazardous effect of these pollutants, the following recommendation should be applied;

1- The regulation within the frame work of governmental planning for sanitary protection of the environment. At this point, recycling of industrial effeluents as well as hygienic disposal and treatment of agricultural and sewage wastes are recommended.

2- Application of phosphate fertilizer and sewage sludge should be kept under control and the used leaded petrol should be banned.

3- Continuous monitoring for poultry feeds at different location of Egypt is recommended. Also, drinking water for poultry should be investigated for presence of heavy metals. The permitted amount of metals in animal feeds were 5 ppm for Pb, 1 ppm for Cd, 0.1 ppm for Hg, 35 ppm for Cu and 250 ppm for Zn **(Baars et al., 1992)** and the permitted amount of the same metals in drinking water were 1 ppm for Cu, 0.05 ppm for Pb, 0.005 ppm for Cd, 5 ppm for Zn and 0.001 ppm for Hg **(WHO, 1984).**

4- A regular and representative monitoring of heavy metal contamination of chicken eggs and egg products is recommended at an appropriate frequency to establish the true contribution of eggs and egg products to the dietary intake of heavy metals.

5- Zinc supplementation for poultry farms suffered from cadmium or lead pollution is advisable **(Valiniece and Berzina, 1999 and Ahmad, 2000).**

6- Consuming of egg albumen must be higher than yolk especially for human babies.

SUMMARY

A total of 100 random eggs and egg products (40 egg samples collected form farms cited in non industrial area and 50 egg samples collected from farms cited in industrial area, along the main road of heavy traffics. Egg products (4 egg white powder, 4 egg yolk powdered and 2 whole egg powder) samples were collected from Animal Health Research Institute (Dokki branch). Egg samples were examined physically and all samples were digested and analyzed by Atomic Absorption Spectrophotometry for determination of cadmium, lead, mercury, copper and zinc. In egg samples collected from farms cited in non industrial area. Egg weight, specific gravity, shell thickness, shell weight percentage and shell weight ranged from 44.99 to 71.80 gram, 1.06 to 1.09, 0.28 to 0.42 mm, 8.30 to 13.90% and 4.30 to 8.20 gram respectively with an average of 56.23 gram, 1.08, 0.35 mm, 10.91% and 6.11 gram respectively. While, it ranged from 42.44 to 75.19 gram, 1.04 to 1.09, 0.26 to 0.38 mm, 7.40 to 13.70% and 4.12 to 8.18 gram respectively with a mean level of 58.25 gram, 1.08, 0.32 mm, 10.26% and 6 gram respectively in examined samples collected from industrial area. There was a significant difference between industrial and non industrial area in the egg weight, shell thickness and shell weight percentage of egg samples. Cadmium, lead, mercury, copper and zinc concentrations ranged from 0.30 to 1.90 ppm, 1.70 to 10 ppm, 0.62 to 1.38 ppb, 0.67 to 8 ppm and 3.10 to 14.10 ppm respectively with a mean of 0.94 ppm, 4.37 ppm, 1.06 ppb, 1.56 ppm and 8 ppm respectively in examined egg samples collected from non industrial area and it range from less than 0.01 ppm to 10 ppm, 1.70 to 43 ppm, 0.61 to 5.90 ppb, less than 0.1 to 30 ppm and less than 0.1 to 87 ppm respectively

