RESEARCH ARTICLE Indian Journal of Animal Research, Volume 59 Issue 10: 1765-1772 (October 2025)

Comparative Macro Anatomical Studies on the Female Reproductive System of Kamrupa Variety and Indigenous Chicken (*Gallus domesticus*) of Assam during Different Stages of Laying

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10.18805/IJAR.B-4850

ABSTRACT

Background: The study was carried out to understand the anatomical details of the female reproductive system of the indigenous chicken of Assam and Kamrupa variety during the different stages of laying period namely, the pre-laying, laying and post-laying period.

Methods: The study was designed on 36 numbers of apparently healthy female chicken in each group as Experimental Group A (indigenous chicken of Assam) and Experimental Group B {Kamrupa variety, AICRP (PB)} which were further divided into 3 sub-groups *viz.,* pre-laying, laying and post-laying birds. Comparative gross anatomical parameters were undertaken. The birds were sacrificed as per the technique advocated by Gracey (1986) according the research age group. The abdominal cavity of each experimental bird was opened and anatomic location and relative *in-situ* topographic position of the female reproductive organs and biometrical parameters were recorded.

Result: Average weight of entire reproductive system of Kamrupa variety (58.24±8.47 gm) was significantly higher than indigenous chicken of Assam (27.28±4.25 gm, p<.001). Average weight of the ovary of Kamrupa (laying: 54.91±4.92 gm, post laying: 6.53±0.33 gm) was significantly higher than that indigenous one (laying: 29.2±0.76 gm; post-laying: 2.26±0.24 gm, p<0.05). Relative mean length of the oviduct of Kamrupa variety (laying: 753.73±4.25 mm; post-laying: 576.49±5.27 mm) was significantly greater than indigenous chicken of Assam (laying: 358.91±3.63 mm; post-laying: 278.84±15.48 mm, p<0.05) respectively.

Key words: Gross anatomy, Indigenous chicken, Kamrupa variety, Reproductive system, Stages of laying.

INTRODUCTION

The poultry production strategy and action plan 2022 aims at enabling the doubling of farmers' income to fulfil its objective of protein enriched food requirement of the growing population of our country and to prevent malnutrition to the malnourished children and to achieve 2 per cent of the world egg market trade through exports. Hence, poultry plays an important role in the economics of our country.

During the different stages of development in ovary, each ovisac contained yolk and the oocyte of the egg in chicken. They were round in shape with varying sizes attached firmly at the base of the ovary through a serous pedicle named stalk (Blendea *et al.,* 2012). Whereas the ovaries were arranged as a cluster of follicles of 2-4 cm in diameter with some small yellow follicles of 2 to 10 mm of four to six large yolk-filled follicles and had left functional oviduct, which was a long highly convoluted musculo-tubular structure that occupied a large part of abdominal cavity and comprised of five parts namely; infundibulum, magnum, isthmus, uterus (shell gland) and vagina in the Kashmir faverolla birds (Wani *et al.,* 2017). The chalaziferous layer of albumen is secreted by the infundibulum and the albumen is secreted by the tubular gland of magnum. The outer shell membrane is formed in isthmus and plumping of egg occurs in uterus (King and McLelland, 1975). The isthmus of domestic fowl was marked by a distinct colour change from off-white to brown and which extended from the magnum to the tubular shell gland *i.e*. the uterus (Solomon, 2007). During laying period the whole length of the oviduct was voluminous and recorded to be 33-59 cm and the oviduct was related rostrally to the ovary, caudally to the cloaca, dorsally to the left kidney, ventrally to the gizzard and the small intestine and to the colon from the right side. Two peritoneal folds namely dorsal and ventral oviductal ligaments kept the oviduct in position (Mahmoud *et al*., 2018). The infundibulum of hen at the age of 150 days, 180 days and 210 days, weighed 0.87±0.14 gm,

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How to cite this article: Sangma, M.M., Choudhury, K.B.D., Sarma, M., Kalita, N. and Deka, A. (2025). Comparative Macro Anatomical Studies on the Female Reproductive System of Kamrupa Variety and Indigenous Chicken (*Gallus domesticus*) of Assam during Different Stages of Laying. *Indian Journal of Animal Research*. **59(10):** 1765-1772. doi: 10.18805/IJAR.B-4850.

