



Ultrasonographic approaches for breeding soundness evaluation of high and low libido buffalo bulls

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ABSTRACT

The present study was conducted to evaluate ultrasound based rump fat thickness, testicular echogenecity and accessory sex glands diameter in relation to libido in breeding buffalo bulls. Breeding buffalo bulls (20) maintained at bull station of the university and Bhattian, Khanna were used in this study. Bulls were categorized into high (n=10) and low libido (n=10) on the basis of reaction time (high libido < 5 min; low libido > 5 min). Rump fat thickness, testicular echogenecity and diameter of prostate gland and seminal vesicles were measured using ultrasonography (5 MHz probe). The average rump fat thickness was significantly lower in high libido bulls (5.29 ± 0.62 mm) as compared to low libido bulls (7.29 ± 0.93 mm). The average diameter of seminal vesicles was significantly lower (1.54 ± 0.05 cm) in high libido bulls as compared to low libido bulls (1.73 ± 0.08 cm). Diameter of prostate gland was similar in both the groups. It was concluded that internal ultrasound based rump fat thickness and seminal vesicle diameter can be used to differentiate high libido buffalo bulls.

Key words: Breeding soundness evaluation, Buffalo bulls, Poor libido, Rump fat thickness, Ultrasonography

High libido bulls are desired for better herd conception and financial profitability of the dairy farmers. High libido bulls produce more ejaculates, have lesser reaction time and refractory period as compared to low libido bulls (Bury *et al.* 2011). Hence, identification of high libido breeding bulls is imperative for the cost effective production of superior germplasm. Ultrasonographic evaluation of rump fat thickness and reproductive organs can differentiate high from low libido bulls. Back fat thickness measurement is of immense value because it is precise and objective than other body condition parameters (Scroder and Staufenbiel 2006). Increased body fat (especially rump fat) can lead to increased female like traits and decreased libido as well as semen quality in bulls which essentiate its measurement. Ultrasonographic evaluation of reproductive system is a reliable and effective clinical method of differentiating potential bulls (Gnemmi and Lefebvre 2009) and can be useful in predicting major lesions and abnormalities of the reproductive tract. Hence, the present work was planned to evaluate rump fat thickness and reproductive tract using ultrasonography in high and low libido breeding buffalo bulls.

MATERIALS AND METHODS

Breeding buffalo bulls (20) between 5–10 years of age

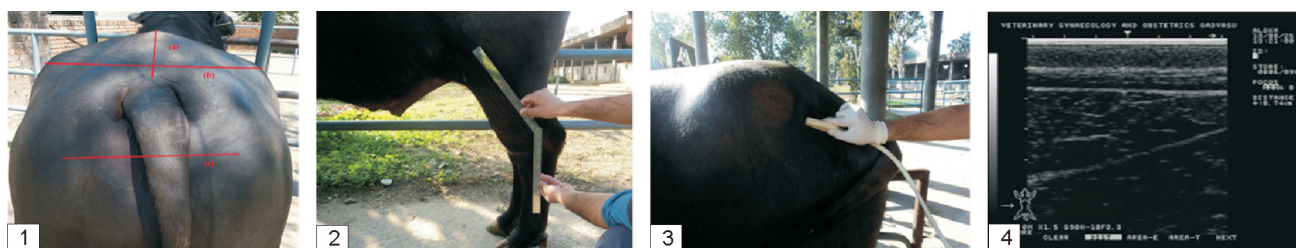
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maintained at bull station (GADVASU, Ludhiana) and Bhattian were kept loose in half walled concrete sheds in individual pens (covered area – 12' × 10' and uncovered area – 25' × 10'). Semen from buffalo bulls were collected twice a week by artificial vagina method. All the animals were fed according to standard feeding schedule along with *ad lib.* green fodder. The buffalo bulls were given exercise for half an hour on alternate days by manual exerciser.

Breeding buffalo bulls were divided into 2 groups (good and poor libido) on the basis of reaction time. Buffalo bulls were categorized as good libido (reaction time less than 5 min) and poor libido (reaction time more than 5 min) at the time of semen collection. All the bulls of good libido (n=10) and poor libido (n=10) were examined for various parameters of breeding soundness evaluation.

