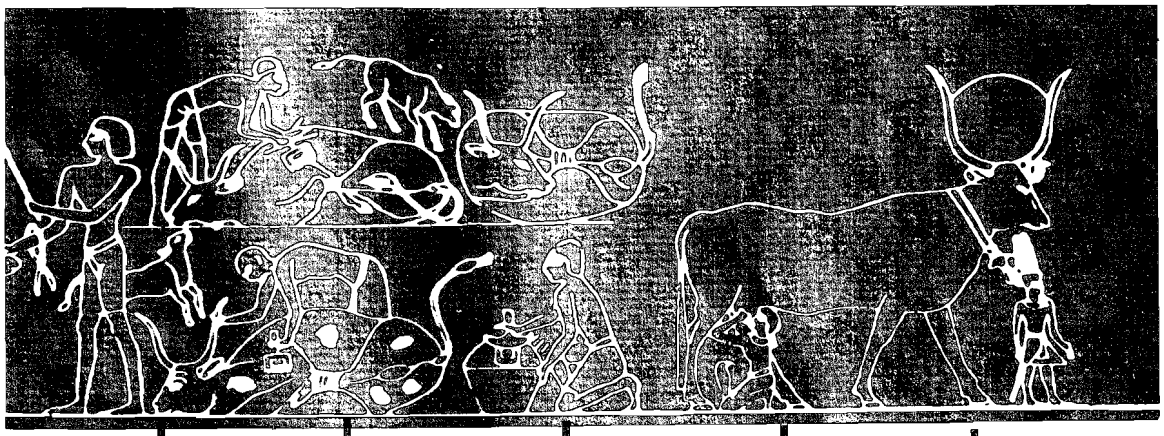
JOURNAL OF THE EGYPTIAN VETERINARY MEDICAL ASSOCIATION

Vol 64 2004 No 5



J. Egypt. Vet. Med. Assoc. 64, No 5: 17-28, (2004).

EVALUATION OF BUFFALO-BULLS BY USING MODIFIED SERVING CAPACITY TEST AND DIAGNOSTIC ULTRASOUND

By

ABOU-EL-ROOS, M.E.A.

Department of Theriogenology, Fac. Vet. Med. Moshtohor,

Zagazig Univ. Benha Branch,

SUMMARY

This study was carried out to assess buffalo-bulls libido and mating capacity using modified serving capacity test (M.S.C.T) and ultrasonographic appearance of the testis and accessory sex glands. Six buffalo-bulls were used throughout the study. The current results showed that the dominant bulls had larger scrotal circumference (SC) and earlier reaction time and a good semen characteristics. The ultrasonographic examination revealed a significant variation between the testicular and accessories dimensions of dominant and dominated bulls for length, width and thickening. The ultrasonographic appearance showed a changes in the echotextures of the genital tracts of buffalo-bulls during various physiologic status and results were recorded and tabulated. From the present study it could be concluded that M.S.C.T offers a good idea to assess buffalo-bulls libido and mating ability. Also, the ultrasonograph could be used accurately to evaluate the testicular and accessory sex glands of buffalo-bulls and recognition of abnormal conditions of these organs.

INTRODUCTION

Males sexual behaviour is of important to achieve good fertility and considered as an important tool to detect the best sires in the herds **(Kotaya and Narasimba Rao, 1990).** Loss of libido and poor sexual desire have been identified as a major limiting factor, in buffalo breeding **(Barnable et al., 2000 and Sundaraman et al., 2002).** Studies on breeding efficiency in bulls have been associated with the welfare aspects and merits of the M.S.C.T. **(Blockey, 1978; Boyed et al., 1989 and Godfrey and Lunstre, 1989).** Many other factors like semen quality and genotypic and phenotypic attribution must be taken in consideration **(Rodriguez-Martinoz, 1998).**

Scrotal circumference of the sire is an indirect indications of number and size of seminiferous tubules and thereby sperm out put **(Coulter and Foote, 1976).**

Ultrasonography is a non invasive technique which can by used to measure bull testes and accessory sex glands in their normal orientation **(Weber et al., 1988)**.

The present investigation aimed to assess buffalo-bulls libido and mating ability by MSCT and characterize the ultrasonographic appearance of the tests and accessory sex glands.

MATERIALS AND METHODS

Six buffalo bulls belonging to a private farm near Tanta; Gharbia Governorate were used in the present investigation during the period of December, 2003 till the end of April 2004 for selection of the best of sires for breeding purposes. The age of bulls were 28 to 38 months old and had a body weight range of 463 to 498 Kg. They were fed on barseem and rice straw ad libitum and concentrates according to **NRC (1970)**.

