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# Effect of age on the haematological and biochemical profile of Japanese quails (*Coturnix coturnix japonica*)

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**Abstract**
The haemato-biochemical profile of the Japanese quail was estimated at different stages of growth. The parameters which were evaluated include serum glucose, cholesterol, total protein, albumin, globulin, uric acid, calcium, magnesium, chloride, potassium, Hb, TEC, PCV, MCV, MCH and MCHC. The biochemical profile showed changes in the level with age of the bird but does not seem to affect the haematological parameters. The glucose content of the birds decreased with age while the other parameters like cholesterol, total protein, albumin, globulin, uric acid calcium etc. increased with age.

**Keywords:** Quail, Hb, PCV, Serum biochemistry, age-related difference

## INTRODUCTION

Poultry industry forms a major portion of the agriculture sector in developing countries including India. During the last two decades, India has a remarkable growth in poultry industry. India's egg production was 2 million tones in the year 2002 and remained amongst the top 5 of egg producing countries in the world. The broiler meat production was 1.566 million tons in the same year (Poultry International, Vol-42, No. 11, Nov.2003).

Quail farming is cropping up as a new venture of diversification of poultry farming to diverse the choice of taste and to strengthen the meat production unit for fulfilling the shortage of animal protein demands. In India, Japanese quail (*Coturnix coturnix japonica*) breeding for egg and meat production has been introduced very recently. Quails possess an excellent disease resistance quality than those of chickens and have been chosen for its economical viability in farming. Japanese quails are rapidly gaining popularity for its commercial exploitation and in near future may acquire an important segment in rapidly expanding Indian poultry industry [1]. The blood biochemical analysis is a valuable tool for evaluating the health of animal and helps both in diagnosis and clinical monitoring of disease [2]. Its evaluation indicates the extent of damage in various vital organs and status of the disease. Serum biochemical profiling has been used in several species of domestic livestock to monitor herd health and to detect subclinical disease. Application of this technique to commercially raised poultry flocks has been limited by a lack of suitable reference ranges for most of the parameters being tested although much work has been done on specific individual parameters. In addition, much of the information that is available is based on small sample numbers, limited parameters and often outdated analytical techniques. Nonspecific "avian" values are not adequate because hematological and biochemical status is a reflection of many factors such as sex, age, breed, diet, management and stress level. The primary objective of the present investigation is to evaluate the haematological and biochemical profile of Japanese quails at different stages of growth.

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## MATERIALS AND METHOD

The experimental work of the present investigation was conducted at Department of Livestock Production Management and Department of Veterinary Physiology & Biochemistry, College of Veterinary Sciences & A.H., Central Agricultural University, Selesih, Aizawl, Mizoram, India in the month of September- October, 2010. A total of fifty Japanese quails were used in the study. The birds were reared under litter system and feed and water were provided *ad libitum* throughout the experimental period. Birds were fed on starter ration up to five weeks and later on a breeder ration.

The birds were slaughtered for blood collection by severing the jugular vein at three intervals *i.e.* 5$^{th}$, 6$^{th}$ and 7$^{th}$ week of age resembling three stages of production. The analysis was conducted up to 7 weeks of age as the birds' started laying egg at 7$^{th}$ week of age.

The blood samples for haematological and biochemical analysis was collected in heparinized tubes and sterile tubes without any anticoagulant respectively. The blood samples for biochemical analysis were allowed to clot and serum was separated within 2 h of collection after centrifugation at 5000 rpm for 15 min in a table top centrifuge machine (Remi RC8).

Hematological parameters i.e. hemoglobin (Hb), total erythrocyte count (TEC), packed cell volume (PCV), mean

corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were estimated by following the procedures as described by Jain [3].The biochemical profile of the samples was determined using an UV-Visible Spectrophotometer (Chemito Spectroscan 2600). The profile consisted of glucose, cholesterol, total protein, albumin, uric acid (UA), magnesium (Mg), potassium (K) and chloride (Cl). Glucose was determined by the glucose oxidase reaction and cholesterol was determined enzymatically and included the free and esterified forms. The total protein and albumin levels were determined with biuret and bromocresol green reagents respectively. Uric acid level was determined by uricase/ PAP method. The level of calcium was determined based upon a colour product formed when calcium reacts with o-cresolphthalein complexone in an alkaline medium. The level of magnesium was measured spectrophotometrically using the metallochrome dye Calmagite to form a red-coloured complex.

