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Comparative Biometry of Reproductive Organs between Indigenous and Cross Bred Cow in Bangladesh

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Abstract **– A comparative biometrical study was conducted on reproductive organs of dairy cows (n = 86) of different genotypes available in Rajshahi city corporation of Bangladesh. Three types of genotype were considered for this experiment. The genotypes are Local, Local×Holstein Friesian and Local×Sahiwal. Reproductive tracts of cows were collected immediately after slaughter from different slaughter houses in Rajshahi, Bangladesh from July 2017 to June 2018. The comparison of measurements of most of the parameters of reproductive tract observed in different genotypic cows showed significant differences ($p<0.05$). Local×Holstein Friesian had significantly higher values ($p<0.05$) on the most of parameters of genitalia measured, followed by the Local×Sahiwal and Local. Local×Holstein Friesian cows had the longest uterine horn (28.16±1.64 cm for right and 29.83±1.71 cm for left), uterine body (3.45±0.22 cm length and 2.84±1.37 cm width), cervix (5.62±0.23 cm length and 4.95±0.23 cm width) and vagina (25.45±0.63 cm length and 6.12±0.36 cm width). The right ovary was wider in diameter, larger in length as compared to left one in all genotypes. This confirms the fact of right ovary being more active than the left one. Moreover, the biometry of ovary and tubular parts of genitalia in Local×Holstein Friesian and Local×Sahiwal cows are suggestive for selection of crossbred dairy cows to get maximum benefits from crossbreeding in respect of productive and reproductive performance and also for genetic improvement.**

Keywords **– Comparative Biometry, Crossbred Cow, Indigenous, Reproductive Organs.**

I. INTRODUCTION

Bangladesh is one of the densely populated and the fourth largest agricultural country in the world (Habib, 2001). According to DLS, (1998) statistics, at present there are 29,649 cross-bred dairy farms in the country and this number increasing day by day. Rajshahi division comprises about 4.87 million cattle population which was 21.06% of total cattle population of Bangladesh (DLS, 2013). One of the major problem is poor management of the dairy farms, resulting cross-bred cows which is more susceptible to infections and reproductive diseases and disorders, suffer frequently and make economic losses of the farmer due to the lack of proper knowledge on reproductive tract of cow and doe. We got frequent complaint from the cattle farmers about reproductive diseases and disorders including anoestrus, repeat breeding, pyometra, metritis, retain placenta, prolapse of uterus and similar problems. Production disorder like milk fever and mastitis are also very common of high yielding cows. Infectious diseases cause a great harm in livestock.

It has been estimated that about 10% animals die annua-lly due to diseases (Ali *et al.,* 2011).

Reproductive disorders among farm animal is the great economic problems. It is particularly widespread among dairy cattle, but is of lesser significance in the beef breeds (Arthur *et al.,* 1989). Poor reproductive performance is a crucial production imitating issue. It has been reportable that reproductive disorders are accountable exceptional economic losses to the dairy farmers in Bangladesh (Talukder *et al.,* 2005). In European and American dairy herds, about a third of all cows are culled because of reproductive disturbances (Faruq, 2001). The occurrence of various reproductive disorders is increased in Bangladesh due to introduction of intensive cross breeding programme through artificial insemination (Faruq, 2001).

The reproductive performance depends upon the normal structure and functions of genital organs of an animal (Siddiqui *et al*., 2005). The knowledge of biometrical status of female genital tract is essential to perform artificial insemination, pregnancy diagnosis and dealing with the infertility problems (Memon, 1996). However, in a bid to increase and improve cattle production in Bangladesh, study on the effect of genotype/breed, age and body weight on reproductive organ of cow is essential for a maximum and rational utilization of the cattle breeding (Ibrahim *et al*., 2012). Furthermore, there is limited study that compared reproductive organ on morphometric characteristic of any genotypes, age and body weight groups of cows. Little is known on the anatomy and physiology of the female genitalia of tropical breeds of cattle (Kumar *et al*., 2004); compared to the exotic breeds (*Bos taurus*) been described by various authors (Getty, 1975; Napolcan and Quayam, 1997; Amle *et al.*, 1992; Newham, 2001).

