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Biometrical and histological study of reproductive organs of indigenous cattle in Bangladesh

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ABSTRACT

Reproductive anatomy is vital for successful reproductive management and has significance for application of assisted reproductive biotechnology. This study was carried out to characterize biometrically and histologically reproductive organs of 50 slaughtered female cattle (<3 years; n=25, 3 to ≤5 years; n=25). The measurements (length, weight and width) of the right segment of the studied reproductive organs were greater compared to the left segment. No significant difference (p>0.05) was observed between left and right ovary length, width and weight within and between age groups. The length of ovaries were 1.92±0.19 cm and 1.95±0.04 cm at <3 years; 2.16±0.21 cm and 2.17±0.19 cm at 3 to ≤5 years; width were 1.09±0.14 cm and 1.17±0.10 cm at <3 years and 1.31±0.10 cm and 1.46±0.11 cm at 3 to ≤5 years and the weight were 1.77±0.41 gm and 2.20±0.57 gm at <3 years; 1.79±0.45 gm and 2.54±0.14 gm at 3 to ≤5 years in the left and right ovaries, respectively. Oviduct length, width and weight did not differ significantly (p>0.05) between the left and right oviducts within and between the age groups. Oviduct length (16.36±0.78 and 17.58±0.97 cm), width (0.21±0.02 and 0.26±0.33 cm) and weight (0.72±0.03 and 0.81±0.11 gm) was found for the right oviduct at <3 years and 3 to ≤5 years and for left oviduct length, width and weight were 16.20±0.65 and 16.64±0.86 cm; 0.19±0.02 and 0.23±0.03 cm; and 0.69±0.04 and 0.79±0.13 gm, at <3 years and 3 to ≤5 years, respectively. However, uterine horn length differed significantly (p<0.05) between age groups in the left (16.18±1.18 vs 27.45±2.98 cm) and the right horn of the uterus (17.45±1.40 cm vs 28.35±2.88 cm). On the other hand, uterine horn width and weight were not differed significantly between the left and right segments within and between the age groups. Uterus body length and weight were significantly (p<0.05) higher at 3 to ≤5 years compared to <3 years old cow. The average weight, length and width of uterine body were 44.40±7.33 gm vs 21.49±5.91 gm; 7.89±0.61 cm vs 5.87±0.43 cm; 3.46±0.27 cm vs 2.76±0.34 cm at <3 years and 3 to ≤5 years, respectively The whole uterus weight was also differed significantly (p<0.05) at <3 years (47.18±14.92 gm) and 3 to ≤5 years (86.07±11.98 gm). Histological studies showed ideal characteristics of cattle oviduct and uterus. In nutshell, the right ovary was larger in length, wider in diameter, and heavier in weight as compared to left one in indigenous cattle of Bangladesh.

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INTRODUCTION

Bangladesh is mainly an agricultural country of which agriculture sector plays an important role for accelerating the overall growth of economy (DLS, 2017). Livestock is one of the important components of agriculture, playing a very important role in the agricultural economy of Bangladesh (DLS, 2020). Among the livestock, cattle are important source of milk and meat in the whole world. It plays an important role not only in the rural economy but also in the national economy of Bangladesh.

The main goal of farmers is to get one calf per year. Regular and successful reproduction is the key to profitable livestock production. High reproductive efficiency is an important factor for achieving maximum return from the animal. The reproductive performance depends upon the normal structure and functions of genital organs of an animal (Siddiqui *et al.,* 2005). Any structural and functional abnormalities in reproductive system may interrupt animal reproduction (Khaton *et al.,* 2015a). In cattle, the reproductive disorders can results in monetary losses in terms of decreased fertility, longer interval of calving and higher expense on treatment purpose in farms (Samad *et al.,* 1987). When enough information will be available about reproductive organs of cattle then these disorders and problems could be minimized. Moreover, knowledge of the biometrical status of female reproductive organs is also crucial to accomplish artificial insemination, pregnancy diagnosis and coping with the infertility problems (Kunbhar *et al.,* 2003) and its treatment (Kumar *et al.,* 2004). Modern technologies such as *in-vitro* fertilization (IVF), artificial insemination (AI) requires a good knowledge of female reproductive biometry. Besides these, for successful *in vitro* production (IVP) of embryos, the evaluation of ovaries, the efficient collection and grading of oocyte is very important. Therefore, extensive research on *in vitro* maturation (IVM), *in vitro* fertilization (IVF) and *in vitro* culture (IVC) of the resulting zygotes has so far been reported (Cognié *et al*., 2003). However, there are some reports on the biometry of crossbred cattle reproductive organs (Khaton *et al.*, 2015 a, b) but there is limited information available on the whole reproductive tracts' morphometry at different ages of indigenous cows in Bangladesh. So, the current experiment was designed to study the morphometric features of the reproductive tracts' at different ages of indigenous cows in Bangladesh as well as determine their histological characteristics.

