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Gross morphological studies on ovaries of Punjab white quail

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Introduction

The quail originally domesticated around 11th century as a pet song bird, is now highly valued.[1,2] Quail reproduces throughout the year on contrary to seasonally breeding birds. It attains the maturity at 28days and first decline of fertility has been recorded at 12months and last egg laid or 90% fertility loss at 17-24months of age.[3]

The advantages of quail farming includes minimum floor space, low investment, comparatively sturdy birds, early market age and sexuality, high rate of egg production and less feed requirement.[4] Besides, Quail meat and egg are tastier than chicken and has less fat contents. It has been shown to promote body and brain development in children and nursing mothers.[5] In quail farming, the reproductive and immune status of birds is of prime importance to obtain good production.[6]

Quail females begin to lay eggs at the age of 45days and the peak of egg production is attained at 5month of age.[7] The short life cycle, the high fecundity and adaptability to life in cages, the low maintenance cost, and the easy ways to raise and handle it, make the quail an ideal model for research. In comparative studies between chicken and Japanese quail, the latter gives an annual egg mass production twenty times higher than the female adult body weight, while it is only ten times in hen.[8]

The bird ovary is a well-developed model for studies of cellular and molecular aspects of ovarian aging, particularly the regulation of follicular apoptosis, artesian and follicular cell death.[9] The quail ovary contains thousands of follicles of various sizes and provides a unique model for the study of follicular development.[10] Hence this review article ongross anatomy of ovary of Punjab White Quail will provide valuable information for further studies.

Fitzgerald[11] reported that left ovary of Japanese quail was situated just ventral to the cranial lobe of left kidney extending about half way down the middle lobe and was surrounded by other organs. Ribeiro et al.,[12] found in pigeon (*Columba livia*) that the ovary was located in the abdominal cavity and was related to the cranial portion of the lung, as well as with the dorsal portion of the kidney and adrenal gland. Banerjee et al.,[13] found that ovary was situated dorsally on the left side of the abdominal cavity close to the median line in Rhode Island Red breed of poultry. Cranially, the ovary became closely related to the caudal end of left lung. Whereas, Kimaro.[14] observed in brood parasitic bird that only left ovary was located in the cranial part of body cavity. Ovary had a short stalk, ventral to abdominal aorta and caudal vena cava and was related caudally to the cranial extremity of the kidney in ostrich. Whereas, Cediel[15] found that ovary was located over left kidney and suspended by me ovarian ligament in peritoneal cavity.

Parizzi et al.,[16] reported that the left ovary of Rhea occupied the dorsal portion of the coelomic cavity in contact with the cranial portion of the left kidney and the suprarenal gland, through the mesovarium. Banerjee et al.,[17] studied in post-natal developing hen that ovary was located at the dorsal part of the abdominal cavity at 8th week whereas at 12th and 16th week, ovary on the left side of abdominal cavity close to midline. Reed jr et al.,[18] noticed that ovary was located dorsomedial to the spleen, located on the left side of the abdominal cavity, cranial to the left kidney in Emu. On contrary to this, Gonzalez-Moran[9] found that left and right ovaries lied on ventromedial surface of the mesonephros with the dorsal aorta between them. The position of right ovary was even more oblique than that of the left in chicken.

Blendea et al.[19] reported that ovary of chicken was situated on the roof of the abdominal cavity at 98days. Oladehinde.[20] observed that ovary of Japanese quail was related cranially to the caudal extremity of the lung, ventrally to the abdominal air sac and dorsally to the kidney. However, Deka et al.,[21] reported in Pati and Chara-Chemballi ducks that mature ovary was located on ventral surface of the cranial lobe of left kidney.The ovary of Punjab white quail was situated on cranio-dorsal part of abdominal cavity close to midline, ventral to aorta and caudal vena cava and was close to last two ribs. Cranially, the ovary was related to caudal border of left lung. On ventral side, ovary was related to abdomen, dorsally to left kidney and adrenal gland. The base of ovary was attached to dorsal wall of abdomen by fold of peritoneum called mesovarium.[22]

Fitzgerald[11] reported that ovarian surface was rough due to early development of large egg follicles in Japanese quail. Dahl.[23] and Ribeiro et al.,[12] observed that ovary was a flat organ in quiescent state whereas in active state, it was a large organ having five to seven large follicles filled with yellow yolk and large number of small follicles of pale color in domestic fowl and pigeon, respectively. Banks[24] stated that avian ovary was not as compact as mammalian ovaries. Only left ovary was retained in adults as functional entities. Ovary was finger like projections suspended pendulously from the abdominal wall by the mesovarium. Kimaro.[14] found that ovary of ostrich was pink-brown, elongated structure with broad base cranially and narrow apex directed caudally. Inactive ovary was flat, with granular appearance due to presence of numerous follicles**.** Banerjee et al.,[13] and Banerjee et al.[17] also reported in Rhode Island Red breed and in postnatal developing hen that ovary was in the form of irregular lump, pinkish in color and elongated in shape.