Submitted: 21-12-2021 **Accepted:** 04-06-2022 **Online:** 14-07-2022

0.87±0.16 gm and 1.0±0.3 gm with a length of about 9.0±0.7 cm, 9.2±0.2 cm and 9.7±0.8 cm respectively (Khokhlov, 2008). A proper scientific study is very important to identify the morphological characteristics of the ovary and its associated female genital system by gross morphological observation. Therefore, the present study was carried out to explore the comparative gross anatomical details of the female reproductive system of the indigenous chicken of Assam and Kamrupa variety during different stages of laying namely, the pre-laying, laying and post-laying period.

MATERIALS AND METHODS

The investigation was designed on a total of 72 numbers of apparently healthy female chickens after approval of Institutional Animal Ethics Committee (Approval No. 770/ GO/Re/S/03/CPCSEA/FVSc/AAU/IAEC/19-20/729 dated 23/ 12/2019),CVSc, Assam Agricultural University, Khanapara. These 72 chickens were divided into two groups as Experimental Group A (Indigenous chicken of Assam) and Experimental Group B {Kamrupa variety of All India Coordinated Research Project, AICRP (Poultry Breeding, PB)} which were again categorized into 3 (three) sub-groups comprising 12 chicken in each group: pre-laying, laying and post-laying. Sixty (60) apparently healthy female day old chicks from each group were raised. In the present research the experimental birds were selected as per the report of Sarma *et al.* (2017). The pre-laying group selected was just one week before laying, laying group selected was during the first laying cycle and post-laying period group selected was one week after laying period was over. The birds were sacrificed as per the technique advocated by Gracey (1986). The abdominal cavity of each experimental bird was opened by making a ventro-median incision without disturbing the normal topography of the organs. The gross anatomical disposition and relative *in-situ* topographic position of the female reproductive organs were recorded. The weight (g) of the ovary and the length (mm), breath (mm) and diameter (mm) of different parts of female reproductive system of experimental birds were recorded with pan balance and vernier callipers. The different data of gross anatomical parameters were analyzed by standard statistical methods advocated by Snedecor and Cochran (1989). For difference between the breeds were tested by independent sample t-test for each stage namely, pre-laying, laying and post-laying and the stages within a breed was tested by one-way ANOVA and Tukey's HSD test.

RESULTS AND DISCUSSION

In the present study the female reproductive system of both indigenous chicken of Assam and Kamrupa variety showed only the left oviducts each of which was a single distinct tubular muscular structure situated in the caudo-dorsal aspect of the body cavity. The oviduct was located caudal to the left ovary, cranial to the cloaca, ventral to the left kidney and dorsal to the alimentary tract. The oviduct consisted of five segments *viz.* infundibulum, magnum, isthmus,



Fig 1: Photograph showing a) the different stages of follicles in the ovary of laying indigenous chicken; mature follicle (MF) with vascularization, secondary follicles (SF), primary follicle (PF), infundibulum (pointer) and uterus (UT) having cranial short part (red arrow) and caudal pouch like part (blue arrow) in indigenous chicken b) different stages of developing and vascularized mature follicles connected to the ovary by a stalk (arrow) in laying Kamrupa variety c) ovary with follicles (black arrow), infundibulum (in), magnum (MG), isthmus (IS), uterus (UT), vagina (VG) and utero-vaginal sphincter (red arrow) in pre laying Kamrupa variety d)mature ovum with yolk (arrow) captured with funnel shaped (f-IN) and tubular part of the infundibulum (t-IN) in laying Kamrupa variety.

uterus(shell gland)and vagina (Fig 1c). During the laying period the ovary of both the indigenous chicken of Assam and Kamrupa variety consisted of clusters of developing follicles (Fig 1a, 2c) (follicles ranging from 4.00 to 28.00 mm) connected to the surface of ovary by respective stalks and resembled a bunch of grapes (Fig 1b). The follicles were highly vascularised. The mean weight of ovary (Table 1) were recorded as 29.2±0.76 gm and 54.91±4.92 gm during the laying period in the Indigenous chicken of Assam and Kamrupa variety. Comparatively, the mean weight and volume of the ovary of Kamrupa variety was significantly higher ($p<.001$) than that of the indigenous chicken of Assam (Fig 3C,D). During the post laying period on gross observation regressed and atretic follicles were observed in ovary of Kamrupa variety and indigenous chicken of Assam (Fig 2a,b).