Reliable information on the reproductive parameters of cattle of different genotypes, age and body weight groups and parities owned by farmers and nomadic farmers in Bangladesh is scanty in the literature. Superior dairy cows selection seems to be very important and alternative approach to boast up the production potential. Therefore, during selection of dairy cows for breeding/production special attention should be given on genotype, age, body weight, soundness of the sexual organ. Hence, the need for this study to provide a baseline data for teaching and further research on the anatomy and physiology of the reproductive system and for enhancing the reproductive capacity within the genotypes, age and body weight groups.

For identification of reproductive problems and its clinical trends we need to survey and conduct a slaughter house based study from where we will get real sample and

actual measurement of the reproductive tract of different genotypes of cow such as Local (L), Local × Holstein Friesian (HL) and Local × Shahiwal (SL) which is important for artificial insemination (AI).

Any structural and functional abnormalities in reproduc--tive tract may interrupt animal reproduction (Shamsuddin *et al.,* 1988). The reproductive disorders of cattle can lead to economic losses in term of reduce fertility, longer calving interval and increased expense on medication in farms (Samad *et al*., 1987). Ultimately its effects fall on the economic trait of this species.

Therefore, the present study was undertaken to compare the reproductive tract in different genotypes of dairy cows as well as to establish baseline data on the normal dimensions of different segments of the reproductive tract in cows which will help to identify best genotype for artificial insemination in Bangladesh.

II. METHODOLOGY

The aim of the present study was to evaluate the comparative biometry of reproductive tract between indigenous and cross bred cows in Bangladesh. The reproductive tract of cows were collected freshly from different slaughter houses under the selected study area from July, 2017 to June, 2018. The biometrical study was conducted at the Laboratory of the Department of Preclinical Courses, Faculty of veterinary and animal sciences, Gono Bishwabidyalay.

Study Time and Area

The present research work, comparative biometry of reproductive organs between indigenous and cross bred cows in Bangladesh was done from July, 2017 to June, 2018 from different slaughter houses of Rajshahi City Corporation, Bangladesh.

Selection of Samples

Initially of the research it was proposed to collect 100 reproductive tract of cows. A total of 86 reproductive tract (Cow = 86) of local and cross bred cows were collected from slaughter house of selected study area. The research animal were grouped according to their genotype such as:

Group-A: Local (L)
Group-B1: Local (L) × Holstein Friesian (HF)
Group-B2: Local (L) × Shahiwal (SL)

Procedure for Collection of Sample

After slaughtering, the female reproductive tract were separated from the pelvic viscera by dissection after sawing through the pelvic symphysis, the broad ligaments, the loose connective tissue and fat surrounding the vulva and the retroperitoneal part of the vagina was removed as far as possible. Excess fat and other tissues surrounding the reproductive organs were discarded by careful dissection to clear the organs for a better examination. The flexures of the fallopian tubes were straightened out by freeing them from the mesosalpinx.

Methods of Gross Observation and measurement of Reproductive Organs

The observations of various parts of the reproductive or--gans were done under broad day light. Grossly the entire reproductive system from ovary to vulva was examined for the presence of any detectable abnormalities. After separating the broad ligaments and straightening the oviducts and horn, genitalia were cut to open and the measurements of the organ were taken.

Examination Procedure

After collection of reproductive organs were transferred to the laboratory in physiological saline of 30 to 38ºc within 30 minutes of slaughter. As documented by Wilson, 1995; the ovaries were removed at their junction with the ovarian ligament as close to the ovarian tissue as possible after the fimbria was removed. The following parameters were observed. The length of ovary was taken along the excision from the ovarian ligament with the help of Slide Calipers (Stainless Hardened). The width was taken as the greatest line perpendicular to the length line. The thickness was the distance between the medial and lateral surfaces of the ovary. The weight of ovary was taken in gm separately for the right and left with the help of Digital weighing balance.