Cediel[15] reported in brood parasitic bird that color of ovary was creamy yellowish with dark reddish hue due to high vascularization.

Ovary of non-reproductive birds had granulosa compact texture and pyramidal shape due to presence of small pre-vitellogenic follicles. Active ovary resembled a cluster of grapes. Claver et al.,[25] analyzed that the ovary was ovoid and whitish in Spotted Tinamous during resting stage. Ovary showed more irregular surface in developing stage. In reproductive stage, ovary increased notably in volume and showed the most irregular surface.

Reed jr et al.,[18] and Vijayakumar et al.,[26] found that ovary of emu was dark brown to black in color and triangular in shape. The ventral surface of the ovary was covered with follicles which was light grey in color. Whereas, Blendea et al.,[19] reported that ovary in chicken had smooth surface at 56days, uneven and pale pink at 98 days and acquired grape like shape at 126days. Mirhish et al.,[27] observed in Indigenous Turkey Hen that ovary had an irregular surface. Bala et al.,[22] reported that the ovary was yellow to brown in color with numerous ovarian follicles resembling the bunch of grapes.

Sinowatz et al.,[10] observed in Japanese quail that the prominent, healthy follicles of the laying quail lent the characteristic grape shaped appearance to the avian ovary. Shyam et al.[28] and Deka et al.,[21] observed in Aseel and Rhode Island Red breed of poultry and in Pati and Chara-Chemballi ducks that left ovary was slightly yellow to pinkish white in colour in group I, irregular lump fine granular and lobulated in group II and resembled to bunch of grapes in group III. Bala et al.,[22] reported that medium to large follicles were more and small size follicles had greatly reduced in number. The large spherical and orange follicles were connected by a long pedicle to the ovary.

Nester et al.,[29] reported in quail that ovarian follicle number and weight of ovary were influenced by body weight but not by the concentration of yolk. Kimaro[14] found that the ovary contained between 25 to 30 follicles; with diameter of the largest follicle from 11 to 19mm. white and yellow-yolk follicles, with latter more predominant in ostrich. Parizzi et al.,[16] observed 72.4±17.09 follicles in different stages of development and 30.4±3.65 atretic follicles in ovary of Rhea. Reed jr et al.,[18] measured the follicular size from 3.0 to 12.0mm in diameter in Emu.

Hassan et al.,[30] analyzed that ovarian follicular diameter was divided into 3 groups ranging 1-2mm, 2-4mm and 4-6mm in 3 physiological condition of the hen. At 23rd week of age before laying condition, all the follicles were less than 1mm. However at 28week of age, greater number of follicles was of 1-2mm in diameter. During laying condition, mean number of follicles increased in all the 3 groups of diameter at 32nd week of age. At 36th week, a decline in mean number of follicles was observed in two groups of diameter but not in third (4-6mm) group. Highest mean number of follicles was observed in all diameter groups. All the 3 groups showed decline in mean number of follicles after 40th week. During broody condition, follicles ranging 1-2mm was observed in all age groups from 32nd-53rdweeks.

Bala et al.,[22] reported that all age groups showed follicles representative to 2-4mm diameter excepting 36th week. Decrease in mean number of follicles was observed in 1-2mm at 40th week of age and in 2-4mm at 32nd week of age. Increase in mean number of follicles was observed in higher age groups with the highest mean number of follicles seen in 48th week of age. In all the age groups studied, three types of follicles viz. small (2-4mm), medium (6-9mm) and large (14-19mm) were found. The number of small follicles (2-4mm) was 32.33±0.611 at 8weeks, 25.33±0.8 at 16weeks, 13.5±0.77 at 24weeks and 6±0.47 at 30weeks. The number of medium follicles (6-9mm) was 4.66±0.3 at 8weeks, 7.66±0.38 at 16weeks, 8.66±0.47 at 24weeks and 5.33±0.51 at 30weeks. The number of large follicles (14-19mm) was 21.66±0.28 at 16weeks, 4.83±0.28 at 24weeks and 3.33±0.192 at 30weeks. The present study showed that with increasing body weight of Punjab white quail the number and size of follicles increased.

