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Effects of Snail Supplemented Feed on Quail (Corturnix Japonica) Production

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Abstract

This study was conducted to investigate the effects of Snail supplemented diet on production performances of Japanese quail. A total of 120, day old quails were assigned into four groups T_0, T_1, T_2 and T_3, each group contained 10 birds with 3 replication. Group T_0 was considered as control formulated diet without snail. Groups T_1, T_2 and T_3 fed also formulated diet supplemented with 1%, 2% and 3% snail respectively. Live body weight, body weight gain, plasma calcium and phosphorus level were determined at the age of 15, 30, 45 and 60 days of quail. Number of egg, egg weight, yolk and albumin index, Egg shape index, parameters were started from the day of 45 to end of the experiment. Although of the T_1 on day 30, 45 & 60 live body weights were not significantly ($p>0.05$) increased, the birds of T_2 and T_3 were significantly increased from the control birds without snail. Number of egg, egg weight, yolk and albumin index, Egg shape index were almost similar among different treatment groups. Plasma Calcium and phosphorus level were higher among the treatment groups compared to the control and differed significantly ($p<0.01$). The present study revealed that the supplementation of snail in the quail feed ration were effective improve the performance in quail.

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INTRODUCTION

Quail is fast growing bird with a short generation gap. Quail were first introduced in India in 1974 from California. The Japanese quail is the largest species, it is much smaller then pigeon. A broiler quail can be sold at 5 weeks. Quail start laying eggs at the age of 6 week, and continue laying eggs up to 24 weeks of age. The meat of quail is consider as delicacy. From the quails meat make different recipes pickled meat, tandoori quail and use as ready to cook meat. Also eggs used to eat as boiled or make egg pickles. Quail requires smaller house compare to chicken. Mostly, commercial chicks are kept in multitier cages, thereby increasing labor efficiency and better utilization of land space. Another species of quail, Japanese quail (*coturnix japonica*) have created a big impact in recent years and many quails farms have been established throughout the country both for egg and meat production. It is due to fact that increasing consumer awareness for quality meat, it demanded the production of better quality broiler quail meat. It is of great importance to select the stocks, which have the inherent capacity to yield better quality meat and egg (Mishra Priti and Shukla Satish, 2014). The most studied aspect of quail production is nutrition, particularly of Japanese egg-type quails (Garcia *et al.,* 2000; Ribeiro *et al.,* 2003; Murakami *et al.,* 2006; Araujo *et al.,* 2007; Murakami *et al.,* 2007). On the otherhand, there are few studies on the egg production potential of European meat-type quails (Mori *et al.,* 2005; Barreto*et al.,* 2007), and therefore, on their reproduction capacity. Poultry meat contributes 28.0% of the total meat production of Pakistan and this industry is showing 8-10% annual growth (Economic Survey of Pakistan, 2014). People all over the world are diverting their attention towards the meat and eggs of other poultry species like quail, ostriches and emus to enhance per capita protein availability for ever increasing human population. Quail farming is gaining much popularity due to unique flavor of its meat (Kayang*et al.,* 2004), relatively low investment, resistance to diseases and quick body weight respond to genetic selection (Yalcin*et al.,* 1995; Oguz and Minvielle, 2001). To enhance the production and maintain the need of customers, the producers are bound to limit the costs of their products as per requirement of the consumers. This can only be achieved by lowering the cost of production, which is minimized by using economical ingredients, principally the sources of energy. The most necessary nutrient required for growth is energy even though energy itself is not changed into meat or eggs but used as fuel for getting high production. A number of scientists have made efforts to attain the optimum level of energy which provides better growth with minimum possible cost (Dozier *et al.,* 2006, 2007; Ghaffari*et al.,* 2007). They have proved that by increasing energy level of feed, feed conversion ratio can be improved (Dozier *et al.,* 2006, 2007; Ghaffari*et al.,* 2007; Jackson *et al.,* 1982) but this is true up to a certain limit because the dietary energy and availability of essential nutrients of feed are much related to one another. The amount of feed consumed and ultimately the intake of essential nutrients is affected inversely with energy level (Slagator and Waldroup, 1990). So, energy level more than that of normal will result in deficiency of nutrients availability and will cause high cost of production. Current study was planned to check the optimum level of dietary energy for growth and other production characters of Japanese quail with economical production cost.

