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Fetal Wastage and Morphometrical Study of Reproductive Organs of Local Zebu and Crossbred Female Cattle Slaughtered At Addis Ababa Abattoir Enterprise and Adama Municipal Abattoir, Central Ethiopia

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Abstract: For evaluating fetal wastage of slaughtering pregnant female cattle and to perform morphometric study on female reproductive organs of local zebu and crossbred adult cattle in Addis Ababa enterprise and Adama municipality abattoirs in the central Ethiopia, a total of 191 (77 local zebu and 114 crossbred) cattle reproductive organs were collected twice weekly for six months. Data revealed that 28(14%) were pregnant in different stages of pregnancy. The morphometrical study showed that a significant ($p<0.01$) low overall 2 dimensions mean of left ovary (14.94±0.80; 20.00±0.64mm) and mean left uterine length (18.99±0.70 cm) compared to the right ovary (22.53±0.88; 29.22±12.59 mm) and the mean length of right horn (20.48±0.74 cm). The measurements of the uterine body length and width were 7.95±0.32 cm; 3.86±0.13 cm; the cervical length and width were 6.72±0.52 cm; 3.81±0.29cm and the vaginal length and width were 4.26±0.15 cm and 4.26±0.15cm. There was significant association of the breed with width and length of ovary, length of the uterine horns and the uterine body. Both length and width of the cervix and vagina of crossbred cattle was significantly ($p<0.05$) higher than local zebu breeds except the right ovary. As well as, the right uterine horn is longer than left uterine horn. There is high need to routine strict pregnancy diagnosis by veterinary professionals in the abattoirs in particular and in the country in general. However, the morphometrical data recorded provided baseline data for research and educational institutions; it needs detailed research in correlation with the cyclic stages of these organs, the parity of the animals, the age and the body condition.

Key words: Ethiopia · Female Cattle · Fetal Wastage · Reproductive organs and Morphometry

INTRODUCTION

Ethiopia has the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country and still promising to rally round the economic development of the country. The total cattle population for the country is estimated to be about 57.83 million. Out of this, the females constitute about 55.38 percent and the remaining 44.62 percent are male cattle. On the other hand, 98.59 percent of the total cattle in the country are local breeds. The remaining are hybrid and exotic breeds that accounted for about 1.22 percent and 0.19 percent, respectively [1].

Although the indigenous Zebu cattle are more adapted to the local tropical environment, their production and productivity is usually low [2]. Crossbreeding of improved exotic dairy cattle breeds like Holstein Frisian (HF) on a wide scale was introduced several decades ago to improve the genetic potential of the indigenous zebu cattle while preserving the indigenous breeds [3-5]. Holstein Friesian and Jersey are the two breeds of choice for crossbreeding [6].

Reproduction is crucial for production of the necessary replacement stock, for reducing unproductive periods like dry periods and for increasing lifetime milk production and income [7, 8]. Diseases and abnormalities of the female genital tract are believed to be the major

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reason for economic loss associated with infertility, culling and slaughtering of cows [9-12]. Reproductive problems are the most prevalent reason of culling and slaughtering female cattle in addition to udder problems, low milk yield, old age, lameness and others [13]. However, most of reproductive organ abnormalities can only be diagnosed when the animal is subjected to postmortem examination [14]. No doubt, the slaughter of pregnant cows will decrease the precarious supply of animal protein to the populace [15]. It is most uneconomical to continue the practice of slaughtering pregnant animals, a situation that greatly threatens the livestock industry. Fetal losses through the slaughter of pregnant cows have received increasing attention over the past few years [16].

The characterization of genotypes of livestock is the first approach to a sustainable use of its animal genetic resource [17]. The reproductive performance depends upon the normal structure and functions of genital organs of any animal [18]. The knowledge of biometrical status of female genital tract is essential to perform artificial insemination, pregnancy diagnosis and dealing with the infertility problems [19].

Morphometry is an assessment tool that continues to be very useful in the selective process for breed amelioration, but also provides general data useful in the training of the future clinical specialist. It is also valuable in the assessment of bovine productivity, such as carcass evaluation [20]. Little information on morphometric characteristic of the female genitalia of tropical breeds of cattle (Zebu breed) in comparison to the exotic breeds (*Bostaurus*) was available [21]. Selection and breeding of Zebu cattle breed that will compete favorably with the exotic breeds in production will require an in-depth study of the anatomy of the reproductive organs [22].