Banerjee et al.,[13] reported in Rhode Island Red breed of poultry that very slow increase in weight of ovary was observed from 10th week to 18th week, but the rate was heigher after 18th week due to endocrinological and other factors. Weight of the ovary was within range of 0.3 to 0.45g in immature stage. Banerjee et al.,[17] observed in postnatal developing hen that average weight of ovary as 0.392±0.06g at 8th week, 0.441±0.03g at 12th week, 0.50±0.01g at 16th week and 19.23±1.09g at 20th week, respectively.

Claver et al.,[25] analyzed that ovary of spotted tinamous was 0.09g during resting stage, 0.12g during developing stage, 0.54g during reproductive stage and 0.19g during involutive stage. Kigir et al.,[31] reported that ovary was 0.0334g at 1 week, 0.0421g at 2weeks, 0.0640g at 4weeks, 0.0576g at 11weeks, 0.0773g at 12weeks, 0.1565g at 13weeks and 0.2552g at 14weeks of age in female domestic pigeon.

Hassan et al.[30] reported that ovary was 558±438 mg before laying, 4.044±0.211g during laying and 1.2208±0.125g during broody condition, at 32nd week of age. However, Oladehinde[20] found that the ovary was 0.381±0.123g in Japanese quail.

Shyam et al.[28] reported that mean weight of ovary, was 35.5mg and 39 mg in group I (2weeks), 0.52g and 0.97g in group II (5months) and 18.04g and 18.07g in group III (13months), in Aseel and Rhode Island Red breed of poultry. However, Deka et al.,[21] reported that the weight of ovary was significantly higher in Chara-Chemballi duck (88.22±0.52g) than Pati (13.90±0.25g).However, Bala et al.,[22] found that the mean body weight of quail was 256.6±8.05g at 8weeks, 278.3±5.48g at 16weeks, 315±16.7g at 24weeks and 281.66±7.23g at 30weeks and the mean weight of ovaries were 0.192±0.023g at 8weeks, 0.428±0.07g at 16weeks, 5.51±0.79g at 24weeks, 2.682±0.28g at 30weeks.

Kimaro[14] reported that ovary was 5 to 7cm in length in ostrich. Banerjee et al.,[17] observed in postnatal developing hen that average length of ovary was 1.12±0.52cm at 8th week, 1.26±0.036cm at 12th week, 1.39±0.0137cm at 16th and 2.62±0.124cm at 20th week. Claver et al.,[25] analyzed that ovaries of Spotted Tinamous were 11.75mm during resting, 12.88mm during developing stage, 19.27mm during reproductive stage and 14.81mm during involution stage, respectively. Reed jr et al.[18] reported in Emu that mean length of ovary as 7.97±0.76 cm. However, Deka et al.[21] found that mean length of left ovary was significantly higher in Chara-Chemballi duck (9.83±0.37cm) than Pati (3.51±0.10cm).The average length of ovary was 1.42±0.098cm at 8weeks, 1.46±0.1cm at 16weeks, 2.28±0.086cm at 24weeks and 2.21±0.079cm at 30weeks.

Gonzalez-Moran[9] reported that left ovary of chicken showed marked increase in total ovarian volume with age from 8 day old chicken embryo to 4week old chicken and maximum volume was increased during last stage. Bala et al.,[22] reported that the average length of ovary was 1.42±0.098cm at 8weeks, 1.46±0.1cm at 16weeks, 2.28±0.086cm at 24weeks and 2.21±0.079cm at 30weeks.

Conclusion

It is concluded from the review that only left ovary was found in all the birds studied. The ovary was situated on cranio-dorsal part of abdominal cavity close to midline, ventral to aorta and caudal vena cava and was close to last two ribs. The ovary was ovoid in shape

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with granular surface and was covered by protruding follicles (both healthy and atretic follicles) at 8weeks. The follicles were more on lateral and ventral aspect than the dorsal side. Small follicles were more in number as compared to large size follicles with few yellow yolk healthy follicles. At 16weeks, ovary became irregular and grayish yellow in color. At 24weeks**,** the ovary was yellow to brown and resembled the bunch of grapes. In this age group medium to large follicles were more and small size follicles had greatly reduced in number. At 30weeks**,** ovary became irregularly lobulated as it had numerous ova in cortex. With the advancing age of Punjab white quail, large follicles increased and were maximum at 24weeks of age. It was observed that weight, length and volume of ovary increased with age.

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Conflicts of interest

The author declares no conflicts of interest.

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