The general objective of the current study was to know the production performance of quail of snail supplemented formulated diet with the following specific objectives;

- To know the effect of snail supplementation on live body weight and body weight gain of quail.
- To see number of eggs, egg weight, egg shell thickness, egg yolk and albumin index, egg shape index.

- To determine the Plasma Calcium and Phosphorus level.

MATERIALS AND METHODS

Statement of the research work

The study was conducted from 10th July to 20 September/2018 research lab. under Physiology and Pharmacology Department of Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur to evaluate the Dietary effect of snail supplemented feed in quail production. The following procedures were followed during study period.

Experimental Design

A total quail birds of 120, day old quails were assigned into four groups T_0, T_1, T_2 and T_3, each group contained 10 birds with 3 replication. Group T_0 was considered as control formulated diet without snail. Groups T_1, T_2 and T_3 fed also formulated diet supplemented with 1%, 2% and 3% snail respectively. All the birds were kept in the wire cages of the experimental shed. Proper ventilation and lighting was maintained inside the shed throughout the experimental period.

Preparation of the experimental house and equipment

At first the room as well as the wire cages were washed by sweeping with tap water using hose pipe connected with the tap. The room was disinfected with a phenolic disinfectant and allowed to dry leaving the room unused with the electric fan and the bulb switched on overnight. The room was properly ventilated. All the utensils required for the experiment such as feeder, water pot, beakers, pestle and mortar, syringe, needle etc. were collected and the experimental shed was properly designed.

Collection of feed ingredients

The feed ingredients like as Maize, Rice polish, Soybean meal, Meat and bone meal, Vitamin-mineral premix, Salt, Toxin binde, Methionine, lysine, were collected from the feed selling store in Dinajpur district. The snail were collected from pond and river.

Brooding management

Brooding temperature was kept at 37^{o} C in the first 1 week of age and decreased gradually at the rate of 3^{o}C in each week until they were adjusted to normal environmental temperature of the house and final temperature was 28^{o} C at the end of experiment.

Lighting management

During the whole experimental period, all quails were exposed to a 16 hours continuous photoperiod (natural light plus artificial light) in an open sided house. Adequate hygiene and sanitation were maintained properly.

Feed and water management

At the first week Feeds were supplied to the chicks on clean newspapers at three hours interval for the first 3 days. Linear feeder and round plastic drinker were used during brooding period. After that linear feeder was replaced by round plastic drinker. Feed and fresh water were offered to the bird manually according to experimental schedule.

Collection and preparation of Snail

The Snail was collected from the river and pond near the HSTU Campus. The snails were transformed into a meal by crushing, grinding, cooking and drying, so that they could be incorporated into a basal Quail feed.

Blood Sample

0.5 ml blood from each group was collected from wing vein with the help of syringe (1 ml) and needle. The 1st blood sample was collected after the commencement of treatments and then every 15 days of interval up to the end of the experiment

Measurement of body weight & record keeping

The quails were weighed just before to the commencement of treatment at the 15th day of age and then every 15 days interval body weight was recorded with the help of digital balance.

Measurement of weight gain

The following formula is used to measure weight gain of quail

Weight gain= Final body weight -Initial body weight

Egg count and record keeping

Eggs were collected from each replication everyday from the beginning to fifteen days of laying and the number of eggs were recorded. Egg production percent was determined replication wise by the following formula.

$$\text{Hen day egg production (HDEP) (\%)} = \frac{\text{No.of eggs laid}}{\text{Total no.of days}} \times 100$$

Each egg for quality determination was cleaned by wet cloth and then numbered by permanent marker pen.

Egg weight of quail

Weight of each egg was recorded before quality determination by using a digital balance.