The animals were assigned randomly into two experimental groups. Each trial was done with 3 buffalo-bulls at a time, in a 3: 2 ratio of male / living mount female relation, in order to stimulate competition and establish social hierarchy. So, in each evaluation there were studied 2 batches of 3 animals (group I, bull No. 1, 2 and 5 and group II bulls No. 3, 4 and 6). Experimental animals were allowed to stay in a cattle court in order to let them feel easy going and free to choose a certain living mount. Two adults females acted as living mounts for mounting. They were kept away from each other nearly 6 meters and had the head restrained. Libido of the males was evaluated in 10 x 15 meters cattle court. A 20 minutes visual stimulation was done before starting the tests; by this technique the most experienced male was released free towards the living mount to perform some mounts, exciting the younger ones.

The MSCT includes:

Interest: obviously it is related to the sexual desire shown by the male in relation to the living mount.

Trying to mount: when the male's legs give up from the ground, but the mounting is not completed.

Mounting: it must be complete in a right position, with or without intromission.
Service or mount: amount with full intromission plus an ejaculatory thrust.
Reaction time: it is the time interval, since the entrance of the male inside the cattle court until the first service. Records are made in seconds.
Social hierarchy: These will be evaluated by the dominance ratio among the young buffalo-bulls of each batch.
SC was measured at the largest diameter of the testis using plastic cloth tape according to **Almquist et al. (1976).**

All buffalo-bulls were trained for semen collection by using of an artificial vagina. Accordingly, semen sample were collected from each bull twice weekly for two weeks as an adjustment period to acclimate the bulls on the handling procedures. Semen samples were collected from each bulls twice weekly and for five successive weeks (10 samples for each buffalo-bulls).

The quality of semen of the dominant buffalo-bulls was evaluated considering ejaculate volume, mass activity, live dead, sperm concentration and sperm motility **(Blom, 1950 and Tomar et al., 1966).**

Ultrasound examination of all bulls were measured twice per week for three consecutive weeks to assess variation in measurements over time by using, a real time B- and M-mode linear array ultrasound scanner (Scanner 240 Vet., Pie medical Company). The scanner provided with linear transducer (frequency 6 and 8 MHZ) and sector transducer (frequency 5 and 7.5 MHZ).

Data obtained were statistically analysed using the Statistical Analysis System SAS (1987).

RESULTS

As shown in table, 1 the dominant bull (which never supplanted by others) showed larger SC and earlier reaction time. Social hierarchy was gradually shown with dominance of two bulls over the others (No. 1 and 2). Another dominant bull in the second group (No. 3) with normal sexual behaviour, felt himself as dominated up to the end of

the experiment. This bull no more showed interest towards females, and afraid other bulls of group I. The other bulls were completely inhibited by dominant males, which not allow them to approach the females. These males (No. 4, 5 and 6) did not accomplish any service due to inhibition. One bull (No. 5) showed a penile dorsal curvature and it was possible only to mount without ejaculation.

As shown in table 2, the semen quality of bull No. 1 was better than the other two bulls regarding the significant increase in the total sperms count per ejaculate, mass activity, live sperm percentage, live sperm concentration. However, there was non significant variations in the ejaculate volume.

As presented in table, 3 there was a significant ($P < 0.05$) variation between the testicular dimensions of dominant and dominated bulls for length, width and thickening.

The ultrasonic monitoring of the testis, also has been used to study, the echtextures changes in various physiologic status. The normal testis showed echogenicity of the testicular parenchyma and enlarged tail of epididymis with moderate echogenicity (Figure, 1). After excitation, the testis showed many blood vessels (pampini form) of the spermatic cord, upper left anechoic fluid filled vessels and moderately hypoechogenic head epididymis (Figure, 2). The testis just before ejaculation showed moderate echogenicity of head and tail of epididymis and anechoic small particles within testicular parenchyma (Figure, 3). While the testis after ejaculation showed hyperechogenic tail of epididymis and anechoic testicular parenchyma (Figure, 4).

As presented in table, 4 there was a significant variation between the accessories of dominant and dominated buffalo-bulls.

The paired bulbourethral glands were ovoid, uniformly hyperechoic structures embedded within the bulbospongiosis muscle (Figure, 5). They were located dorsal and lateral to the pelvic urethra where it began to curve posteriorly around the ischial arch. A hypoechoic collecting duct could be visualized at the ventral extremity of some glands.

The pelvic urethra was visualized in longitudinal and transverse section from a point ventral to the bulbourethral glands to a point dorsal to the bladder neck. In transverse

Table 1: Scrotal circumference and modified serving capacity test in buffalo-bulls (M ± SE).