The infundibulum was divided into two parts, the funnel shaped part which carried the released ovum and the tubular

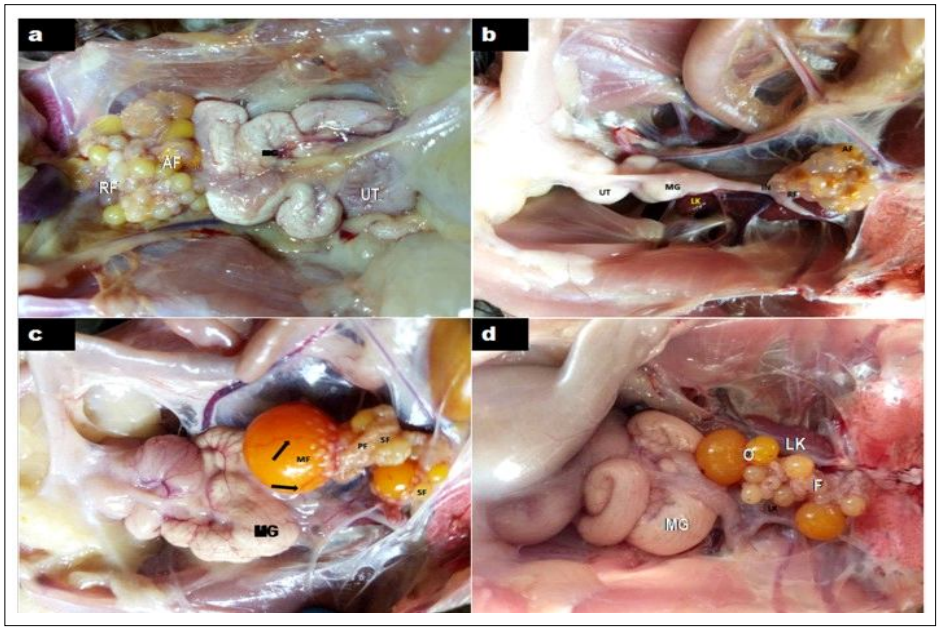


Fig 2: Photograph showing *In-situ* position of the female reproductive system a) different stages of follicles in the ovary of post laying Kamrupa variety; magnum (MG), regressed follicle (RF) and atretic follicle (AF) b) regressed follicle (RF), atretic follicle (AF), ventral to the left kidney (LK), infundibulum (IN), magnum (MG) and uterus (UT) in post-laying indigenous chicken c) magnum (MG), mature follicle (MF) with vascularization (ARROW), secondary follicles (SF) and primary follicle (PF) in laying indigenous chicken d) ovary (O) to the ventral aspect of the left kidney (LK) with different stages of developing follicles (F) in pre-laying Kamrupa variety.

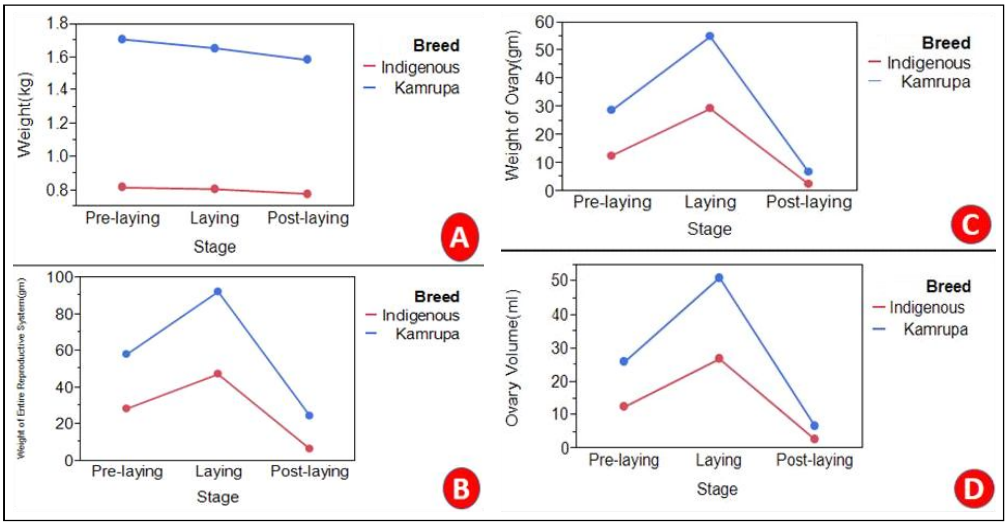


Fig 3: Graph depicting the comparative average (A) body weight (kg), (B) weight of entire reproduction system (gm), (C) weight of ovary (gm) and (D) volume of ovary (ml) of indigenous chicken of Assam and Kamrupa variety, during the pre-laying, laying and post-laying period.

