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# Determination of Trace Elements in the Eggs of Poultry in Quetta, Balochistan

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## Abstract

*The purpose of this research study was to analyze metal ions such as Fe, Cu, Ni, Cd, and Zn through atomic absorption spectroscopy method in eggs collected from different poultry production in the Balochistan region. The findings exposed the highest amount of iron in the Ostrich egg of all. On the other hand, the highest copper level was determined in a Quail egg, while the least amount was evaluated in an egg sample of Ostrich. Besides, the highest amount of nickel was found in the Domestic egg sample. Whereas, the least amount was detected in the ostrich egg. A higher level of cadmium was assessed in the Ostrich egg sample. However, there was no significant difference among cadmium levels in Broiler, Domestic, and Duck egg samples in the present study. The present study indicated the highest amount of Zinc in the Broiler egg sample. While, Domestic egg showed a higher level of Zinc than Duck and Ostrich eggs. However, overall findings within the range of standard value given by WHO/FAO. There was no any limit for Iron and Nickel.*

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**Keywords:** Poultry eggs, Heavy metals, Atomic Absorption Spectroscopy

## INTRODUCTION

The poultry industry has become one of the world's most significant agricultural sectors. Extensive poultry production enhances the availability of economic, palatable, and nutritious food protein to increase urban populations. Despite massive involvement in the trace metal material of eggs by poultry breeders, nutrition experts, and ecologists, reliable data regarding trace metals amounts in eggs are scant **[1]**. Chicken eggs have been one of the significant protein sources. If polluted by harmful heavy metals due to industrial pollution, geochemical systems, and agricultural practices are grave issues for human health and the environment **[2].**

Eggs, a necessity of the living organism everyday routine diet, are used all over the globe. Eggs reflect a "comprehensive food" essential for human being and are identifiable by consumers as efficient and healthful with a balance of vital nutrients **[3].** Additionally, eggs have wellbeing actively promoting characteristics; many being protective in design, with some having characteristic ability. Eggs are relatively low cost and low-calorie form of good quality protein sources are beneficial to human wellbeing.

Besides these, consumption of feed also exposes poultry to heavy metals. Chicken may take heavy metal from various sources, mainly through feeding. Metal particulates can then accumulate in their meat and eggs **[4].** These heavy metals are transmitted to human's body via chicken eggs **[5].** Although chicken's eggs are perceived as one of the excellent nutritional and affordable food products in the daily human diet, particularly that of kids, it is highly regarded for human health **[6].** Metals are present in all living beings where they may perform different functions such as structural, control system, components (e.g., in muscles and nerves) and enzyme activator. Certain elements, such as zinc, iron, calcium, copper, and magnesium, perform a decisive function in the processes that control critical metabolic pathways. Others are unnecessary metal and also trace-toxic, particularly cadmium, arsenic, lead and mercury **[7].**

This research study was thus planned to determine levels of eggs for the protection of public health of different areas of Balochistan (Fe, Cu, Ni, Cd, Zn) for certain heavy metal goods. This research study would help to assess possible hazards from the environmental effects of heavy metals and in providing guidelines for future implementation by local wellbeing regulators.

## METHOD AND MATERIALS

### Collection of Samples

The samples of different eggs (Broiler egg, Domestic egg, Ostrich egg, Quail egg and Duck egg) were collected randomly from various areas of Balochistan. The collected egg samples have been packed in polyethylene bags and taken to the laboratory of the Chemistry Department, University of Balochistan Quetta and were kept for further process under the suitable environment.

**Figure 1**: Quail egg

**Figure 2:** Hen egg

**Figure 3:** Duck egg

**Figure 4:** Ostrich egg

### Sample Preparation and Analysis

All the reagents were of analytical grade. The glass wares used were rinsed numerous times with tap water to eliminate the contamination and rinsed with deionized water. First eggs were vigorously washed using deionized water, and then each egg content was separated from the eggshell. A homogenized mixture was formed from egg content. One gram of each homogenized egg mixture was taken into 100 ml of digestion flask separately and added 5ml $HNO_3$ (65%) and 2ml $HClO_4$. The mixture was then heated on a hotplate until a clear solution achieved. Afterwards, the solutions were cooled and filtered with what man paper 41. The filtrate was diluted with deionized water up to 50 ml. Finally, the analysis was conducted for heavy metals through atomic absorption spectrophotometer.