Hence, the need to provide a baseline data of morphometry for teaching and for determining the normal dimensions of different segments of the reproductive tract of cows within the genotypes in additions to estimation of fetal wastage was our aim by estimating fetal wastage of cows at abattoir level and determining and comparing the reproductive tracts' morphometry of local and crossbred cows in Ethiopia.

MATERIALS AND METHODS

Study Area and Animals: The present study was conducted on 191 non-gravid female reproductive organs of two breeds (Local zebu, n = 77; Local zebu×Holstein Friesian, n = 114) of cows, at Addis Ababa abattoirs enterprise and Adama municipal abattoir in Central Ethiopia. The cattle slaughtered in the abattoir were collected from different parts of the country which were characterized by widely varying climato-ecological conditions mainly due to altitudinal differences. It was difficult to trace the origin of the animals as they usually pass a chain of markets. Some animals come directly to the abattoir from grazing while others pass through feedlots. However, according to animal sellers at market, the origins of cows to Addis Ababa abattoir enterprise during the study period was from dairy farms in and around Addis Ababa whereas cows slaughtered at Adama abattoir were originated from in and around Adama, Arisi and Bale areas. Both of the abattoirs slaughter every day of the week with largest two days in the week: Wednesday to supply the demand of non-fasting day between two fasting days and Friday, day that supply meat for high weekend demand.

Study Design: The study was conducted for six months form November, 2015 till April, 2016. Twice weekly visits during high rate slaughtering days, a Genetalia of 191 local and crossbred female cattle were collected from the two abattoirs.

Study methodology

Antemortum Inspection and Sampling Collection: Ante mortem and post-mortem inspection are important for removal of diseased animals from the food chain by differentiating apparently healthy animals. The animals were slaughtered after ante mortem examination within 1 to 6 hours of their arrival to the abattoir. The Addis Ababa abattoir has separate slaughtering sections for small ruminants, swine and cattle, unlike Adama abattoir that slaughters cattle and small ruminants in same room. Ante mortem inspection was conducted on individual animals while they enter into the lairage. For the ante mortem inspection, records of breed and body conditions were recorded.

The reproductive organs samples were moved to a separate room, comprises essential facilities and equipments, soon after evisceration and removal for biometrical study. The reproductive organs collected from the abattoirs were trimmed of all excess fat and associated ligaments. The uterus of any suspected gravid cow was examined and dissected for confirmation of presence of fetus.

Morphometric Study of Reproductive Organs: Length and width of the ovaries; length of right and left uterine horns, length and width of uterine body; length and width of cervix and length and width of vagina were recorded. The samples were examined, trimmed and measured with the help of Varnier caliper, a thin, flexible, graduated steel measuring tape and surgical blade scissors. Measurement errors due to variation in operator technique were kept to a minimum by following a standard procedure of dissection as adopted by Chibuzor [23] with each tract in an identical position.

The ovaries were removed from the ovarian ligament and associated structures after the fimbria was removed. The horns and body of the uterus was incised dorsally straight from the oviduct tubal through the bifurcation of the body of the uterus to the dorsal commissure of the vulva in order to fully expose the cervical canal and the vagina. Then, length and width of ovary was measured in mm after incision. On the other hand, length and width measurements of uterine horns, uterine body, cervix and vagina were recorded in cm according to Khaton *et al.,* [24] and Chibuzor [23].

Statistical Analysis: The Data obtained were coded and entered to Microsoft Excel and subjected to statistical analysis using SPSS software version 20. Descriptive statistics including mean, standard deviation and percent of fetal wastage and biometric measurement of reproductive organs were evaluated. The significant differences of parameters of reproductive organs between two breeds of cows were analyzed using independent sample t- test.

RESULTS AND DISCUSSION

Female Cattle Slaughtering and Fetal Wastage: The main reasons of slaughtering female cattle in the abattoirs were reproductive problems (Like repeated breeder), udder problems and senility. During sample days, from 80 to 150 cows were slaughtered in Adama municipality abattoir per day with higher numbers in Friday evening for high weekend meat demand, of which 2-10 cows principally local Boran breeds were slaughtered. Except in some holidays where thousands of cattle were routinely slaughtered, hundreds of cows were slaughtered at the abattoir Addis Ababa. During sample collection days about 3-11 cattle, majority crossbred originated from dairy farms in and around Addis Ababa were slaughtered. In line with the current result, reproductive disorders are one of the main reasons that female cattle brought for slaughtering to abattoirs [9, 25].