Rump fat thickness: Ultrasonographic probe of 5 MHz was placed halfway between the hook bone and the pin bone. The distance between the hook and pin bone was measured by measuring tape and the centre point was marked for placing of ultrasonographic probe. The ultrasonographic probe was placed longitudinally and slightly dorsal to the halfway between pin bone and hook bone (Fig. 1). The diameter of rump fat thickness was measured including the thick fat layer and the 2 thin subcutaneous fascia layers (Fig. 2).

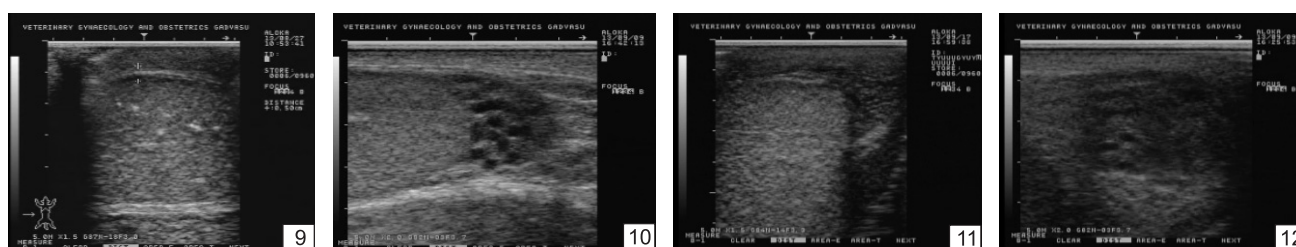
Ultrasonography of external genitalia: Ultrasonographic examinations of the testes were done with a B-mode ultrasound scanner connected to 5.0 MHz linear array transducer. The transducer was applied transversally on the external face of the testis halfway between the head and



Figs 1–4 **1.** (a) Distance between croup and hip joint. (b) Distance between hook bones. (c) Distance between pin bones; Pelvic area calculated using Arloings formula. **2.** Technique for measuring hock joint angulation. **3.** Placement of probe for evaluation of rump fat thickness. Probe placed longitudinally and slightly dorsal to the halfway between pin bone and hook bone. **4.** Diameter of rump fat thickness measured (mm), including the thick fat layer and the two thin subcutaneous fascia layers.



Figs 5–8 **5.** (a) Transverse placement of probe on testis. (b) Longitudinal placement of probe on testis. **6.** Probe was placed diagonally on the testis to have ultrasonographic view of epididymis. **7.** Pelvic urethra was followed and prostate gland was found as separate fluid filled cavity. **8.** Seminal vesicles having lobulated appearance and diameter was measured



Figs 9–12. Ultrasonographic view of: **9.** fibrotic testis; **10.** testis containing fluid; **11.** epididymis lateral to testis; **12.** pampiniform plexus.

tail of the epididymis. Once both testes have been individually assessed, the transducer was then moved longitudinally on both testes (Fig. 3). In the centre of ultrasonographic image of testis a hyperechoic area, rete testis was prominent. Visualization of the rete testis was used as landmark and images were frozen. To have an ultrasonographic view of epididymis, probe was placed diagonally on the testis (Fig. 4).

Ultrasonography of the internal genitalia: Per rectal examination was performed with the help of ultrasonography (5 MHz linear probe) to detect any abnormalities in pelvic urethra, seminal vesicles and prostate. Pelvic urethra was identified as the landmark for the examination of internal genital organs inside the pelvic cavity. Pelvic urethra was followed and prostate gland was found as separate fluid filled cavity (Fig. 5) and diameter was measured using ultrasonography. Bilateral seminal vesicles were found on the lateral sides of pelvic urethra. Seminal vesicles were confirmed by its lobulated appearance and diameter were measured (Fig. 6). Echogenicity of the fluids present in the accessory sex glands were examined for any abnormalities. Data were analyzed using students 't' test.