part (Fig 1d). In the present study the average length of the infundibulum was recorded as 50.22±1.93 mm and 175.92 ±0.29 mm during the laying period in indigenous chicken and Kamrupa variety. The average length of the infundibulum was significantly higher in the Kamrupa during laying 175.92±0.29 mm and lowest in the indigenous chicken of Assam during its pre-laying stage 42.16±1.02 mm ($p<0.001$). This was depicted in Fig 4-B. The longest segment of the oviduct, the magnum, recorded average length as 119.61± 5.68 mm in Indigenous chicken and 268.13±16.64 mm in Kamrupa variety. The mean length of magnum during the laying period was 135.03±4.6 mm and 331.97±0.07 mm in the Indigenous chicken of Assam and Kamrupa variety respectively. The magnum was a roughly convulated structure (Fig 2 a,c,d) and the present study revealed that the length of the magnum was significantly higher ($p<0.01$) during the laying period in comparison to the post-laying period in both the groups (Table 2 and Fig 4C), which may have been possible due to inactivity of the organ. The slightly constricted segment of the oviduct in the mid-section the isthmus, was a narrow tubular structure (Fig 1c), light reddish in colour observed in both the indigenous chicken of Assam and Kamrupa variety. The total average length recorded as 67.26±3.59 mm in Indigenous chicken and 102.55±6.6 mm in Kamrupa variety. The mean length and diameter in the indigenous chicken of Assam and Kamrupa variety (Table 2 and 3) were 76.14±0.72 mm and 3.56±0.58 mm and 87.14 ± 18.4 mm and 6.16±0.7 mm during the pre-laying period, were 76.95±1.65 mm and 4.37±0.21 mm and 118.74±0.79 mm and 6.69±0.65 mm during the laying period and were 48.68±4.93 mm and 4.02±0.12 mm and 101.77±2.29 mm and 5.95±0.37 mm respectively during the post-laying period. The present study revealed that the length of the isthmus was longer during the laying period in comparison to the post-laying period and found to be significant in indigenous chicken ($p<0.001$), which may be due to inactivity of the organ, presented in Fig 4D. The shell gland containing uterus of both Indigenous chicken of Assam and Kamrupa variety was the dilated muscular portion of the oviduct (Fig 1a). The mean length of the uterus (Table 2) of the indigenous chicken of Assam and Kamrupa variety during pre-laying, laying and post laying periods were 40.36±1.83 mm and 45.04±6.9 mm, 43.75±0.1 mm and 60.89±1.48 mm and 26.03±1.41 mm and 45.52±1.21 mm respectively (Fig 4E).