The oviducts were dissected out and a measurement taken on their extended length from the top of the fimbria to the tubal-uterine horn junction. The uterine horns were dissected free of their ligamentous attachments and extended their full length for measurement. Each uterine horn was incised along its dorsal surface to expose its lumen from the oviduct tubal junction to the bifurcation of the body of the uterus. The body of the uterus was also incised and this dorsal incision continued in a straight line to the dorsal commissure of the vulva in order to fully expose the cervical canal and the vagina. This method of exposure gave the relative thickness of the walls of the uterine horns, body of the uterus, cervix and vagina. The length of the uterine body was taken from its bifurcation to the internal os of the cervix. The length and diameter of the cervix was recorded. The length of the vagina was taken as the distance from the external os of the cervix to the ventral commissure of the vulva. A measurement of the vaginal width was regularly taken at a point from the external os of the cervix, prior to extending the dorsal incision through the vagina. All measurements were taken with a thin, flexible, graduated steel tape. Measurement errors due to variation in operator technique were kept to a minimum by following a standard procedure of dissection as adopted by Chibuzor (2006) with each tract in an identical position. All measurements were recorded in centimeters with the help of Digital Slide Calipers, China (Stainless Hardened) and measuring tape and scale. All weights were recorded in grams by using Digital weighing balance.

Statistical Analysis

The measurement of different parts of genital organs of dairy cows was recorded using computer package programme. Simple ANOVA was performed considering the age of dairy cows and to observe the significant differences among the mean values. The Duncan's multiple range test (DMRT) was performed to observe significant differences of ovaries and genital tract in between different genotypes of dairy cows. Data were presented as Mean ± SE. All analysis was performed using SPSS software version 17.0. $P < 0.05$ was considered as si-

-gnificant.

III. Results and Discussions

Major anatomic deviation of reproductive tract especia--lly length, width, thickness and weight were measured and these measurements in different genotypes of cows shown in Table 01, Table 03 and figure 01, figure 02, figure 03.

Ovary

The measurements of ovaries in different genotypes of cows was shown in Table 03. The results of the study revealed that the average mean length, width and thickness of right ovary were recorded as 2.53 ± 0.28, 1.91 ± 0.48 and 1.60 ± 0.44 cm and that of the left ovary 2.44 ± 0.45, 1.84 ± 0.51 and 1.61 ± 0.44 cm, respectively. The weight of right and left ovary was recorded as 3.85 ± 0.82 and 3.92 ± 0.85 g, respectively. The comparison of the morphometric values of both ovaries in the different genotypes such as A (Local), B1 (Local × Holstein Friesian) and B2 (Local × Sahiwal) showed significant differences ($P<0.05$) in length, width, thickness and weight (Table 03). B1 (Local × Holstein Friesian) has a significantly higher values ($P<0.05$) on most of the parameters measured, followed by the B2 (Local × Sahiwal) and the A (Local).

Table I. The mean length, width, thickness and weight of ovaries in different genotypes of cow.

Organs	Measurements	Genotypes			Average
		A	B1	B2	
		(Local) n=26	(L × HF) n=48	(L × SL) n=12	
Right ovary	Length (cm)	2.17±0.45^{b}	2.72±0.29^{a}	2.66±0.32^{a}	2. 53±0.28
	Width (cm)	1.70±0.33^{b}	1.99±0.42^{a}	1.94±0.63^{ab}	1.91±0.48
	Thickness (cm)	1.28±0.34^{b}	1.70±0.33^{a}	1.74±0.54^{a}	1.60±0.44
	Weight (gm)	3.06±0.62^{b}	4.34±0.63^{a}	3.63±0.47^{ab}	3.85±0.82
Left ovary	Length (cm)	2.19± 0.49^{b}	2.48±0.36^{ab}	2.58±0.43^{a}	2.44±0.45
	Width (cm)	1.58±0.44^{b}	1.93±0.44^{a}	1.89±0.66^{a}	1.84±0.51
	Thickness (cm)	1.32±0.48^{b}	1.71±0.27^{a}	1.60±0.52^{ab}	1.61±0.44
	Weight(gm)	2.83±0.52^{b}	4.55±0.52^{a}	3.61±0.32^{ab}	3.92±0.85