MATERIALS AND METHODS

Sample collection and management

Indigenous cattle reproductive organs were randomly collected from the local abattoir of Mymensingh district for biometrical and histological studies. After slaughtering, the age was estimated based on dental formula (Natumanya *et al*., 2008). Reproductive organs (n=50) were categorized into two groups based on age of slaughtered cows (<3 years (25)-central incisors are in wear and incisors (I_2) is erupted, 3 to ≤5 years (25)-2nd incisor is erupted and in wear /4th incisor is erupted / all the teeth are permanent). The specimen were brought to the Reproductive Biotechnology Laboratory at Bangladesh Agricultural University, Mymensingh in a thermo-flask containing 0.9% physiological saline at 25ºC to 30ºC within 30 minutes of slaughtered. Segments of the reproductive organs were then trimmed and transferred to sterilized petri dishes and rinsed thoroughly by physiological saline before further processing.

Biometrical study

A thin, flexible and graduated steel scale was used for taking all measurements. Same operator took all the measurements to avoid the errors in measurement following standard system of dissection according to Chinbuzor (2006). Electronic digital callipers and measuring scale were used for measurement and weights were recorded by electrical weighing balance (Unilab Instrument, USA).

Ovary length (cm): Ovary length was taken along the excision from the ovarian ligament using electronic digital callipers.

Ovary width (cm): Ovary width was taken from the greatest line perpendicular to that the length line. Each time width was taken at three positions at the upper part, lower part and at the middle and then average value was taken to avoid mechanical error.

Oviduct length (cm): The oviducts had been dissected out and measurement was taken on their extended length from top of fimbria to tubal-uterine horn junction.

Oviduct width (cm): Oviduct width was taken from the greatest line perpendicular to length line. Each time width was taken at three positions at the upper part, lower part and at the middle and then average value was taken to avoid mechanical error.

Uterus weight: Uterus containing uterine body with right and left uterine horn was weighed using electrical weighing balance. The weight was measured in gm.

Uterine horn length (cm): Each uterine horn was dissected free of its ligamentous attachments and extended its full length for ease of measurement. Uterine horns were incised along their dorsal surface to expose their lumen from oviduct tubal junction to the bifurcation of uterine body.

Uterine horn width (cm): Uterine horn width was measured from the greatest line perpendicular to length line. Each time width was taken at three positions at the upper part, lower part and at the middle and then average value was taken to avoid mechanical error.

Uterine body length (cm): Uterine body length was measured from its bifurcation to internal os of cervix.

Uterine body width (cm): Uterine body was incised dorsally and this incision continued in a straight line to dorsal commissure of vulva to expose the cervical canal and vagina. The width was measured from greatest line perpendicular to length line. Each time width was taken at three positions at the upper part, lower part and at the middle and then average value was taken to avoid mechanical error.

Electrical weighing balance was used for weighing ovary, oviduct, uterus, horn of uterus and body of uterus. The weight was measured in gm.