Determination of egg shell thickness, egg yolk and albumin index, egg shape index

Egg Shell thickness

Immediately after breaking the eggs, the egg shell was soaked with cotton to remove adhesive albumin and Egg shell plus membrane thickness (mm) was measured by screw gauze. Three measurements were taken from three different locations of each shell; two reading from the waist region and one reading from each end of egg.

Albumen index

The albumen index was determined according to the formula developed by Heiman and Carven (1936).

$$\text{Albumen index} = \frac{\text{Average height of thick albumen}}{\text{Average diameter of thick albumen}} \times 100(\%)$$

Average height of thick albumen was determined as the mean of three measurements taken by a spherometer in three different locations of the albumen avoiding the location of chalazae. Average diameter of the thick albumen was recorded as the mean value of three measurements taken by slide calipers.

Yolk index

The yolk index was determined by the formula developed by Wesley and Stadelman (1959).

$$\text{Yolk index} = \frac{\text{Average height of yolk}}{\text{Average diameter of yolk}} \times 100(\%)$$

The height of the yolk was measured by a spherometer and the diameter by slide calipers. In each parameter, three measurements were taken and the mean value was taken for final calculation.

Egg shape index

Measurements of egg length and width were taken with a calliper to the nearest 0.01 mm. The egg shape index was determined from these measurements according to Reddy *et al.* (1979) and Anderson *et al.* (2004) as given with the following formula.

$$\text{Egg shape index} = \frac{\text{Egg width}}{\text{Egg length}} \times 100(\%)$$

Statistical analysis

The collected data on different variables were subjected to analysis of variance (ANOVA). The significant differences between the treatment means were calculated from analysis of variance (ANOVA) table. All analyses were performed by using "IBM SPSS statistics 20" Program.

RESULTS

Growth performance of Japanese Quail

Live body weight of Japanese quail

N.B: **T_0 =** Formulated diet with supplemented snail at 0% level (control group),**T_1 =** Formulated diet with supplemented snail at 1% level, **T_2** Formulated diet with supplemented snail at 2% level, **T_3=** Formulated diet with supplemented snail at 3% level The mean body weight of quails during the experiment period is presented in table 01. The highest body weights of 15th days quails T_1 (39.603c±0.036) was found, On the other hand, lowest body weight T_3 (37.770a±0.238), 30th days highest body weights of quails T_2 (89.45c±0.12) was found, On the other hand, lowest body weight T_1 (85.36^a±3.08), 45th days highest body weights of quails T_3 (165.52^c±0.0208) was found, On the other hand, lowest body weight T_1 (144.76^a±0.538) and 60th days highest body weights of quails T_3 (185.54c±0.038) was found, On the other hand, lowest body weight T_1 (159.57^a±0.059), The difference in the body weight among were statistically significant ($p<0.05$).

Body weight gain of Japanese quail

The mean body weight gain of quails during the experiment period is presented in table 02. The highest Body weight gain T_3 (164.19^b ± 1.49) was found, On the other hand, lowest Body weight gain T_1 (140.40^a ±1.23. The difference in the body weight among were statistically significant ($p<0.05$).

Performance of laying and egg weight of Japanese quail at (45-60 days) on different treatment level of supplemented snail feed.

The results of feeding Supplemented snail as an alternative to limestone for the better number of egg production and egg weight in Japanese quail are presented in the following sub-headings:

Effects of supplemental snail on egg production and egg weight in between 45-60 days at four treatment group