n = Total, L= Local, F = Holstein Friesian, SL = Sahiwal, ± = Standard error, a,b means superscripts are statistically significant ($P<0.05$) in between the column.

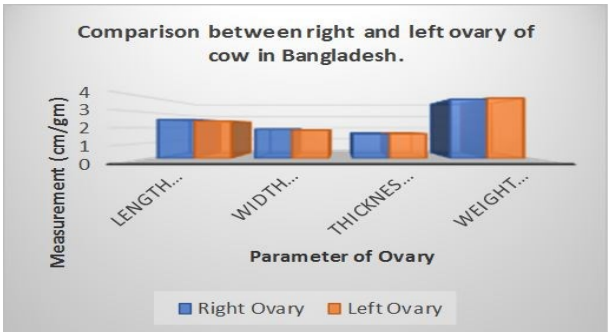

Fig I: Comparison between right and left ovary of cow in Bangladesh.

Table II. Analysis of variance (ANOVA) for the ovarian biometry of different breeds of cows.

Ovarian parameter	Sources of variation	Sum of square	D.F	Mean square	F-value	P-value
Length of right ovary	Between the breed groups	2.072	2	1.036	7.970	.001
	Within the breed groups	6.108	83	.130		
Width of right ovary	Between the breed groups	.680	2	.340	1.528	.228
	Within the breed groups	10.453	83	.222		
Thickness of right ovary	Between the breed groups	1.681	2	.841	5.457	.007
	Within the breed groups	7.239	83	.154		
Weight of right ovary	Between the breed groups	13.718	2	6.859	17.160	.000
	Within the breed groups	18.787	83	.400		
Length of left ovary	Between the breed groups	.930	2	.465	2.859	.067
	Within the breed groups	7.644	83	.163		
Width of left ovary	Between the breed groups	1.055	2	.528	2.322	.109
	Within the breed groups	10.681	83	.227		
Thickness of left ovary	Between the breed groups	1.392	2	.696	4.423	.017
	Within the breed groups	7.398	83	.157		
Weight of left ovary	Between the breed groups	23.435	2	11.717	34.920	.000
	Within the breed groups	15.771	83	.336		

D.F = Degree of freedom, F= Factorial value, P= Probability value

The average mean length of the ovary recorded in the present study fall within the range (1.30 to 3.5 cm) of the results of Dobson and Kamonpatana (1986), Kunbhar *et al.* (2003), Carvalho *et al*. (2005), Ali *et al.* (2006), Ahmed (2011) Bello *et al.* (2012) and Leal *et al*. (2013). However the measurement for length recorded in the present study was shorter than the figures (2.8 to 5.0 cm) reported by Salisbury and Vandemark (1961), Settergren (1983), Roberts (1982), Memon (1996) and Jaji *et al.* (2012) in cattle. The width of ovary as recorded in the present study was in agreement with the results (1.1-1.9 cm) of Salisbury and Vandemark (1961), Roberts (1982), Kunbhar *et al.* (2003), Ali *et al.* (2006), Ahmed (2011) and Bello *et al.* (2012) in cattle. However, it was slightly smaller to those (2.2-3.01 cm) reported by Drennan and Macpherson (1966), Sission and Grossman (1972), Getty (1975), Carvalho *et al*. (2005), Jaji *et al.* (2012) and Leal *et al*. (2013) in cattle. The thickness of the ovary found in the present study was in the range of those (0.6-2.0 cm) recorded by Kunbhar *et al.* (2003), Carvalho *et al*. (2005) and Ali *et al.* (2006) Bello *et al.* (2012), Jaji *et al.* (2012) and Leal *et al*. (2013)in cattle.