Histological study

The oviduct and uterus was cut into 2-4 pieces 2×2×2 cm size and were fixed for 24 hours in a solution composed of picric acid (75 ml), 37-40% formalin (25 ml) and glacial acetic acid (5 ml) named Bouin's fluid. Oviduct and uterus dehydration were performed in a sequence of 12 hours in 70% alcohol, 1 hour in 80% alcohol, 1 hour in 90% alcohol and 1 hour in 100% alcohol for three times. Xylene was used for clearing the sample through keeping it in 50% xylene-alcohol solution for 1 hour and then transferred into absolute (100%) xylene for 1 hour. Then the dehydrated and cleared samples were transferred in a tube containing equal part of paraffin and xylene, and then placed in an oven (50-60ºC) for 1 hour. Samples were added into mould containing melted paraffin. The blocks were kept in the room temperature for 24 hours. Six µm thick sections were cut by using rotatory microtome and placed upon glass slide and dried overnight in the air. Xylene (3 minutes, 2 minutes) for clearing; 100% alcohol (3 minutes, 3 minutes), 95% alcohol (3 minutes), 70% alcohol (3 minutes) for rehydration; tape water running (10 minutes); haematoxylin (2 minutes) for staining; again tape water running (7 minutes) for rehydration; eosin (5 minutes) for counter staining; 70% alcohol (3 dips), 95% alcohol (3 dips), 100% alcohol (2 minutes), 100% (2 minutes) for dehydration and finally xylene (2 minutes, 2 minutes) for clearing. Haematoxylin and eosin were used for staining the sections. The stained sections were then permanently mounted with a cover slip using DPX (Merck Specialities Private Limited, Mumbai, India) mounting reagent for microscopic observation.

Statistical Analysis

The data generated from this experiment were entered in Microsoft Excel worksheet, organized and processed for further analysis. Analysis was performed using Statistical Analysis System (SAS, 1998). *t-test* was used to observe the significant differences among the mean values between and within the samples and the age groups of the animals. $P<0.05$ was taken as significant.

RESULTS AND DISCUSSION

Ovary

The length of left and right ovaries was 1.92±0.19 cm and 1.95±0.04 cm at <3 years of age whereas 2.16±0.21 cm and 2.17±0.19 cm at 3 to ≤5 years of age, respectively (Table 1). The width of left and right ovaries was 1.09±0.14 cm and 1.17±0.10 cm at <3 years of age and at 3 to ≤5 years of age they were 1.31±0.10 cm and 1.46±0.11 cm, respectively.

The weight of left and right ovaries was 1.77±0.41 gm and 2.20±0.57 gm at <3 years of age and 1.79±0.45 gm and 2.54±0.14 gm at 3 to ≤5 years of age, respectively. There were no significant differences between length, weight and width of the right and left ovary within same age group as well as in different age groups.

Table 1: The measurements of length, width and weight of ovaries at different ages of Indigenous cattle (Mean±SE)

		Age group		Level of significance
		<3 years (25)	3 to ≤5 years (25)	
Ovary Length (cm)	Left	1.92±0.19	2.16±0.21	NS
	Right	1.95±0.04	2.17±0.19	NS
	Level of significance	NS	NS	
Ovary width (cm)	Left	1.09±0.14	1.31±0.10	NS
	Right	1.17±0.20	1.46±0.22	NS
	Level of significance	NS	NS	
Ovary weight (gm)	Left	1.77±0.41	1.79±0.45	NS
	Right	2.20±0.57	2.54±0.14	NS
	Level of significance	NS	NS	

Parenthesis indicates number of observation, NS= Non-significant

Table 2: The measurements of length, width and weight of oviduct at different ages of indigenous cattle (Mean±SE)

Oviduct		Age group		
		<3 years (25)	3 to ≤5 years (25)	Level of significance
Length (cm)	Left	16.20±0.65	16.64±0.86	NS
	Right	16.36±0.78	17.58±0.97	NS
	Level of significance	NS	NS	
Width (cm)	Left	0.19±0.02	0.23±0.03	NS
	Right	0.21±0.02	0.26±0.03	NS
	Level of significance	NS	NS	
Weight (gm)	Left	0.69±0.04	0.79±0.13	NS
	Right	0.72±0.03	0.81±0.11	NS
	Level of significance	NS	NS	

Parenthesis indicates number of observation, NS= Non-significant

Kouamo *et al.* (2017) reported that the right and left ovary weight was 5.17±0.11 gm and 4.02±0.09 gm, respectively in zebu cattle of Cameroon. Shahrooz *et al.* (2013) found that ovary weight in mature buffalo was 3.24 gm. Leal *et al.* (2013) reported that the weight of bovine ovaries 7.7±2.5 gm. Bello *et al.* (2012) observed the weight of left and right ovaries in cow were 4.88 gm and 5.48 gm, respectively. Kunbhar *et al.* (2003) observed the right and left ovary weight was 3.83 gm and 3.58 gm, respectively in Thari cow. Ali *et al.* (2021) reported the mean±SE weight (W) of right and left ovaries were 2.44±1.51 gm and 2.06±0.93 gm, respectively.