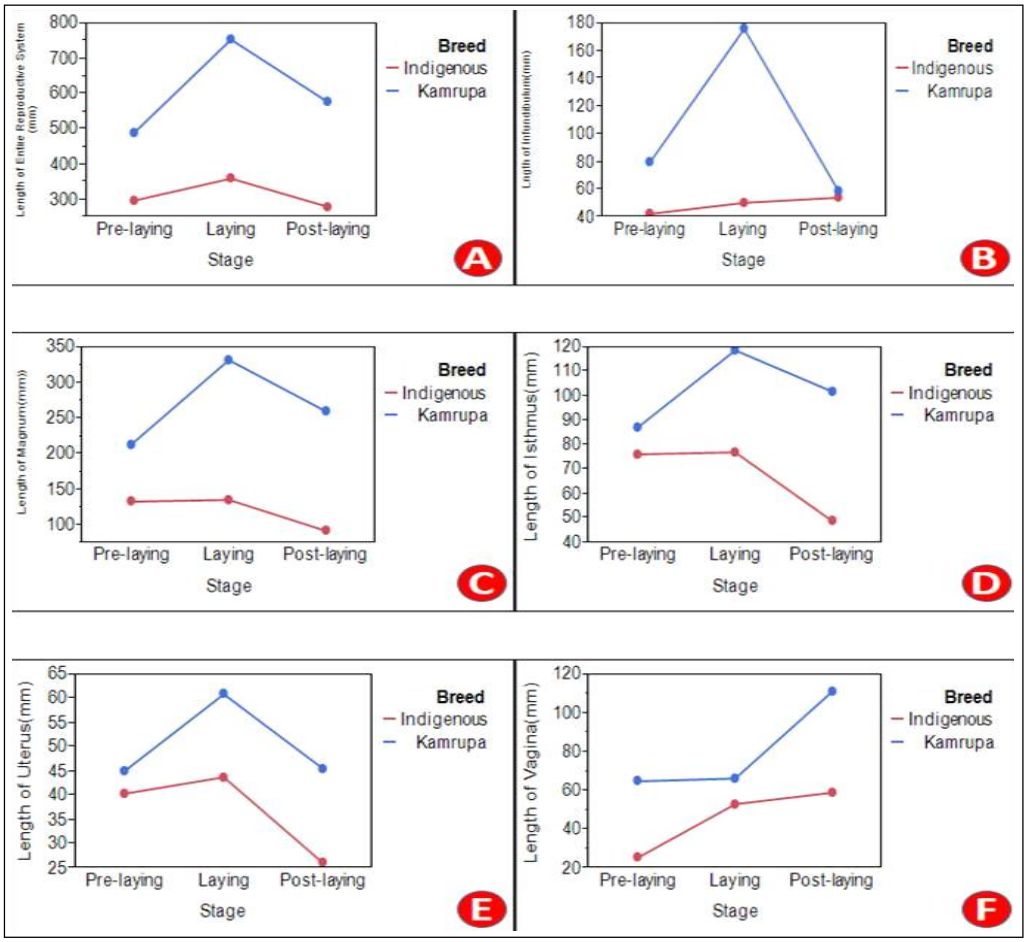


Fig 4: Graph presenting the average length of (A) the entire female reproductive tract, (B) infundibulum, (C) magnum, (D) isthmus, (E) uterus and (F) vagina of the indigenous chicken of Assam and the Kamrupa variety during the pre-laying, laying and post-laying period.

The vagina was a musculo-tubular structure, cranially related to the uterus by the vaginal sphincter (Fig 1c) and caudally connected to the urodeum of the cloaca in both the indigenous chicken of Assam and Kamrupa variety. In the present study the mean length (Table 2) of the vagina in the Indigenous chicken of Assam and Kamrupa variety were 25.3±2.35 mm and 64.75±12.98 mm during pre-laying period, 52.96± 0.66mm and 66.22±2.18 mm laying period and 58.94±3.18mm and 111.28±0.37 mm during post-laying period respectively. The mean diameter of the vagina (Table 3) in the Indigenous chicken of Assam and Kamrupa variety were 5.08±0.3 mm and 5.28±0.44 mm pre-laying period, 6.08±0.24 mm and 6.27±0.12 mm laying period and 4.98±0.15 mm and 3.61±0.18 mm post-laying period respectively. The increase in the mean length of the vagina during and after laying might be due to repeated dragging of the egg through the vagina and the difference in length between different varieties was probably due to age and breed variation of the birds (Fig 4F).

In the present study the female reproductive system of both indigenous chicken of Assam and Kamrupa variety at maturity consisted of the functional left ovary and oviduct, which is in agreement with the findings of Mc Lelland (1990). The ovarian follicles were highly vascularized and this was in concurrence to the findings of Wani *et al.* (2017) in Kashmir faverolla chicken. In the present study, the ovarian follicles were rounded yellowish structure containing the ova along with the yolk and the mature follicles were connected to the ovary by a stalk which was in accordance with Blendea *et al.* (2012) who reported that during the different stages of development of ovary each ovisac contained yolk and the oocyte in chicken, which firmly attached at the base of the ovary through a serous pedicle. In the present study, the mean weight of ovary were recorded as 29.2±0.76 gm and 54.91±4.92 gm during the laying period in the Indigenous chicken of Assam and Kamrupa variety. However, McLelland (1990) found 60 gms in laying birds from 18-21 weeks. The variation in the weight of the ovary in the indigenous chicken of Assam might be due to the smaller body size in the native breed, or because of early sexual maturity which were in accordance with the observation of Deka *et al.* (2015) who reported that the mean value of length, breadth, thickness and weight of Chara-Chemballi ducks were significantly higher than the Pati ducks. Beginning with the funnel shaped infundibulum and its tubular part which were responsible for capturing the released ovum in accordance with Blendea *et al.* (2012) in chicken; Wani *et al.* (2017) in Kashmir faverolla chicken and Dyce *et al.* (1987) in avians. Mahmoud *et al.* (2018) reported that the infundibulum of Egyptian Balady duck during the laying cycle measured about 4-8 cm in length and divided into two parts, the funnel and tubular part. Similar findings were also recorded by Wani *et al.* (2017)

Table 1: The average live body weight, weight of the entire reproductive system, weight of ovary and the volume of the ovary of the indigenous chicken of Assam and the Kamrupa variety during the pre-laying, laying and post laying period.