## RESULT AND DISCUSSION

Data confirmed for analyzing, Fe, Cu, Ni Cd, and Zn in Broiler, Domestic, Duck, Quail and Ostrich egg samples with the comparison of internationally recognized cumulative permitted limits are displayed in Table 1. While comparison of findings in Broiler, Domestic, Quail, Duck and Ostrich eggs are shown below in Figures 1-5.

**Table 1: The Level of some heavy metals in Egg samples of various birds (ppm).**

| Metals | Broiler Egg | Domestic Egg | Quail Egg | Duck Egg | Ostrich Egg | WHO/FAO |
|---|---|---|---|---|---|---|
| **Fe** | 0.9296 | 0.8283 | 1.8662 | 0.8742 | 3.1547 | - |
| **Cu** | 0.1877 | 0.2546 | 0.3322 | 0.3011 | 0.0942 | 10 ppm |
| **Ni** | 0.0667 | 0.0744 | 0.0654 | 0.0602 | 0.0108 | - |
| **Cd** | 0.0380 | 0.0370 | 0.0372 | 0.0366 | 0.0455 | 0.05 ppm |
| **Zn** | 3.2367 | 2.2863 | 3.0163 | 2.0045 | 2.0877 | 20 ppm |

### Iron (Fe)

Broiler, Domestic, Quail, Duck, and Ostrich eggs were analyzed to detect iron concentration. The highest amount of iron among the eggs, as mentioned above, was detected in the Ostrich egg. The iron level in Quail egg was lesser than Ostrich but greater than Broiler, Domestic, and Duck eggs. On the other hand, there was no significant difference between Domestic and Duck eggs. However, Duck egg and Domestic egg were detected with a lesser iron level than the Broiler egg sample.

There was no any permissible limit for iron. The comparison among various egg samples is shown in figure 1.

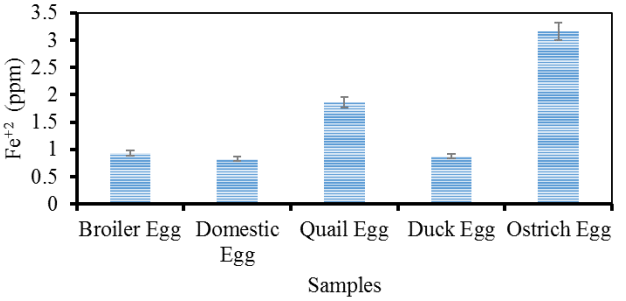


**Figure 1: Concentration of Iron in various egg samples (ppm)**

## Copper (Cu)

Copper metal is an important ingredient for physiological homeostasis and co - factors for many enzyme functions within the body. The concentration of copper was detected in different egg samples of various types of poultry. The highest level of copper was determined in Quail egg, while the least amount was evaluated in an egg sample of Ostrich. The copper level in Duck egg was lesser than Quail egg but greater than Broiler and Domestic eggs. On the other hand, the Domestic egg sample contained a greater amount of Copper than the Broiler egg sample (Figure 2). However, overall result was below WHO/FAO permissible limit (10 ppm).

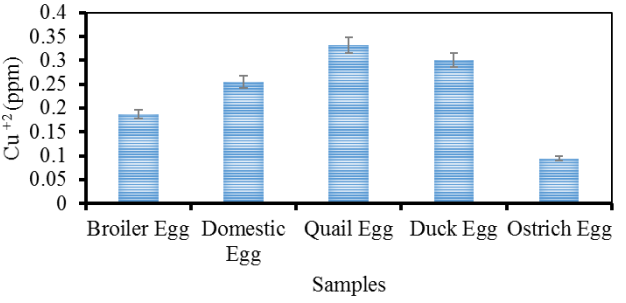


**Figure 2: Concentration of Copper in various egg samples (ppm)**

## Nickel (Ni)

The highest amount of nickel was found in the Domestic egg sample among all used egg types. In contrast, the least amount was detected

in the Ostrich egg. However, no significant difference was observed among Broiler, Quail, and Duck egg samples. These contained a higher amount of nickel than Ostrich egg but a lesser amount of nickel than the Domestic egg sample. It is shown below in figure 3.