## RESULT AND DISCUSSION

The blood biochemical profile of Japanese Quails (*Coturnix coturnix japonica*) reared in Mizoram, India were estimated at different stages of growth using the commercially available diagnostic kits in a UV-Vis Spectrophotometer (Chemito Spectroscan-2600). The result of biochemical estimation is given in Table 1. The serum glucose level at 5th week has significant difference ($p<0.05$) with other groups of different ages. The observed serum glucose level was highest on 5th week (559.37±61.04 mg/dl) and the content decreased with age. The observed value on 7th week was 395.47±6.26 mg/dl. The change in the glucose level with respect to the age is given in figure 1. The decrease in the serum glucose level in the present investigation may be due increased secretion of steroid hormones with age of the birds for the preparation of laying. El-Ghalid [4] reported that the development of reproductive stage caused a decrease in plasma glucose as compared to pre-sexual maturity, as it was decreased by 13 and15% at sexual maturity and at peak of production, respectively. The decreasing trends of glucose level was accompanied by increased liver glycogen indicating a stimulated pancreatic activity which comes in agreement with the findings of Schulz [5] who had reported that in pigeons, the pancreatic islets of Langerhans increased in size and number during the laying period of the female [4].

Table1. Haematological and Biochemical Profile of Japanese Quails (*Coturnix coturnix japonica*) at different stages of growth

| Parameters | Age of the birds | | | F- values |
|---|---|---|---|---|
| | 5th Week | 6th Week | 7th Week | |
| Glucose (mg/dl) | 559.37±61.04$^{a}$ | 417.24±26.30$^{b}$ | 395.47±6.26$^{b}$ | 5.33* |
| Cholesterol (mg/dl) | 91.95±4.45$^{c}$ | 212.82±19.83$^{b}$ | 466.11±15.81$^{a}$ | 164.93** |
| Total Protein (g/dl) | 3.75±0.21$^{c}$ | 4.78±0.39$^{b}$ | 12.64±0.04$^{a}$ | 358.23** |
| Albumin (g/dl) | 1.29±0.012$^{b}$ | 1.54±0.23$^{b}$ | 2.59±0.17$^{a}$ | 19.21** |
| Globulin (g/dl) | 2.46±0. 0.015$^{b}$ | 3.24±0.45$^{b}$ | 10.05±0.16$^{a}$ | 222.57** |
| A:G ratio | 0.52 | 0.48 | 0.26 | |
| Uric Acid (mg/dl) | 8.31±0.27$^{b}$ | 13.25±1.93$^{a}$ | 7.41±0.28$^{b}$ | 7.56* |
| Calcium | 8.60±0.30$^{b}$ | 10.35±2.09$^{b}$ | 21.64±0.20$^{a}$ | 33.37** |
| Magnesium (mg/dl) | 0.77±0.11$^{b}$ | 2.62±0.39$^{a}$ | 2.02±0.02$^{b}$ | 15.93** |
| Chloride | 111.53±3.69 | 107.83±13.23 | 116.69±2.84 | 0.30$^{NS}$ |
| Potassium (mmol/L) | 2.75±0.48$^{a}$ | 1.01±0.11$^{b}$ | 2.66±0.23$^{a}$ | 9.88* |
| Hb (g/dl) | 12.40 ± 0.20 | 13.10 ± 0.12 | 13.20 ± 0.12 | 1.72$^{NS}$ |
| TEC ($10^{6}$/µl) | 2.55 ± 0.26 | 2.95 ±0.13 | 2.45 ± 0.10 | 2.91$^{NS}$ |
| PCV (%) | 31.45 ± 2.34 | 35.57 ±1.17 | 36.00 ±1.15 | 2.26$^{NS}$ |
| MCV (fl) | 123.80 ± 2.16$^{b}$ | 120.81 ± 2.39$^{b}$ | 147.24 ± 1.29$^{a}$ | 25.61** |
| MCH (pg/dl) | 49.33 ± 3.83 | 44.88 ± 2.34 | 54.10 ± 1.94 | 2.84$^{NS}$ |
| MCHC (%) | 39.75 ± 2.16 | 37.08 ±1.53 | 36.73 ± 1.04 | 0.76$^{NS}$ |

$^{NS}$Non-significant, *Significant at $p<0.05$, ** significant at $p<0.01$,
Values bearing different superscripts in a row differ significantly.