Effects of experimental factors on egg production and egg weight in between 45-60 days experiment period is presented in table 03. The highest egg production of (45-60) days quails T_2 (96.67±1.76) was found, On the other hand, lowest egg production T_0 (92.67±0.33). The highest Egg weights of 45th days quails T_2 and T_3 (6.10±3.05) 46th days T_2 (9.27±0.09), 47th days T_2 (9.20±0.06), 48th days T_1 (9.17±0.07), 49th days T_2 ($9.47±0.12^b$), 50th days T_2 (9.35±0.08), 51th days T_2 ($9.49±0.09^b$), 52th days T_2 (9.36±0.03), 53th days T_2 (9.38±0.04), 54th days T_2 (9.46±0.08), 55th days T_2 (9.55±0.06), 56th days T_2 (9.46±0.13), 57th days T_2 ($9.58±0.10^b$), 58th days T^2 (9.34±0.16), 59th days T_0 (9.34±0.09), 60th T_0 (9.51±0.10) was found, On the other hand, lowest Egg weights 45^{th} T_1 (6.07±3.03), 46^{th} T_1 (9.10±0.003), 47^{th} T_1 (9.07±0.02), 48^{th} T_0 (9.11±0.05), 49^{th} T_1 ($9.07±0.02^a$), 50^{th} T_1 (9.14±0.03), 51^{th} T_1 and T_3 ($9.14±0.04^a$), 52^{th} T_2 (9.17±0.03), 53^{th} T_0 and T_3 (9.21±0.07), 54^{th} T_0 (9.17±0.08), 55^{th} T_1 (9.15±2.01), 56^{th} T_1 (9.17±0.06), 57^{th} T_0 ($9.14±0.03^a$), 58^{th} T_0 (9.13±0.03), 59^{th} T_2 (9.26±0.10), 60^{th} T_2 (9.18±0.07), The difference in the Egg weights among were statistically non-significant ($p>0.05$).

Effects of supplemental snail on albumin index, Yolk index and egg shape quality

Effects of experimental factors on albumin index, Yolk index and egg shape quality the experiment period is presented in table 04. The highest Albumine index of 45th days quails T_2 ($9.24±0.02^c$) was found, On the other hand, lowest Albumine index T_1 ($9.10±0.02^a$), 60th days Albumine index of quails T_3 ($8.99±0.04^b$) was found, On the other hand, lowest Albumine index T_2 ($8.60±0.05^a$), 45th days Yolk index of quails T_2 ($46.51±0.07^c$) was found, On the other hand, lowest Yolk index T_1 ($42.52±0.05^a$) , 60th days Yolk index of quails T_2 ($46.45±0.04^c$) was found, On the other hand, lowest Yolk index T_1 ($1.47±0.05^a$), highest 45th days Egg shape index of quails T_0 (77.12±0.27^b) was found, On the other hand, lowest Egg shape index T_1 (76.33±0.03^a) , 60th days Egg shape index of quails T_2 (77.10±0.04^c) was found, On the other hand, lowest Egg shape index T_3 (76.29±0.04^a). Albumin index, Yolk index and egg shape among the difference group were statistically Non-significant (P>0.05).

Determination of plasma Calcium and Phosphorous level of Japanese Quail at (45th -60th days) on different treatment level of supplemented snail feed.

Determination of plasma Calcium and Phosphorous level of Japanese Quail at (45th -60th days) on different treatment level of supplemented snail feed experiment period is presented in table 05. The highest Inorganic Phosphorus level of quails T_2 (5.20±0.124) was found, On the other hand, lowest Inorganic Phosphorus level T_0 (5.13±0.114). The highest Calcium (mg/dl) (45th -60th days) of quails T_2 (9.82±.30) was found, On the other hand, lowest Calcium (mg/dl) T_0 (9.41±0.257. The difference in plasma Calcium and Phosphorous level among were statistically significant (5%).

DISCUSSION

Live body weight & Body weight gain of quail

The highest body weights of 15th days quails T_1 (39.603c±0.036) was found, On the other hand, lowest body weight T_3 (37.770a±0.238), 30th days highest body weights of quails T_2 (89.45c±0.12) was found, On the other hand, lowest body weight T_1 (85.36^a±3.08), 45th days highest body weights of quails T_3 (165.52^c±0.0208) was found, On the other hand, lowest body weight T_1 (144.76^a±0.538) and 60th days highest body weights of quails T_3(185.54c±0.038) was found, On the other hand, lowest body weight T_1 (159.57^a±0.059). The highest Body weight gain T_3 (164.19^b ± 1.49) was found, On the other hand, lowest Body weight gain T_1 (140.40^a ±1.23. The difference in the body weight among were statistically significant (p<0.05).