Gross parameters	Experimental groups	Mean±SE			(With in group)	
		Pre-laying	Laying	Post-laying	p-value	Level of significant
Body weight (kg)	Indigenous	$_{A}0.81\pm0.001^{A}$	$_{A}0.80\pm0.02^{A}$	$_{A}0.78\pm0.03^{A}$	.467	NS
	Kamrupa	$_{A}1.71\pm0.07^{B}$	$_{A}1.66\pm0.09^{B}$	$_{A}1.58\pm0.06_{B}$	.496	NS
(Between groups) p-value		<.001	<.001	<.001		
Level of significant		***	***	***		
Weight of entire reproductive system (gm)	Indigenous	$_{B}28.27\pm4.02^{A}$	$_{C}47.15\pm1.16^{A}$	$_{A}6.43\pm0.50^{A}$	<.001	***
	Kamrupa	$_{AB}57.96\pm15.66^{A}$	$_{B}92.25\pm5.24^{B}$	$_{A}24.51\pm0.65^{B}$	.001	**
(Between groups) p-value		.096	<.001	<.001		
Level of significant		NS	***	***		
Weight of ovary (gm)	Indigenous	$_{B}12.48\pm2.46^{A}$	$_{C}29.2\pm0.76^{A}$	$_{A}2.26\pm0.24^{A}$	<.001	***
	Kamrupa	$_{B}28.61\pm8.96^{B}$	$_{C}54.91\pm4.92^{B}$	$_{A}6.53\pm0.33^{B}$	<.001	***
(Between groups) p-value		.113	<.001	<.001		
Level of significant		NS	***	***		
Volume ovary (ml)	Indigenous	$_{B}12.42\pm2.01^{A}$	$_{C}26.83\pm0.79^{A}$	$_{A}2.72\pm0.28^{A}$	<.001	***
	Kamrupa	$_{A}25.83\pm8.21^{A}$	$_{B}51.17\pm3.93^{B}$	$_{A}6.75\pm0.34^{B}$	<.001	***
(Between groups) p-value		.143	<.001	<.001		
Level of significant		NS	***	***		

Note: Subscript A, B, C before mean±SE of a parameter to be seen row-wise separately. Superscript A, B after mean±SE of a parameter to be seen column-wise separately. Subscript/Superscript not similar within a parameter is significantly different (P<.05). ^{NS}Not significant, *Significant at P (<.05), **Significant at *P* (<.01), ***Significant at *P* (<.001).

in the native chicken of Kashmir. However, Caceci (2015) reported that the size of the infundibulum was proportional to the size of the egg and the opening could be expanded. Likewise, Khokhlov (2008) also documented that the length of the infundibulum around 150 days, 180 days and 210 days were 9.0±0.7 cm; 9.2±0.2 cm and 9.7±0.8 cm and which was in agreement with the present study in indigenous chicken of Assam where the length increased with age. The reduced length of infundibulum in post-laying Kamrupa was probably due to functionally inactive stage of the organ. The magnum was a roughly coiled or convoluted tubular structure with longitudinal folds covered by a translucent membrane with a mean length of 135.03±4.6 mm and 331.97±0.07 mm in the Indigenous chicken of Assam and Kamrupa variety. This was in accordance with Dyce *et al.* (1987) and Wani *et al.* (2017) in native chicken of Kashmir. The magnum of Egyptian Balady duck was the longest thick and creamy part of the oviduct which was convoluted and attached by dorsal and ventral oviductal ligament with average length of about 15-25 cm (Mahmoud *et al.,* 2018). The present study revealed that the length of the magnum was significantly higher ($p<0.01$) during the laying period in comparison to the post-laying period in both the groups which might be due to functional inactivity of the organ. Mohammadpour *et al.* (2012) reported that the mean length of isthmus were 14.05±4.34 cm and 12.18±3.36 cm in hen and duck at the age of 1-1.5 years. The mean length and weight of the isthmus was 7.68±3.46 cm and 2.78±0.574 gm

Table 2: The average length of the entire female reproductive tract along with individual segments of the indigenous chicken of Assam and the Kamrupa variety during the pre-laying, laying and post laying period.