Leal *et al.* (2013) found the length of bovine ovaries 30.9±5.0 mm. Bello *et al.* (2012) studied the length of left and right ovaries in cow and found 2.81 cm and 2.84 cm, respectively. Khandoker *et al.* (2011) found the length of right ovary was 2.32±0.06 cm and the left one was 2.14±0.05 cm in buffalo. Kunbhar *et al.* (2003) reported the mean length of right ovary and left ovary were 2.56 cm and 2.50 cm, respectively in Thari cow. Kouamo *et al.* (2017) found that the length of right ovary was 2.83±0.03 cm and 2.64±0.03 cm in the left ovary of zebu cattle in Cameroon. Wahyuni *et al.* (2021) stated that the length of right ovary were 4.20±1.45 cm and 3.90±0.56 cm in repeat breeder and non-repeat breeding Aceh cow while in case of left ovary it was 3.27±1.10

cm and 3.70±0.20 cm, respectively. Differences were non-significant between width of the right and left ovary within same age group or different age groups (Table 1). Khaton *et al.* (2015b) found that the average width of right ovaries at different age (<3 yrs, 3 to ≤5 yrs and > 5 yrs) were 1.84± 0.59 cm and that of left ovaries were 1.62±0.27 cm. Leal *et al.* (2013) observed the width of bovine ovaries was 21.7±3.3 mm. Bello *et al.* (2012) studied the breadth of left and right ovaries in cow were 1.56±0.01 cm and 1.63±0.02 cm, respectively in non-pregnant cows of African indigenous cattle. Kunbhar *et al.* (2003) evaluated the mean width of right ovary and left ovaries were 1.33 cm and 1.30 cm, respectively. Kouamo *et al.* (2017) found that the width of right ovary was 1.96±0.02 cm and 1.78±0.02 cm in the left ovary of zebu cattle in Cameroon.

The difference between the present study and previous studies might be due to breed and age parity, body condition score, body weight, and managemental factors. Previously, researchers observed that ovary length, width and weight were significantly lower in local cattle than those of crossbred cattle (Khaton *et al.,* 2015a). It is well established that *Bos-indicus* breed's ovaries are usually smaller and lighter than that of *Bos-taurus* breeds. Besides these, right ovary is longer in length, wider in width and heavier in weight to that of the left ovary in different genotypes of cows. Greater physiological activity on the right ovary would be responsible for the increase of its weight (Ginther *et al.*, 2013). This ensures that the right ovary is more active compared to the left one. Moreover, length, width and weight of both the ovaries increased with age and differed significantly >5 years of age groups than those of <3 and 3 to ≤ 5years of age but no difference between <3 and 3 to ≤ 5 years of age in crossbred cattle (Khaton *et al.,* 2015b).