From a total of 191 cows (120 from Addis Ababa and 71 form Adama), 28 (14.6%) had fetus in their uterus during the, study period. Out of these, 21 local zebu and 7 crossbred cows accounting 27.3% and 6.8% respectively, of both breeds. According to the abattoir sites, from total number of fetal wasted in the study, 5 (4.2%) was from Addis Ababa whereas 23 (32.4%) was from Adama municipality abattoir. Concerning the stage of pregnancy (age of the fetus), most cows slaughtered with fetus at Addis Ababa were at early stage of pregnancy (first trimester), but fetal wastages from Adama abattoir were dominated by more advanced stage of pregnancy.

The fetal wastage in the current study 14.6% is comparable with 18.4% pregnant recorded at Kumasi abattoirs in Ashanti Region, Ghana [26]. But much more lower than pregnancy recorded in 26.67% (n=92) in another two abattoirs in Southern Ethiopia [27] and those reported in different part of the country and abroad in Jimma (24.5%) by Amare [28], in Nekemte (31.4%) by Samuel [29], in Hawassa (29.91%) by [10], in Nigeria (22.4%) by [30] and in Bahirdar (37.8%) by [31]. On the other hand, the result is higher than the value for pregnant cows slaughtered ranged from 9.7 to 11.4% in Nigeria [32] and the incidence rate of slaughter of pregnant cattle over 4 years period study at shahrekord industrial abattoir in Iran w ranged from 1.5-2.1% with the average of 1.8 [33].

The result of this study indicated majority of the fetus were in the first trimester at Addis Ababa abattoir which is comparable with the result of Mekibib *et al.* [27] who reported 45.65% (n=42) were in the first trimester, while 30.43% (n=28) and 23.91% (n=22) in the second and third trimesters, respectively. This seems to be arisen due to inappropriate ante mortem pregnancy diagnosis or occasional absence of the inspection especially in Adama Municipality abattoir.

Morphomery of Reproductive Organs: A total of 191 complete reproductive genitalia of non-pregnant animals were used for the study. Measurement of width and length of ovary (Right and left) and uterine horn (Right and left), uterine body, cervix and vagina revealed that the mean length and width of the left ovary were 14.94±0.80 and 20.00±0.64mm and of the right ovary were 22.53±0.88 and 29.22±12.59 mm. The mean length of the right and left uterine horns were 20.48±0.74 cm and 18.99±0.70cm.The length and width of the uterine body were 7.95±0.32 cm 3.86±0.13 cm. The cervical length and width were 6.72±0.52 cm and 3.81±0.29cm. The vaginal width and length were 4.26±0.15 and 4.26±0.15cm. The length and

Table 1: Fetal wastage of local zebu and crossbred (local X Holstein Frisian) cows at Addis Aababa abattoir enterprise and Adama municipality abattoir in central Ethiopia.

	Addis Ababa abattoir enterprise		Adama municipality abattoir		Total
Breeds	Frequency	Positive (%)	Frequency	Positive (%)	Positive (%)
Local zebu (N=77)	17	2 (11.7)	60	19 (31.7)	21/77(27.3)
Crossbred (N=114)	103	3 (2.9)	11	4 (36.4)	7/103 (6.8)
Total (N=191)	120	5/120 (4.2)	71	23/71 (32.4)	28/191 (14.66)

Table 2: Mean and standard variation of the variables length and width of reproductive organs of local zebu and their crossbred cattle in central Ethiopia

Organ	Measurements	Average (191)	Local breed (n = 77)	Crossbred (L×HF) (n = 114)	P value breeds
Left Ovary	Length	14.94±0 .80	15.44±1.30	23.074±0.90	0.001
	Width	20.00±0.64	10.45±0.92	17.98±0.744	0.001
Right Ovary	Length	22.53±0.88	16.75±1.31	26.44±1.02	0.001
	Width	29.22±12.59	11.62±1.11	41.10±21.05	0.252
Left uterine horn	Length	18.99±0.70	22.05±0.76	14.48±1.14	0.00
Right uterine horn	Length	20.48±0.74	15.00±1.16	24.19±0.79	0.00
Uterine body	Length	7.95±0.32	5.83±0.48	9.39±0.35	0.00
	Width	3.86±0.13	2.95±0.23	4.47±0.13	0.00
Cervix	Length	6.72±0.52	4.72±0.37	8.08±0.81	0.01
	Width	3.81±0.29	2.74±0.21	4.53±0.46	0.00
Vagina	Length	17.15±0.60	13.08±0.99	19.90±0.63	0.00
	Width	4.26±0.15	3.20±0.26	4.98±0.16	0.00

width of right ovary significantly ($p<0.05$) higher than the left ovary as well as length of right and left uterine horns.