Performance of laying and egg weight of Japanese quail at (45-60 days) on different treatment level of supplemented snail feed.

The highest egg production of (45-60) days quails T_2 (96.67±1.76) was found, On the other hand, lowest egg production T_0 (92.67±0.33). The highest Egg weights of 45th days quails T_2 and T_3 (6.10±3.05) 46th days T_2 (9.27±0.09), 47th days T_2 (9.20±0.06), 48th days T_1 (9.17±0.07), 49th days T_2 (9.47±0.12^b), 50th days T_2 (9.35±0.08), 51th days T_2 (9.49±0.09^b), 52th days T_2 (9.36±0.03), 53th days T_2 (9.38±0.04), 54th days T_2 (9.46±0.08), 55th days T_2 (9.55±0.06), 56th days T_2 (9.46±0.13), 57th days T_2 (9.58±0.10^b), 58th days T^2 (9.34±0.16), 59th days T_0 (9.34±0.09), 60th T_0 (9.51±0.10) was found, On the other hand, lowest Egg weights 45th T_1 (6.07±3.03), 46th T_1 (9.10±0.003), 47th T_1 (9.07±0.02), 48th T_0 (9.11±0.05), 49th T_1 (9.07±0.02^a), 50th T_1 (9.14±0.03), 51th T_1 and T_3 (9.14±0.04^a), 52th T_2 (9.17±0.03), 53th T_0 and T_3 (9.21±0.07), 54th T_0 (9.17±0.08), 55th T_1 (9.15±2.01), 56th T_1 (9.17±0.06), 57th T_0 (9.14±0.03^a), 58th T_0 (9.13±0.03), 59th T_2 (9.26±0.10), 60th T_2 (9.18±0.07), The difference in the Egg weights among were statistically non-significant (p>0.05).

Effects of supplemented snail on albumin index, Yolk index and egg shape index

The highest Albumine index of 45th days quails T_2 (9.24±0.02^c) was found, On the other hand, lowest Albumine index T_1 (9.10±0.02^a), 60th days Albumine index of quails T_3 (8.99±0.04^b) was found, On the other hand, lowest Albumine index T_2 (8.60±0.05^a), 45th days Yolk index of quails T_2 (46.51±0.07^c) was found, On the other hand, lowest Yolk index T_1 (42.52±0.05^a) , 60th days Yolk index of quails T_2 (46.45±0.04^c) was found, On the other hand, lowest Yolk index T_1 (1.47±0.05^a), highest 45th days Egg shape index of quails T_0 (77.12±0.27^b) was found, On the other hand, lowest Egg shape index T_1 (76.33±0.03^a) , 60th days Egg shape index of quails T_2 (77.10±0.04^c) was found, On the other hand, lowest Egg shape index T_3 (76.29±0.04^a). Bahie *et al.,* (2009) observed that total protein values of quail decreased with progressing age and increased onset of egg production (Urist *et al.,* 1958). Total protein including albumin and globulin indicates the body defense mechanism. Finally, the value of serological test showed 15549 ± 141.85 mg/dl of albumin and 14915.50 ± 128.29 mg/dl of globulin. Findings of the value of blood chemistry were more or less similar except the value of glucose, albumin and calcium (Ali *et al.,* 2012).

Determination of plasma Calcium and Phosphorous level of Japanese Quail at (45th - 60th days) on different treatment level of supplemented snail feed.