Oviduct

The length of left and right oviduct at <3 years of age was 16.20±0.65 cm and 16.36±0.78 cm and at 3 to ≤5 years of age was 16.64±0.86 cm and 17.58±0.97 cm, respectively (Table 2). These results corroborates with finding of Ali *et al*. (2021) who reported the mean (±SE) length of right oviduct was 18.17±1.27 cm whereas left oviduct length was 17.45±1.80 cm, respectively in Boran heifer. Kouamo *et al.* (2017) found average oviduct length of 19.27±0.14 cm in non-pregnant zebu cattle of Cameroon. Wahyuni *et al.* (2021) stated that the length of right oviduct was 19.7±4.35 cm and 15.7±3.47 cm in repeat breeder and non-repeat breeding Aceh cow while in case of left oviduct it was 18.9±3.92 cm and 18.9±3.37 cm, respectively. Khaton *et al.* (2015b) found that at different age (<3 yrs, 3 to ≤5 yrs and > 5 yrs) the average of right oviduct length was 21.05±0.39 cm and left oviduct length was 21.00±0.38 cm in Bangladeshi dairy cows. The width of left and right oviduct at <3 yrs of age was 0.19±0.02 cm and 0.21±0.02 cm and at 3 to ≤5 yrs of age was 0.23±0.03 cm and 0.26±0.03 cm, respectively (Table 2). These are in line with the results of Wahyuni *et al.* (2021) who stated that right oviduct width was 0.19±0.04 cm in Aceh cow while in case of left oviduct it was and 0.20±0.04 cm, respectively. The weight of left and right oviduct at <3 years of age was 0.69±0.04 gm and 0.72±0.03 gm and at 3 to ≤5 years of age was 0.79±0.13 gm and 0.81±0.11 gm, respectively. Variation from previous studies may be due to difference in genotype, ages and nutritional status of animal. There were no significant differences between right and left oviduct weight within same age group or between various age groups. Previous researchers also found that length, width and weight of right and left oviduct increased with age but did not differ between <3 years, 3 to ≤5 years of age however that significantly differed between <3 years and > 5 years of age in crossbred cattle (Khaton *et al*., 2015b).

Uterine Horn

Length of the left and right uterine horn at <3 years of age was 16.18±1.28 cm and 17.45±1.40 cm and at 3 to ≤5 years of age was 27.45±2.98 cm and 28.35±2.88 cm, respectively (Table 3). Significant difference was observed in the length and width of left and right uterine horn of indigenous cattle between various age groups. The present results corroborated with the findings of Khaton *et al.* (2015b) who found that at different age (<3 yrs, 3 to ≤5 yrs and > 5 yrs) the average right uterine horn length was 25.34±0.72 cm and left uterine horn length was 25.79±0.73 cm in Bangladeshi dairy cows. Devkota *et al.* (2017) found that the length of the left and right uterine horn were 24.6±8.2 cm and 25.7±8.1 cm, respectively. Bello *et al.* (2012) studied the

length of left and right uterine horn in cow 30.04 cm and 30.21 cm, respectively. Kunbhar *et al.* (2003) reported the right uterine horn length was 21.63 cm and left uterine horn length was 20.90 cm in Thari cow. In contrary, Ali *et al*. (2021) reported the right uterine horn length was 18.47±2.54 and that in the left was 18.05±2.73 cm, respectively for Boran breed. Kouamo *et al.* (2017) found average uterine horn length of 20.32±0.20 cm in non-pregnant zebu cattle of Cameroon.

Table 3: The measurements of length, width and weight of uterine horn at different ages of indigenous cattle (Mean±SE)

Horn of uterus		Age group		Level of significance
		<3 years (25)	3 to ≤5 years (25)	
Length (cm)	Left	16.18±1.28	27.45±2.98	*
	Right	17.45±1.40	28.35±2.88	*
	Level of significance	NS	NS	
Width (cm)	Left	1.09±0.14	1.46±0.11	*
	Right	1.10±0.15	1.52±0.15	*
	Level of significance	NS	NS	
Weight (gm)	Left	12.57±5.15	20.53±2.53	*
	Right	14.58±7.55	20.58±3.29	NS
	Level of significance	NS	NS	

*Parenthesis indicates number of observation, * (p<0.05), NS= Non-significant*

Both right and left uterine horn length was significantly lower in local cattle than other genotypes of cattle (Khaton *et al.*, 2015a). Though uterine horn length increased with age but did not differ between <3 years and 3 to ≤5 years but differed between <3 years and >5 years (Khaton *et al.*, 2015b). This is probably because of great variation in age and body weight of that particular animal.

The width of left and right uterine horn at <3 years of age of age was 1.09±0.14 cm and 1.10±0.15 cm and at 3 to ≤5 years of age was 1.46±0.11 cm and 1.52±0.15 cm, respectively (Table 3). Devkota *et al.* (2017) observed the width of left and right uterine horn were 2.1±0.5 cm and 2.1±0.6 cm, respectively in Murrah cross buffalo. Bello *et al.* (2012) evaluated the diameter of left and right uterine horns and found 2.89 cm and 2.92 cm, respectively in African zebu cattle. Both studies show higher value of width than the present study. The weight of left and right uterine horn at <3 years of age was 12.57±5.15 gm and 14.58±7.55 gm and at 3 to ≤5 years of age was 20.53±2.53 cm and 20.58±3.29 cm, respectively (Table 3). No significant variations were found between weight of the left and right uterine horn within same age group of indigenous cattle. The growth of uterine horn was related to age of the animal (Farnandez *et al.,* 2020). Breed variation, and physical condition of selected animal also may be responsible for variation with others.