The length and width of left ovary 15.44±1.30 and 10.45±0.92 mm of the local breed were significantly ($p<0.05$) low compared to the length and width of left ovary 23.074±0.90 and 17.98±0.74mm of crossbred cows. The right ovarian length and width 16.75±1.31and 11.62±1.11mm for local breed were significantly ($p<0.05$) low compared to those 41.10±21.05 and 26.44±1.02 mm of crossbred (Table 1).

The mean length and width of the ovaries of local breed in the current study was lower than zebu breed as reported by Kumar *et al*. [21] which was 2.7±0.7 and 1.8±0.06 cm, respectively and the mean length and width, of the ovaries ranged from 2.50-2.84 cm and 1.44-1.63 cm respectively for African zebu cattle [22]. Non-pregnant Zebu cows had a left ovarian length and width of 2.8 and 2.0 and a right ovarian length and width of 2.8 and 1.8 [34]. The size length, width and thickness of 2.53x 1.60 x 1.25 cm were report by Parkale *et al.* [35] for Nigerian cattle.

The result for the crossbred cattle also showed that the result was by far lower than 30.5±4.9 and 21.7±3.8 mm for exotic breed as reported [36]. The values registered for the length of the ovaries yielded a mean of 3.27 cm (Right) and 3.42 cm (Left) ovary and the mean values of the ovary width 2.16 cm (Right) and 2.34 cm (Left) [37].

The current result indicated a great variability of ovary size, that is due to is important morphological fluctuations over the course of the estrous cycle. There significant difference between length and width of right and left ovary agreed with other reports [22] that confirms dimension of the right ovary is significantly greater than that of the left. However, Nascimento *et al.* [38] did not report size differences for right and left ovaries of cyclic and pregnant cows.

The mean length of right and left uterine horns of the local breed (15.00±1.16 cm and 22.05±0.76cm) were significantly low ($p<0.05$) compared to those of crossbred cattle (24.19±0.79 cm and 14.48±1.14 cm). The mean length and width of the right and left uterine horns of the local breed (7.95±0.32 cm and 3.86±0.13 cm) were significantly low ($p<0.05$) compared to those of crossbred cattle (9.39±0.35 and 4.47±0.13 cm).

The length of the uterine horns of this study is lower than previously recorded for the right (30.42 cm), the left uterine horns (28.29) and means uterine body (3.38 cm) length [37]. In agreement with our results, [22, 39] studied 1,000 bovine genitalia of African zebu breed and found that the right ovary and right uterine horn were slightly larger than the left ones. Whereas the reports of Parkale *et al*. [35] and Kaikini [40] who recorded a longer left horn than the right

horn. The Disparity in length and diameter might be related to general body growth and genetic make-up of the animal.

The length and width of the cervix of local and crossbred cows yielded a mean value of 4.72±0.37 and 2.74±0.21 cm and 8.08±0.81 and 4.53±0.46 cm, respectively. Vaginal length and width were 13.08±0.9 and 3.20±0.26 cm in local breeds and 19.90±0.63and 4.98±0.16 cm in crossbreds, respectively. Both length and width of the cervix and vagina showed statistical difference in the two breeds ($p<0.05$).

The mean of cervical and vaginal length result in the study were lower than 6.72 cm mean value for the cervical length and 27.22 cm mean values of the vaginal length [37] and Most of the non-pregnant exotic cattle have cervix length measuring 7-10 cm [41, 42]. The length of cervix of African zebu cattle was 8.0 cm as per [22].

CONCLUSION

The incidence of the fetal wastage is high and the abattoirs should work hard to minimize the fetal wastage as much as possible by strict pregnancy diagnosis. The morphometricalresult of the study revealed that the reproductive organs of local zebu are smaller compared to crossbred (Local zebu X Holstein Frisian) and exotic breeds in the literature. The comparison of right and left of ovaries and uterine horns showed that the right ovaries and horns are larger in comparison to left. The variation in dimensions of the organs can be explained by the elasticity of this organs and hormonal influences of ovarian cyclicity. The results of this study provided a baseline for the dimensions of different segments of the reproductive tract of the cows that can be used in researches and educational institutions. Therefore, the registered data alone is thus insufficient for a correct morphometrical characterization of the ovaries, necessitating an ampler study of its correlation to the cyclic stages of these organs. Moreover, care should be taken during breeding/insemination of local and crossbred cows by considering the size to avoid difficulty in birth during parturition.

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