The highest Inorganic Phosphorus level of quails T_2 (5.20±0.124) was found, On the other hand, lowest Inorganic Phosphorus level T_0 (5.13±0.114). The highest Calcium (mg/dl) (45th -60th days) of quails T_2 (9.82±.30) was found, On the other hand, lowest Calcium (mg/dl) T_0 (9.41±0.257. The difference in plasma Calcium and Phosphorous level were statistically significant (5%). Blood chemistry refers to the chemical composition of blood and is important for detecting any blood disease of the animals as well as birds. It includes normal plasma calcium and phosphorous level, biochemical and serological tests. For serological tests, however, albumen, globulin and total protein are usually estimated. In previous studies, there were no differences in serum parameters among juvenile males and females (Schmidt *et al.,* 2007) and serum calcium concentrations were found to decrease during peak egg production of the chickens (Peebles *et al.,* 2009). Glucose and cholesterol produced energy while total proteins indicated the albumin and globulin of the blood (Adeyemo *et al.,* 2010). Recently, Dutta (2010) studied the plasma calcium and phosphorous level parameters in a number of chicken breeds. Here, three vital plasma calcium and phosphorous level were estimated from quail in the study area.

CONCLUSION

In this study supplemented snail showed significant effect on live body weights and weight gain of quail of T_2 and T_3. Although of the T_1 on day 30, 45 & 60 live body weights were not significantly ($p>0.05$) increased. Number of egg, egg weight, egg shell thickness, yolk and albumin index, Egg shape index were almost similar among different treatment groups. Plasma Calcium and phosphorus level were higher among the treatment groups compared to the control and differed significantly ($p<0.01$). The supplementation of snail in the quail feed ration were effective improve the performance in quail. It can be recommended that further study can be done to investigate the determination of lipid profile and biochemical values (Minerals, enzymes).

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Table 01. Live body weight of Japanese quail

Parameter	Treatment group				P-value
	T_0	T_1	T_2	T_3	
Body wt. at 15th days	38.913^b±0.526	39.603^c±0.036	38.637^b±0.073	37.770^a±0.238	0.0024
Body wt. at 30th days	88.68^b±0.09	85.36^a±3.08	89.45^c±0.12	88.20^c±0.006	0.0000
Body wt. at 45th days	151.38^b±0.175	144.76^a±0.538	164.49^c±0.131	165.52^c±0.0208	0.0000
Body wt. at 60th days	169.57^b±0.106	159.57^a±0.059	183.63^c±0.105	185.54^c±0.038	0.0000

Superscripts within the same row indicate significant difference *= Significant at 5% level of probability ($p < 0.05$), **= Significant at 1% level of probability ($p < 0.01$), NS= Non-Significant ($P > 0.05$)

Table 02. Body weight gain of Japanese quail

Parameter	**Treatment group**			
	T_0	**T_1**	**T_2**	**T_3**
Body Wt. gain(g) at 15th day	17.80^a ± 1.03	19.61^a ±1.24	20.60^a ±1.67	19.30^a ± 1.55
Body Wt. gain(g) at 30th day	45.10^b ± 1.81	46.19^b ±1.76	50.23^b ±1.11	50.61^b ± 1.61
Body Wt. gain(g) at 45th day	42.30^a ± 1.53	51.67^a ±1.19	65.71^b ±1.25	77.80^c ± 1.57
Body Wt. gain(g) at 60th day	18.10^a ± 1.11	14.23^a ±1.97	19.45^a ±1.29	20.43^a ± 1.51
Body Wt. gain(g)	146.17^a ± 1.43	140.40^a ±1.23	162.71^b ±1.24	164.19^b ± 1.49

Superscripts within the same row indicate significant difference *= Significant at 5% level of probability ($p < 0.05$), **= Significant at 1% level of probability ($p < 0.01$), NS= Non-Significant ($P > 0.05$)

Table 03. Effects of supplemental snail on egg production and egg weight in between 45-60 days at four treatment group

Parameter	**Treatment group**				**P-value**
	T_0	**T_1**	**T_2**	**T_3**	
Egg Production (45-60 days)	92.67±0.33	93.33±1.20	96.67±1.76	93.67±1.76	0.261
Egg Weight at 45th days	6.08±3.04	6.07±3.03	6.10±3.05	6.10±3.05	0.852
Egg Weight at 46th days	9.16±0.07	9.10±0.003	9.27±0.09	9.13±0.04	0.281
Egg Weight at 47th days	9.09±0.007	9.07±0.02	9.20±0.06	9.10±0.05	0.194
Egg Weight at 48th days	9.11±0.05	9.17±0.07	9.16±0.07	9.16±0.04	0.884