Body of the Uterus

The uterine body length of cattle was 5.87±0.43 cm at <3 years and 7.89±0.61 cm at 3 to ≤5 years of age, respectively (Table 4).

Table 4: The measurements of length, weight and width of body of uterus at different ages of cattle (Mean±SE)

		Age		Level of significance
		<3 years (25)	3 to ≤5 years (25)	
Body of uterus	Length (cm)	5.87± 0.43	7.89± 0.61	*
	Width (cm)	2.76± 0.34	3.46± 0.27	NS
	Weight (gm)	21.49 ±5.91	44.40 ±7.33	*

Parenthesis indicate the number of observation, NS= Non-significant

Significant difference (p<0.05) was observed between the length of body of cattle uterus in different age groups. Khaton *et al*. (2015b) evaluated that at different age (<3 yrs, 3 to ≤5 yrs and > 5 yrs) the average length of body of

uterus 3.12±0.72 cm dairy cows of Bangladesh. Bello *et al.* (2012) studied the length of uterine body in cow 2.27±0.03 cm in African zebu cattle. Kunbhar *et al.* (2003) investigated the uterine body length was 1.70 cm in Thari cow. Kouamo *et al.* (2017) found average uterine horn length of 1.24±0.02 cm in non-pregnant zebu cattle of Cameroon. All these studies show lower value of length than the present study.

The width of uterine body of cattle was 2.76±0.34 cm at <3 years and 3.46±0.27 cm at 3 to ≤5 years of age, respectively. These results are in line with the findings of Devkota *et al.* (2017) who found that the diameter of uterine body was 2.7±0.7 cm.

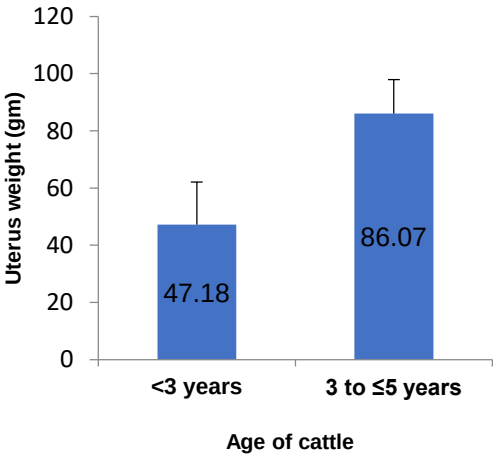

Figure 1: Whole uterus weight of indigenous cow

Khaton *et al.* (2015b) studied that at different age (<3 yrs, 3 to ≤5 yrs and > 5 yrs) the average uterine body width was 2.51±0.59 cm in dairy cows of Bangladesh. Bello *et al.* (2012) reported the average diameter of uterine body was 2.27 cm in African zebu cattle. Kunbhar *et al.* (2003) studied the mean width of uterine body was 2.17 cm in Thari cow. The weight of uterine body of cattle was 21.49±5.91 gm at <3 years and 44.40±7.33 gm at 3 to ≤5 years of age, respectively (Table 4).

There was significant difference ($p<0.05$) between weight of the body of uterus of cattle in different age groups. The weight of whole uterus was 47.18±14.92 gm and 86.07±11.98 gm at <3 years and at 3 to ≤5 years of age, respectively (Figure 1). There was significant difference between the weights of different age groups. This might be due to variation in age, status of fertility and shrinkage of endometrium.

Histology of cattle oviduct

This experiment showed morphometric feature of oviduct at follicular (Corpus luteum, CL-) and luteal (CL+) phase of estrous cycle.

Epithelial layer of oviduct consisted of the single layer of ciliated and non-ciliated columnar cells (Figure 2). No histomorphological changes were observed in the corpus luteum present or absent group which coincides with the findings of Bailey *et al.,* (1958).