Gross parameters (Length in mm)		Experimental groups	Mean±SE			(With in group)	
			Pre-laying	Laying	Post-laying	p-value	Level of significant
Entire female reproductive tract		Indigenous	$_{A}296.38±16.79^{A}$	$_{B}358.91±3.63^{A}$	$_{A}278.84±15.48^{A}$	.002	**
		Kamrupa	$_{A}489.36±85.31^{A}$	$_{C}753.73±4.25^{B}$	$_{AB}576.49±5.27^{B}$	.006	**
(Between groups)	p-value		.051	<.001	<.001		
	Level of significant		NS	***	***		
Infundibulum		Indigenous	$_{A}42.16±1.02^{A}$	$_{AB}50.22±1.93^{A}$	$_{B}53.92±4.35^{A}$	.028	*
		Kamrupa	$_{A}79.4±12.18^{B}$	$_{B}175.92±0.29^{B}$	$_{A}58.54±0.88^{A}$	<.001	***
(Between groups)	p-value		.012	<.001	.322		
	Level of significant		*	***	NS		
Magnum		Indigenous	$_{B}132.54±0.53^{A}$	$_{B}135.03±4.6^{A}$	$_{A}91.26±8.14^{A}$	<.001	***
		Kamrupa	$_{A}213.04±37.14^{A}$	$_{B}331.97±0.07^{B}$	$_{AB}259.39±2.59^{B}$	.005	**
(Between groups)	p-value		.055	<.001	<.001		
	Level of significant		NS	***	***		
Isthmus		Indigenous	$_{B}76.14±0.72^{A}$	$_{B}76.95±1.65^{A}$	$_{A}48.68±4.93^{A}$	<.001	***
		Kamrupa	$_{A}87.14±18.4^{A}$	$_{A}118.74±0.79^{B}$	$_{A}101.77±2.29^{B}$	.148	NS
(Between groups)	p-value		.564	<.001	<.001		
	Level of significant		NS	***	***		
Uterus		Indigenous	$_{B}40.36±1.83^{A}$	$_{B}43.75±0.1^{A}$	$_{A}26.03±1.41^{A}$	<.001	***
		Kamrupa	$_{A}45.04±6.9^{A}$	$_{B}60.89±1.48^{B}$	$_{A}45.52±1.21^{B}$	.025	*
(Between groups)	p-value		.527	<.001	<.001		
	Level of significant		NS	***	***		
Vagina		Indigenous	$_{A}25.3±2.35^{A}$	$_{B}52.96±0.66^{A}$	$_{B}58.94±3.18^{A}$	<.001	***
		Kamrupa	$_{A}64.75±12.98^{B}$	$_{A}66.22±2.18^{B}$	$_{B}111.28±0.37^{B}$	.001	**
(Between groups)	p-value		.014	<.001	<.001		
	Level of significant		*	***	***		

Note: Subscript A, B, C before mean ± SE of a parameter to be seen row-wise separately. Superscript A, B after mean ± SE of a parameter to be seen column-wise separately. Subscript/Superscript not similar within a parameter is significantly different (P<.05). ^{NS}Not Significant, * Significant at P (<.05), **Significant at P (<.01), ***Significant at P (<.001).

Table 3: The mean diameter of certain segments of female reproductive tract of the indigenous chicken of Assam and the Kamrupa variety during the pre-laying, laying and post laying period.