However, the results obtained by Salisbury and Vandemark (1961), Arthur *et al.* (1989) and Memon

(1996) were greater than the present findings. The present findings for the weight of ovary were in agreement to those (3.8 g) reported by McEntee (1983), Arthur *et al.* (1989) and Kunbhar *et al.* (2003) in cattle. On the otherhand higher weight (4-19 g) of right and left ovary was reported by Roberts (1982), Carvalho *et al*. (2005), Ali *et al.* (2006), Ahmed (2011), Bello *et al.* (2012), Jaji *et al.* (2012) and Leal *et al*. (2013). The discrepancy in the parameters could be due to age, breed, parity, body weight, body condition score, and manage mental factors variation as it is established fact that the ovaries of *Bos indicus* breeds are generally smaller and lighter than those of the *Bos taurus* breeds. It was concluded that the left ovary is shorter in length, narrower in width and lighter in weight to that of the right ovary in different genotype, age and body weight and parities of dairy cows. This confirms the fact that the right ovary is more active than the left ovary (Rind *et al*., 1999). The results which were disagreed may be due to variation of sample size, breed, age, geographic location, climate, management system and nutritional variations.

Oviduct

The oviduct was torturous, wiry and hard and embedded in fat of mesosalpinx and opened into the fimbria. It helps to transport ova or unfertilized eggs from the ovary to the uterus. The average mean length of right and left oviducts were 19.05± 0.39 and 21.10 ± 0.42 cm, respectively in different genotypes (Table 03). Genotype had significance effect (P<0.05) on the length of both of right and left oviducts. The values of right and left oviducts were higher in B1 (Local × Holstein Friesian) (22.75 ± 0.73 and 24.52 ± 0.77 cm) than A and B2 (Figure. 02).

The findings of present study about the length of oviducts were in agreement with the results (20-30 cm) of McEntee (1983) and Petter (1993), Kunbhar *et al.* (2003) and Bello *et al.,* (2012) in cattle. On the other hand lower length (16.8-19.8 cm) of right and left oviducts were reported by Carvalho *et al*. (2005) and Ahmed (2011). These differences might be due to the aforementioned reasons.

Uterine horns and Body of uterus

The uterus of a cow consists of two horns such as right and left horn. The average mean length of right and left uterine horns were 24.34 ± 0.71 and 23.75 ± 0.73 cm, respectively in different genotypes (Table 03). The highest length of right and left uterine horns was observed in B1 (Local × Holstein Friesian) and it was 28.16 ± 1.64 and 29.83 ± 1.71 cm, respectively (Figure. 02).

The uterus of cows was bicornuate in shape; two horns were joined posteriorly to form a short body of uterus. This is the point where semen is deposited during artificial insemination. The mean length and width of body of uterus were 3.14 ± 0.72 and 2.50 ± 0.56 cm, respectively in different genotypes (Table 03). The highest length and width of body of uterus was observed in B1 (Local × Holstein Friesian) and were 3.45±0.22 and 2.84±1.37 cm, respectively (Figure. 03).

Table III: Measurements of tubular parts of reproductive tract of different genotypes of cows.