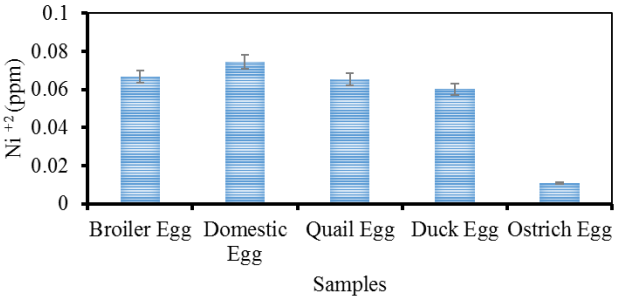


**Figure 3: Concentration of Nickel in various egg samples (ppm)**

## Cadmium (Cd)

The highest amount of cadmium can influence human body in multiple forms such as renal failure, structural destruction, prostate cancer, mutations, fetal death etc. Trace elements can pollute the chicken meat from natural supply, rice, other feed etc. **[8].** A higher level of cadmium was detected in the Ostrich egg sample among all used eggs. Broiler egg contained a lesser amount of Cadmium than Ostrich egg but little higher than Domestic, Quail and Duck egg samples. However, there was no significant difference among cadmium levels in Broiler, Domestic, and Duck egg samples in the present study (Figure 4). Overall detection of Cadmium in all used samples were within the WHO/FAO standard limit (0.05 ppm).

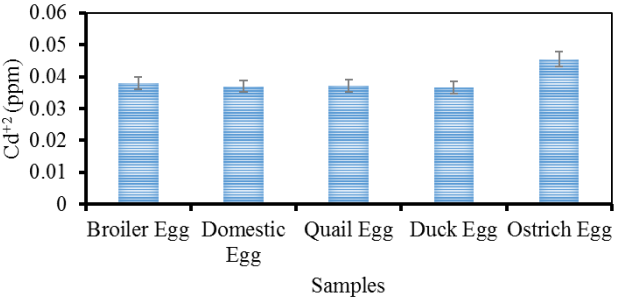


**Figure 4: Concentration of Cadmium in various egg samples (ppm)**

### Zinc (Zn)

Zinc is also essential to human life. Besides that, this may be harmful if present in relatively high concentrations. Zinc is given to chickens by their diet for gaining weight and infection control **[9].** The present indicated the highest amount of Zinc in the Broiler egg sample. The Quail egg sample contained a higher amount of Zinc than Domestic, Duck, and Ostrich eggs, but lesser than Broiler egg samples. On the other hand, Domestic egg showed a higher level of Zinc than Duck and Ostrich eggs. However, no diversity was detected in Duck and Ostrich egg samples (Figure 5).

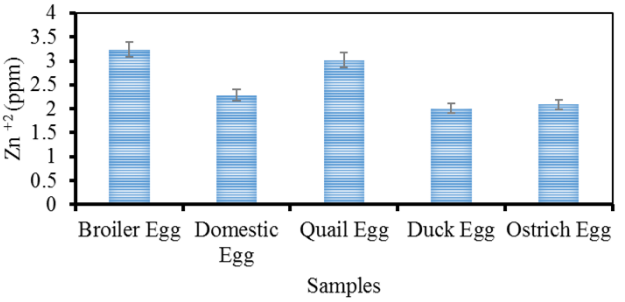


**Figure 5: Concentration of Zinc in various egg samples (ppm)**

## CONCLUSION

The present study showed the highest amount of iron among the eggs in the Ostrich egg. In comparison, there was no significant difference between Domestic and Duck eggs. However, Duck egg and Domestic egg were detected with a lesser iron level than the Broiler egg sample. On the other hand, the highest copper level was determined in a Quail egg, while the least amount was evaluated in an egg sample of Ostrich. Besides, the highest amount of nickel was found in the Domestic egg sample among all used egg types. In contrast, the least amount was detected in the Ostrich egg. A higher level of cadmium was assessed in the Ostrich egg sample among all used eggs. However, there was no significant difference among cadmium levels in Broiler, Domestic, and Duck egg samples in the present study. The present indicated the highest amount of Zinc in the Broiler egg sample. On the other hand, Domestic egg showed a higher level of Zinc than Duck and Ostrich eggs.

However, no diversity was detected in Duck and Ostrich egg samples. It is concluded that the level of detected heavy metals was found within the range of WHO/FAO values. There was no any limit for Iron and Nickel.

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