Gross parameters (Diameter in mm)		Experimental groups	Mean ±SE			(With in Group)	
			Pre-laying	Laying	Post-laying	p-value	Level of significant
Infundibulum		Indigenous	$_{A}1.2\pm0.05^{A}$	$_{AB}1.74\pm0.08^{A}$	$_{B}1.9\pm0.29^{A}$	.031	*
		Kamrupa	$_{A}4.8\pm0.8^{B}$	$_{A}4.48\pm0.22^{B}$	$_{A}4.38\pm0.04^{B}$	.809	NS
(Between groups)	p-value		.001	<.001	<.001		
	Level of significant		**	***	***		
Magnum		Indigenous	$_{B}6.33\pm0.54^{A}$	$_{B}7.12\pm0.27^{A}$	$_{A}4.13\pm0.19^{A}$	<.001	***
		Kamrupa	$_{AB}9.57\pm1.63^{A}$	$_{B}10.03\pm0.69^{B}$	$_{A}6.24\pm0.17^{B}$	.039	*
(Between groups)	p-value		.089	.003	<.001		
	Level of significant		NS	**	***		
Isthmus		Indigenous	$_{A}3.56\pm0.58^{A}$	$_{A}4.37\pm0.21^{A}$	$_{A}4.02\pm0.12^{A}$	.314	NS
		Kamrupa	$_{A}6.16\pm0.7^{B}$	$_{A}6.69\pm0.65^{B}$	$_{A}5.95\pm0.37^{B}$	.673	NS
(Between groups)	p-value		.017	.007	.001		
	Level of significant		*	**	**		
Vagina		Indigenous	$_{A}5.08\pm0.3^{A}$	$_{B}6.08\pm0.24^{A}$	$_{A}4.98\pm0.15^{A}$	.009	**
		Kamrupa	$_{B}5.28\pm0.44^{A}$	$_{B}6.27\pm0.12^{A}$	$_{A}3.61\pm0.18^{B}$	<.001	***
(Between groups)	p-value		.711	.503	<.001		
	Level of significant		NS	NS	***		

Note: Subscript A, B, C before mean±SE of a parameter to be seen row-wise separately.

Superscript A, B after mean±SE of a parameter to be seen column-wise separately. Subscript/Superscript not similar within a parameter is significantly different (*P*<.05).

NSNot Significant, * Significant at *P* (<.05), **Significant at *P* (<.01), ***Significant at *P* (<.001).

respectively at 8-11 months old chicken (Mishra *et al.,* 2014). Wani *et al.* (2017) reported that in chicken of Kashmir, the isthmus was with thin folds. The present study revealed that the length of the isthmus was longer during the laying period in comparison to the post-laying period and which was significant in indigenous chicken (p<0.001). The uterus of both Indigenous chicken of Assam and Kamrupa variety was the dilated muscular portion of the oviduct with visible longitudinal folds internally, which were in concurrence with Wani *et al.* (2017) in native chicken of Kashmir and Mahmoud *et al.* (2018) in Egyptian Balady Duck. The mean length of the uterus in the indigenous chicken of Assam and Kamrupa variety during different stages of laying was in concurrence with the findings of Mahmoud *et al.* (2018) who reported that the uterus measured about 4-9 cm during laying in Egyptian Balady duck. Mishra *et al.* (2014) also reported that the length and weight of uterus was 6.10±2.80 cm and 6.80±1.32 gm respectively at 8-11 months old chicken. The difference in length between different varieties was probably due to age and breed variation of the birds. Wani *et al.* (2017) reported that the vagina was separated from the uterus by the utero-vaginal sphincter muscle in native chicken of Kashmir. In the present findings, a constricted portion like sphincter at the utero-vaginal junction was recorded. The vagina was the last segment observed which connected the uterus to cloaca, total average length recorded as 45.73±3.77 mm in indigenous chicken and 80.75±6.67 mm in Kamrupa variety. Mahmoud *et al.* (2018), reported that the vaginal length measured about 3-5 cm in Egyptian Balady Duck. Mohammadpour *et al.* (2012) recorded that the mean length of the vagina of hen and duck at the age of 1-1.5 years were 6.10±2.10 cm and 6.62±1.13 cm. The increase in the mean length of the vagina during and after laying might be due to repeated dragging of the egg through the vagina and the difference in length between different varieties was probably due to age and breed variation of the birds.

CONCLUSION

The mean weight of the entire reproductive system, average weight of the ovary, relative mean length of the oviduct and average diameter of segments of reproductive system of Kamrupa variety was significantly higher than that of the Indigenous chicken of Assam. Therefore, the thorough knowledge of gross anatomy of female reproductive system of Kamrupa variety and indigenous chicken (*Gallus domesticus*) of Assam will be elucidating its role in physiology, histopathology and endocrinology for effective production. This study will be helpful to the poultry scientist, pathologist, physiologist and microbiologist for diseases control regime.

ACKNOWLWDGEMENT

The authors are grateful to honourable Director of PG Studies, Assam Agricultural University and Dean, CVSc, AAU, Khanapara for providing necessary facility to carry out this research work.

Conflict of interest

All authors declare that they have no conflict of interest.

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