Organs	Measurements	Genotypes			Average
		A	B1	B2	
		(Local) n=26	(L × HF) n=48	(L × SL) n=12	
Right ovary	Length (cm)	2.17±0.45^{b}	2.72±0.29^{a}	2.66±0.32^{a}	2. 53 ±0.28
Left ovary	Length (cm)	2.19± 0.49^{b}	2.48±0.36^{ab}	2.58±0.43^{a}	2.44 ±0.45
Right uterine horn	Length	18.90±1.05^{b}	28.16±1.64^{a}	23.92±1.24^{ab}	24.34 ±0.71
Left uterine horn	Length	19.31±1.03^{c}	29.83±1.71^{a}	22.34±1.24^{bc}	23.75 ±0.73
Body of Uterus	Length	2.86±0.12	3.45±0.22	3.34±0.23	3.14 ±0.72
	Width	2.30±0.46^{b}	2.84±1.37^{a}	2.68±0.24^{ab}	2.50 ±0.56
Cervix	Length	4.64±0.13^{b}	5.624±0.23^{a}	4.75±0.27^{b}	5.06 ±0.12
	Width	4.36±0.17	4.95±0.23	4.63±0.25	4.57 ±0.14
Vagina	Length	19.81±0.47^{b}	25.45±0.63^{a}	21.56±0.58^{b}	22.60 ±0.34
	Width	4.86±0.13^{b}	6.12±0.36^{a}	5.84±0.54^{ab}	5.45 ±0.14
Vulva	Length	7.88±0.24	10.22±0.52	8.96±0.24	8.86 ±0.16
	Width	4.55±0.17^{b}	5.27±0.23^{ab}	4.65±0.32^{b}	4.84 ±0.17

n = Total, L = Local, F = Holstein Friesian, SL = Sahiwal, ± = Standard error, a, b, c means superscripts are statistically significant (P<0.05) in between the column.

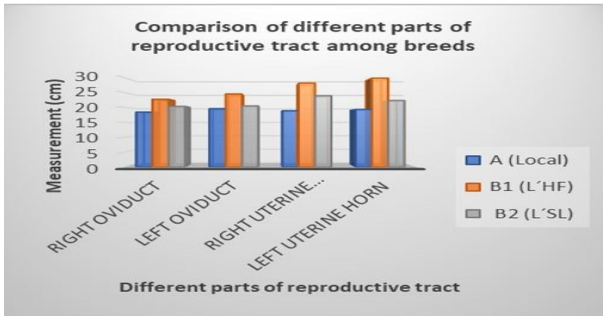

Fig. II. Comparison of different parts of reproductive tract among breeds.

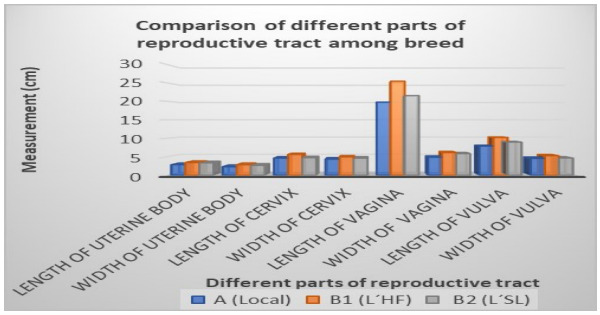

Fig. III. Comparison of different parts of reproductive tract among breeds.

The length of uterine horns of present study fall within the range (15-30 cm) reported by Kunbhar *et al.* (2003), Ali *et al.* (2006), Ahmed (2011), Bello *et al.* (2012) and Jaji *et al.* (2012); however higher values (35-40 cm) were recorded by Hafeez (1968), Getty (1975), Sorensen (1988) and Petter (1993). The result for length of uterine body were higher in line with those (2.3-2.8 cm) reported by Petter (1993), Kunbhar *et al.* (2003), Ahmed (2011) and Bello *et al.* (2012) in cows but was in agreement with the values (3-5 cm) were reported by Getty (1975), Sorensen (1988) and Carvalho *et al*. (2005) in cattle. The findings for the width of the present study were in agreement to the results (2.5 cm) reported by Sorensen (1988) and Kunbhar *et al.* (2003) in cows. Whereas, Sission and Grossman (1972), Roberts (1982), Jaji *et al.* (2012) and Bello *et al.* (2012) reported higher values (3.23-4.60 cm) as compared with the present investigation. The difference in values could have been due to age, breed, fertility status and shrinkage of the endometrium.