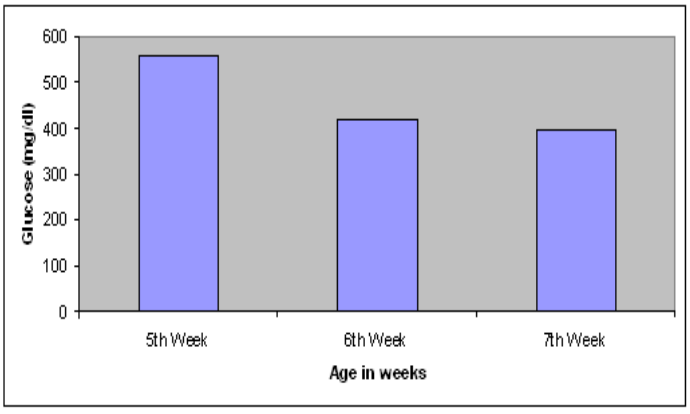


Fig 1.Change in the level of Glucose with age

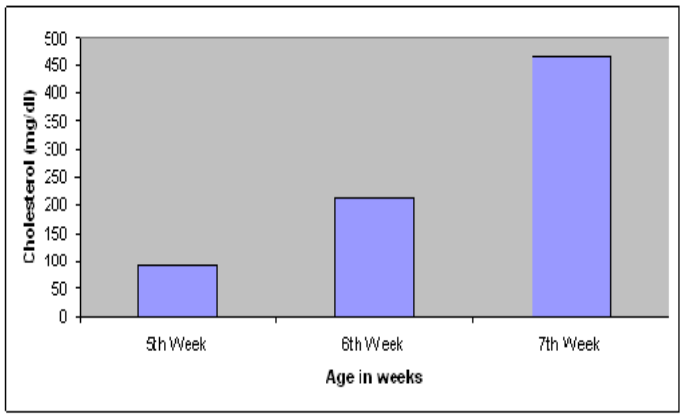


Fig 2. Change in the level of Cholesterol with age

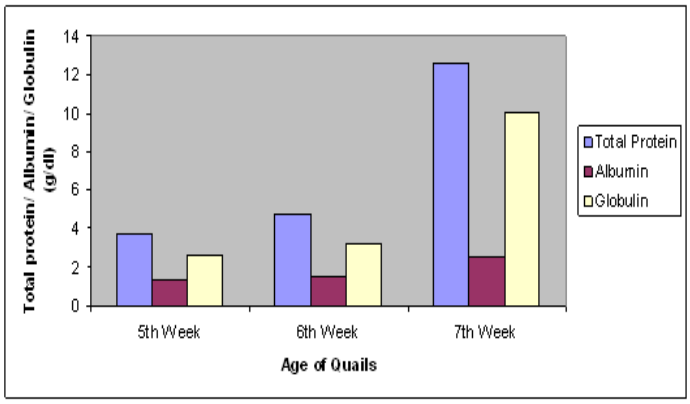


Fig 3. Change in the level of Total protein, Albumin and globulin with age

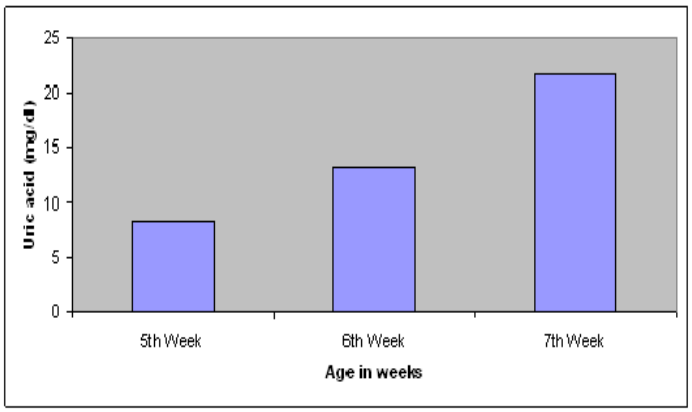


Fig 4. Change in the level of Uric Acid with age

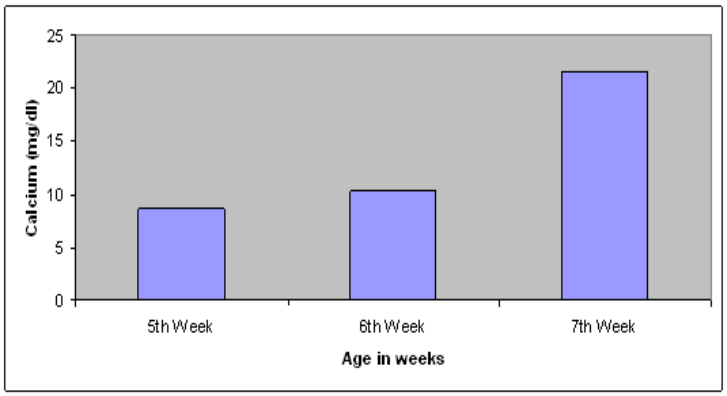


Fig 5. Change in the level of Calcium with age

The serum cholesterol content increased significantly with age ($p<0.01$) in Japanese Quails. At 5th week of age the amount of cholesterol observed was 91.95±4.45 mg/dl and the level increased to 466.11±15.81 mg/dl at 7th week. The change in the cholesterol content with respect to the age is given in figure 2. The present finding is in agreement with the findings of Hassan [6]. Hassan, in his studies on variation in egg performance and plasma constituents at different ages of female Japanese quails observed a gradual increase in cholesterol level with age and the highest value was observed at 30 weeks of age while the lowest value was observed at 8 weeks of age [6].

The total protein content in the serum increased significantly with age similar to change in the content of the serum cholesterol. The total protein content on 5th week of age was 3.75±0.21 g/dl and the level increased to 12.64±0.04 g/dl at 7th week of age. Similarly, albumin level also increased with age of the birds (figure 4). The amount of albumin observed at 5th week was 1.29±0.12 g/dl and the level increased to 2.59±0.17 g/dl at 7th week of age significantly. The observed change in the total protein, albumin and globulin contents at different stages of growth is given in figure 3. The increase in total protein and albumin content in the present investigation is in agreement with the findings of Hassan [6] who have reported an increase in plasma total protein and albumin with increasing age in female Japanese Quails. Hassan [6] observed highest values at 26 and 30 weeks of age though there were insignificant differences in plasma total protein values upto 18 weeks of age and upto 22 weeks for plasma albumin. However, Bahie El-Deen *et al*. [7] observed that total protein values decreased with progressing age of Japanese quail. The increase in total protein and albumin might be due to estrogen secretion at the onset of egg production [8].