RESULTS AND DISCUSSION

This is the first report of conducting breeding soundness evaluation by ultrasonography of rump fat thickness, external and internal genitalia.

Rump fat thickness: The overall average rump fat thickness differed significantly ($P < 0.05$) (5.29 ± 0.62 mm in high and 7.29 ± 0.93 mm in low libido bulls). This is the most important observation of our study (Table 1). Selection of sires with low back fat thickness was expected to improve fertility of bulls (Coulter and Kozub 1989). Production of estrogens from androgens is mediated by the aromatase enzyme (Ellem and Risbridger 2010) and testosterone and estrogen is negatively correlated (Javed *et al.* 2000). In high fed bulls, there is increase in back fat thickness (Chase *et al.* 1990). Increased nutrition may be an indicator of increased rump fat accumulation in bulls, though at this bull farm no overfeeding was practised. In our study, bulls with high rump fat thickness were affected with poor libido, indicating that increased rump fat thickness in poor libido bulls led to increased aromatization of testosterone to estrogen.

Ultrasonography of external genitalia: Ultrasonography was conducted to evaluate the external genitalia.

Table 1. Various parameters of breeding soundness evaluation of high and low libido buffalo bulls

Libido	Internal pelvic area (cm ²)	Hock joint angulation (degree)	Scrotal circumference (cm)	Testicular volume (cm ³)	Rump fat (mm)	Seminal vesicles diameter (cm)	Prostate diameter (cm)
High	1283.95±44.73*	143.4±0.93	35.6±1.23	515.43±21.10	5.29±0.62	1.54±0.05	1.28±0.09
Low	1087.49±47.23	142.6±0.64	34.55±0.50	435.16±43.57	7.29±0.93*	1.73±0.08*	1.22± 0.09

*indicates values significantly (P<0.05) higher than between the corresponding columns.

Hyperechoic images of testes were diagnosed as fibrosis (Fig. 7) and anechoic images were diagnosed as fluid accumulation in testes (Fig. 8). The infertile bulls showed abnormalities like abundance of hyperechoic areas scattered in the testicular parenchyma, acoustic shadowing, showing testicular degenerations with mineralization and many anechoic areas in the testicular parenchyma. Ali *et al.* (2011) also reported similar findings. The rete testis of normal testicles was echogenic and narrow but in affected testicles anechogenic and wide. Bilateral accumulation of fluid in rete testis results in azoospermia (Andersson and Alanko 1991). Epididymis was seen as fluid filled structure lateral to testicular parenchyma (Fig. 9). Any abnormality in the lumen and fluid consistency was noticed. Pampiniform plexus was seen as network of anechoic vessels and any change in echogenicity was diagnostic of abnormality (Fig. 10). The pampiniform plexus of testis was revealed as a network of anechoic vascular lumen and hyperechoic vascular coiling giving a spotted appearance (Manda *et al.* 2012). Ultrasonography of external genitalia can efficiently diagnose lesions affecting fertility in relation to libido of bull.

Ultrasonography of the internal genitalia: The average diameter of prostate were similar (P>0.05) in high and low libido bulls (1.28±0.09 cm vs 1.22± 0.09 cm). Echogenicity of fluid was diagnostic of abnormal fluid accumulation in prostate (Fig. 11). The average diameter of seminal vesicles was significantly lower (P<0.05) in high libido bulls (1.54±0.05 cm) as compared to low libido bulls (1.73±0.08 cm). Seminal vesicles were examined lateral to the ampulla, above the neck of the bladder, which appeared as irregular shaped isoechoic lobes of glandular tissue separated by hypoechoic regions. Similar observations were also reported by Manda *et al.* (2012). Increased diameter and echogenicity in the seminal vesicles in the poor libido bulls may be an indicator of seminal vesiculitis (Fig. 12). Abnormal fluid accumulation in accessory sex glands can be successfully diagnosed, which can cause partial as well as complete loss of libido in breeding buffalo bulls.

Based on the present study, it can be concluded that

ultrasound based rump fat thickness and seminal vesicle diameter can be used to differentiate high libido buffalo bulls.

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