Cervix

The cervix was consisted of rings and the rings were very hard in structure. The average mean length and width of cervix were recorded as 5.06 ± 0.12 and 4.57 ± 0.14 cm, respectively in different genotypes (Table 03). The highest length (5.62 ± 0.23 cm) and width (4.95 ± 0.23 cm) of cervix were observed in B1 (Local × Holstein Friesian) than A and B2 (Figure. 03).

The length recorded in this study was lower with the results (7.99, 6.7 and 7-10 cm) obtained by Garcia (1988), Memon (1996) and Kunbhar *et al.* (2003), Carvalho *et al*. (2005) Ahmed (2011), Jaji *et al.* (2012) and Bello *et al.* (2012) respectively in cows. The findings of present study were in agreement with the values (4.35-6.12 cm) were reported by Ali *et al.* (2006). Whereas the width recorded during present study were higher to the results 2.3-2.8 cm of Petter (1993), Kunbhar *et al.* (2003) and Jaji *et al.* (2012) and were in agreement with the results (3.35-6.25 cm) reported by Ali *et al.* (2006) and Bello *et al.* (2012) in cows. The results which were disagreed may be due to variation in sample size, breed, age, geographic location, nutritional status and estrus condition.

Vagina

The vagina appeared as a long musculo-membraneous tubular sheath like structure/passage extends from cervix to the urethral opening. The average mean length and width of vagina were 22.60 ± 0.34 and 5.45 ± 0.14 cm, respectively in different genotypes (Table 03). The highest length (25.45 ± 0.63 cm) and width (6.12 ± 0.36 cm) of vagina were observed in B1 (Local × Holstein Friesian) cows than A and B2 (Figure. 03).

These results regarding length were in agreement with the results (17.5-25 cm) reported by Roberts (1982), Petter (1993), Kunbhar *et al.* (2003) and Ahmed (2011) in cattle. However the results (25-36 cm) reported by Carvalho *et al*. (2005) was higher than the present findings. The measurement regarding the width of vagina was in agreement with the results (4.50 and 6.50 cm) recorded by Sorensen (1988) and Kunbhar *et al.* (2003) in cattle.

Vulva

Vulva was the external portion of the tract that extends from vagina to the exterior opening. The average mean length and width of vulva were 8.86 ± 0.16 and 4.84 ± 0.17 cm, respectively in different genotypes. The highest length (10.22 ± 0.52 cm) and width (5.27 ± 0.23 cm) of vulva was observed in B1 (Local × Holstein Friesian) cows than A and B2 (Figure. 03). The findings regarding vulva of the present study were lower with the values reported by Kunbhar *et al.* (2003) in cattle. This might be due to sample size, breed, age and geographic location etc.

IV. Conclusion

Local×Holstein Friesian had significantly higher values ($p<0.05$) on the most of parameters of genitalia measured, followed by the Local×Sahiwal and Local. Local×Holstein Friesian cows had the longest uterine horn (28.16 ± 1.64 cm for right and 29.83 ± 1.71 cm for left), uterine body (3.45 ± 0.22 cm length and 2.84 ± 1.37 cm width), cervix (5.62 ± 0.23 cm length and 4.95 ± 0.23 cm width) and vagina (25.45 ± 0.63 cm length and 6.12 ± 0.36 cm width). The right ovary was wider in diameter, larger in length as compared to left one in all genotypes. This confirms the fact of right ovary being more active than the left one. Reproductive tract of dairy cow is a very important part of the animal body. Fertility of the animal depends on the sound reproductive tract. The result will help to compare the normal and abnormal structure of reproductive organ in future. Veterinarians, teachers, researchers, students can use the data for future study such as histopathological study of reproductive organ. The data will help the artificial insemination workers for proper artificial insemination.

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