The serum calcium level in the present investigation increased significantly at 7th week. The value on 5th week (8.60±0.30 mg/dl) increased to 21.64±0.20 at 7th week. The change in serum calcium level is given in figure 4. El-Ghalid [4] observed an increase in the level of serum calcium with age in Japanese quails which is in agreement with the observation made in the present investigation. Increasing the level of calcium with increasing age might be due to increased secretion of steroid hormones. The steroid hormones are implicated in the regulation of Ca metabolism in laying hens through several modes of action. Shortly before sexual maturity, formation of medullary bone and a parallel increase in calcium retention [9] are induced by the action of estrogen [4]. The increase in the calcium level is also due to increased serum levels of protein bound calcium [8]. A considerable increase in plasma Ca levels at the beginning of laying period of hens and subsequent gradual increase were also observed by Cerolini *et al*. [10]; Gyenis *et al*. [11] and Pavlik *et al*. [12]. The serum level of magnesium, chloride and potassium at different ages of the birds is shown in figure 5. The levels of these metal ions also changes significantly with age of the birds except for chloride. The highest value of magnesium was observed at 6th week (2.62±0.39 mg/dl). In the case of potassium the lowest level was observed at 6th week (1.01±0.11).

The levels of Hb, TEC, PCV, MCV, MCH, and MCHC of Japanese quails studied were in the normal range of levels reported for Japanese quail [13]. There were no significant changes in hematological parameters between 5th to 7th weeks of age.

Hb level of the bird remained almost stable upto 7th week of age. TEC increased slightly in the 6th week which however became

to normal range by 7th week. PCV increased gradually. MCV increased from 123.80 ± 2.16 at 5th week to 147.24 ± 1.29 at 7th week with slight decreased at 6th week. MCH decreased slightly from 49.33 ± 3.83 at 5th week to 44.88 ± 2.34 at 6th week and increased to 54.10 ± 1.94 at 7th week. MCHC decreased gradually from 39.75 ± 2.16 at 5th week to 36.73 ± 1.04 at 7th week.

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