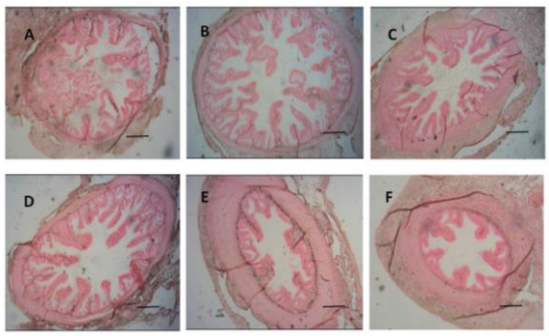

Figure 2: Histological characterization of cattle oviduct. Scale indicates 20 µm (Magnification 10x). *A= Infundibulum (part of CL-ovary); B=Infundibulum (part of CL+ ovary); C=Ampulla (part of CL-ovary); D=Ampulla (part of CL+ ovary); E=Isthmus (part of CL-ovary); F= Isthmus (part of CL+ ovary (Magnification 40x).*

The topography of the oviduct provides a complex system of regulation which may influence not only the passage of the gametes and embryos, but also movement of fluid within the oviduct canal. Muscular layer in isthmus was thicker than ampulla. The regional variation of epithelial cells of oviducts is related to the cyclic changes in the epithelial cells of cattle.

Histology of cattle uterus

The wall of uterus consists of three coats which, from the outermost inward are the serosa or perimetrium, the muscularis or myometrium and the mucosa or endometrium (Figure 3). The present result is in line with Eurell and Frappier (2006) who reported that cow uterus is histologically consists of three layers namely perimetrium, endometrium and myometrium. The perimetrium consisted of loose connective tissue, which was covered by peritoneal mesothelium and smooth muscle. The myometrium is a massive muscular coat, consisting of bundles of smooth muscle fibres held together by connective tissue.

Endometrium consists of two zones with different structures and functions, functional layer with pseudostratified columnar and/or simple columnar epithelial cells, and basal layer (Bailey *et al.,* 1958).

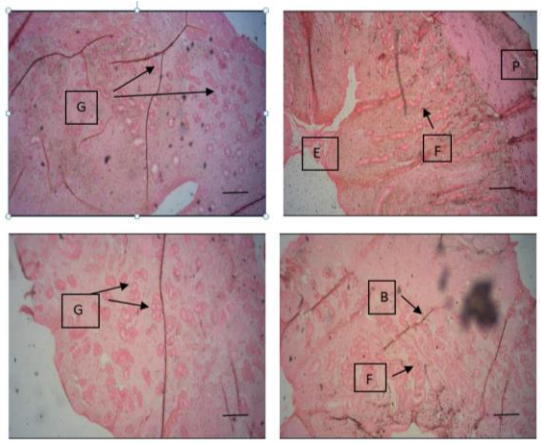

Figure 3: Histological characterization of cattle uterus. *(G= glands; E= endometrium; P= perimetrium; F= functionalis; B= basalis). Scale indicates 20 µm (Magnification 40x).*

CONCLUSION

This study can be concluded that length and width of the uterine horn, length and weight of uterine body significantly differed among different age groups of indigenous cattle in Bangladesh. Besides these, weight of the entire uterus was also significantly varied among age groups of cattle though no significant difference was observed in the ovary and oviduct of different age groups in indigenous cattle. The results obtained from the present study provide baseline data about biometry of the different parts of reproductive organs of indigenous cattle in Bangladesh. Ultimately this will facilitate teaching and research about anatomy, physiology and application reproductive biotechnology in the indigenous cattle of Bangladesh. In future, in-depth study with more age groups in indigenous cattle of Bangladesh are recommended.

Authors contribution:

Conception and design of study: MAMY Khandoker and AS Apu; ***Methodology:*** MA Jahan, SJ Shathi and A Khatun; ***Supervision:*** MAMY Khandoker and AS Apu; ***Data analysis:*** MY Ali, M Mahbubul; **Writing—original and draft preparation:** MY Ali, M Mahbubul; **Writing—review and editing:** AS Apu.

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