with a mean of 1.66 ppm, 12.64 ppm, 2.03 ppb, 6.12 ppm and 13.76 ppm respectively in egg samples collected from industrial area. It was noticed a highly significant variation of lead, mercury, copper and zinc levels in egg samples collected from non industrial and industrial area. Also, cadmium, lead, mercury, copper and zinc concentrations ranged from 0.95 to 7 ppm, 3.3 to 29 ppm, 1.14 to 3.50 ppb, less than 0.1 to 20 ppm and 2 to 27 ppm respectively with a mean level of 2.84 ppm, 12.65 ppm, 2.30 ppb, 5.65 ppm and 9.40 ppm respectively in egg white powder, while it ranged from 1.40 to 10 ppm, 3.3 to 29 ppm, 1.04 to 5.9 ppb, 2 to 20 ppm and 10 to 49 ppm respectively with a mean level of 3.83 ppm, 17 ppm, 2.82 ppb, 11.18 ppm and 26.55 ppm respectively in egg yolk powder. Moreover, it ranged from 0.95 to 2 ppm, 3.3 to 29 ppm, 1.14 to 2.2 ppb, 1.3 to 20 ppm and from 17.2 to 38 ppm respectively with a mean level of 1.48 ppm, 16.15 ppm, 1.67 ppb, 10.65 ppm and 27.6 ppm respectively in whole egg powder samples. The calculated daily intake of cadmium, lead, mercury, copper and zinc from consumption of 100 gram eggs collected from non industrial area were 0.094, 0.437, 0.000106, 0.156 and 0.800 mg respectively for adult person and these amount representing 134.29, 87.4, 0.212, 0.446 and 1.143% respectively of provisional Acceptable Daily Intake, while, in the egg samples collected form industrial area, it were 0.166, 1.264, 0.000203, 0.612 and 1.376 mg respectively for adult person and these representing 237.14, 252.8, 0.406, 1.749 and 1.966% respectively of provisional ADI. Statistical analysis showed that all examined egg samples and egg products were within permissible limit of mercury and having lead levels above its

permissible limit. All examined egg samples collected from non industrial area, industrial area and egg products having cadmium levels above its permissible limit. All egg samples collected from non industrial area having copper and zinc within its permissible limits. Meanwhile, 13 (26%) and 7 (14%) out of 50 egg samples collected form industrial area were exceeded the permissible limits of copper and zinc, respectively. Also, 4 (40%) out of 10 egg product samples were exceeded the permissible limits of zinc and copper.

II- Experimental study:

Fifty of twenty eight weeks old brown Lohman layers were assigned to 2 groups (A and B) of 20 birds each and a control one of 10 birds. The hens of group A had been subdivided into A_1 treated by Cd, A_2 treated by Pb, A_3 treated by Zn and A_4 treated by Cu. Also, the hens of group B had been subdivided into subgroups B_1, B_2, B_3 and B_4 treated by double dose of Cd, Pb, Zn and Cu respectively. The doses of heavy metals were calculated on the basis of higher than the maximum level of tolerable dose. Cadmium chloride, lead acetate, copper sulphate and zinc sulphate salts were given to layers at levels of 36, 120, 302.4 and 235.2 mg/birds in group A and double doses of group A were given to layers in group B. the amount of metals dissolved in deionized water and administrated via stomach tube for each bird as single dose. Experimental chicks were housed in wire case, 17 hours of light was provided to all birds and 7 hr of dark daily during the period of the experiment. Fresh water and balanced ration were available. Egg production, feed intake, shell thickness, egg weight and metal residues

in the albumen and yolk were recorded daily for a single week. The results indicated that all doses which used in group A and B were not clinically toxic to laying hens.

1- Effect of heavy metals on egg production:

It is clear that, the egg production decreased in subgroups B1 and B4 and the differences in egg production between group A and B were not significant.

2- Effect of heavy metals on feed intake:

Most heavy metals in group B had an effect to decrease feed intake of layer hens but it was significant decrease in subgroups B_1 and B_4 and did not in subgroups B_2 and B_3.

3- Effect of heavy on egg shell quality:

a- Egg weight:

The egg weight decreased in subgroup B_4 and increased in subgroup B_1, B_2 and B_3. There is a significant difference between subgroups A_2 and B_2 and also between A_3 and B_3.

b-Shell thickness:

The shell thickness in subgroups B_2 and B_3 was higher than subgroups, A_2 and A_3. There are significant differences between subgroups A_2 and B_2 also, between A_3 and B_3.

4- Heavy metal residues in albumen and yolk of treated laying hens:

The obtained results revealed that, all heavy metals had a clear tendency to accumulate in albumen and yolk but the median value of these heavy metal showed that the accumulation of cadmium and zinc in yolk was higher than that accumulated in albumen but it equal in lead and copper of group A. Meanwhile, in the group B, the accumulation of copper and zinc in yolk was higher than the accumulation in albumen but it was equal in cadmium and lead. Also, the concentration of zinc in albumen and yolk was significantly difference in group A and B.