Egg Weight at 49th days	9.11±0.05[a]	9.07±0.02[a]	9.47±0.12[b]	9.20±0.06[a]	0.019
Egg Weight at 50th days	9.14±0.04	9.14±0.03	9.35±0.08	9.32±0.14	0.218
Egg Weight at 51th days	9.20±0.06[a]	9.14±0.04[a]	9.49±0.09[b]	9.14±0.04[a]	0.01
Egg Weight at 52th days	9.20±0.10	9.17±0.03	9.36±0.03	9.18±0.12	0.368
Egg Weight at 53th days	9.21±0.07	9.24±0.08	9.38±0.04	9.21±0.07	0.254
Egg Weight at 54th days	9.17±0.08	9.20±0.06	9.46±0.08	9.40±0.17	0.201
Egg Weight at 55th days	9.17±0.07	9.15±2.01	9.55±0.06	9.26±0.10	0.376
Egg Weight at 56th days	9.20±0.04	9.17±0.06	9.46±0.13	9.38±0.15	0.241
Egg Weight at 57th days	9.14±0.03[a]	9.26±0.11[a]	9.58±0.10[b]	9.23±0.08[a]	0.031
Egg Weight at 58th days	9.13±0.03	9.13±0.009	9.34±0.16	9.34±0.14	0.338
Egg Weight at 59th days	9.34±0.09	9.26±0.10	9.33±0.10	9.28±0.12	0.927
Egg Weight at 60th days	9.18±0.07	9.32±0.07	9.51±0.10	9.28±0.12	0.152

Superscripts within the same row indicate significant difference *= Significant at 5% level of probability ($p < 0.05$), **= Significant at 1% level of probability ($p < 0.01$), NS= Non-Significant ($P > 0.05$)

Table 04. Effects of supplemental snail on albumin index, Yolk index and egg shape quality

Parameter	Treatment group				P-value
	T_0	T_1	T_2	T_3	
Albumine index (45 Days)	9.16±0.02[ab]	9.10±0.02[a]	9.24±0.02[c]	9.20±0.03[bc]	0.001
Albumine index (60th Days)	8.69±0.03[a]	8.70±0.03[a]	8.60±0.05[a]	8.99±0.04[b]	0.00
Yolk index at 45 Days	43.39±0.04[b]	42.52±0.05[a]	46.51±0.07[c]	43.36±0.07[b]	0.00
Yolk index at 60 Days	42.39±0.04[b]	41.47±0.05[a]	46.45±0.04[c]	41.56±0.03[a]	0.00
Egg shape index at 45 days	77.12±0.27[b]	76.33±0.03[a]	77.05±0.03[b]	76.25±0.04[a]	0.00
Egg shape index at 60 days	76.58±0.09[b]	76.49±0.08[b]	77.10±0.04[c]	76.29±0.04[a]	0.00

Superscripts within the same row indicate significant difference *= Significant at 5% level of probability ($p < 0.05$), **= Significant at 1% level of probability ($p < 0.01$), NS= Non-Significant ($P > 0.05$)

Table 05. Determination of plasma calcium and phosphorous level of Japanese Quail at (45th -60th days) on different treatment level of supplemented snail feed.

Parameter	Treatment group				P-value
	T_0	T_1	T_2	T_3	
Inorganic Phosphorus	5.13±0.114	5.19±0.044	5.20±0.124	5.18±0.122	0.983
Calcium (mg/dl)	9.41±0.257	9.55±0.05	9.82±.30	9.80±.49	0.383

Superscripts within the same row indicate significant difference *= Significant at 5% level of probability ($p < 0.05$), **= Significant at 1% level of probability ($p < 0.01$), NS= Non-Significant ($P > 0.05$)

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