	Age (month)	Scrotal circumference (cm)	Reaction time (minutes)	Ejaculatory thrust	First mount (minute)	No. of mounts	No. of services	Dominance
Group I								
Bull No. 1	38	30.7	4.5 ± 1.2^{a}	2.73 ± 0.06^{b}	0.40 ± 0.31^{c}	6.90 ± 1.8^{a}	2.3 ± 0.7^{a}	++
Bull No. 2	37.5	30.2	5.4 ± 1.2^{a}	2.93 ± 0.03^{a}	0.40 ± 0.20^{c}	5.50 ± 2.3^{a}	2.2 ± 0.8^{a}	++
Bull No. 5	30.5	29.6	–	–	0.56 ± 0.11	3.70 ± 1.00^{c}	–	–
Group II								
Bull No. 3	37	30.0	5.8 ± 1.3^{a}	2.98 ± 0.05^{a}	0.33 ± 0.14^{d}	5.70 ± 0.80^{a}	1.7 ± 0.7^{a}	+
Bull No. 4	35	28.5	–	–	1.53 ± 0.31^{b}	4.60 ± 1.0^{a}	–	–
Bull No. 6	28	27.5	–	–	2.87 ± 0.61^{a}	2.40 ± 1.7^{a}	–	–

Means with different alphabetica superscripts in the vertical columns are significantly different from each other at level ($P < 0.05$)

Table 2: Mean values of the semen characteristics in dominant bulls (M ± SE).

Items / Bull No.	n	Volume	Individual motility %	Mass activity	Live sperm %	Sperm conc./ml ($\times 10^{6}$)
1	10	2.57 ± 0.23^{a}	77.8 ± 1.08^{a}	4.58 ± 0.13^{a}	78.30 ± 2.54^{a}	1118.13 ± 99.77^{a}
2	10	2.41 ± 0.14^{a}	77.2 ± 1.06^{a}	4.00 ± 0.18^{b}	75.40 ± 3.14^{b}	1098.00 ± 28.31^{ab}
3	10	2.35 ± 0.12^{a}	76.8 ± 1.58^{a}	3.44 ± 0.19^{b}	75.37 ± 3.13^{b}	1033.00 ± 33.14^{a}

n : number of collected samples.

Means with different alphabetica superscripts in the vertical columns are significantly different from each other at level ($P < 0.05$)

Table 3: Ultrasonographic measurements (cm) of the testicular dimensions of dominant and dominated buffalo-bulls (M ± SE).

	n	Dominant buffalo-bulls			Dominated buffalo-bulls		
Bull No.		**1**	**2**	**3**	**4**	**5**	**6**
Tests length							
Right	6	7.22 ± 0.33^{a}	7.03 ± 0.40^{a}	6.43 ± 0.53^{a}	5.15 ± 0.033^{b}	5.52 ± 0.43^{b}	5.49 ± 0.41^{b}
Left	6	6.99 ± 0.15^{a}	6.88 ± 0.50^{a}	6.33 ± 0.67^{a}	5.01 ± 0.72^{b}	5.15 ± 0.34^{b}	5.13 ± 0.36^{b}
Width							
Right	6	3.91 ± 0.01^{a}	3.86 ± 0.03^{a}	3.91 ± 0.01^{a}	3.11 ± 0.01^{b}	3.33 ± 0.15^{b}	3.01 ± 0.03^{b}
Left	6	3.71 ± 0.03^{a}	3.16 ± 0.04^{a}	3.15 ± 0.04^{a}	3.00 ± 0.03^{a}	3.01 ± 0.24^{a}	3.11 ± 0.06^{a}
Thickening							
Right	6	5.23 ± 0.14^{a}	5.03 ± 0.05^{a}	4.81 ± 0.06^{a}	4.20 ± 0.11^{b}	4.33 ± 0.15^{b}	4.22 ± 0.31^{b}
Left	6	5.11 ± 0.18^{a}	4.93 ± 0.06^{a}	3.00 ± 0.05^{b}	3.00 ± 0.31^{b}	3.00 ± 0.19^{b}	3.01 ± 0.04^{b}

n : Number of measurements

Means with different alphabetica superscripts in the same horizontal column are significantly different from each other at level ($P < 0.05$)

Table 4: Ultrasonographic measurements (cm) of the taccessory sex glands of the dominant and dominated buffalo-bulls (M ± SE).

	n	Dominant buffalo-bulls			Dominated buffalo-bulls		
Bull No.		**1**	**2**	**3**	**4**	**5**	**6**
Bulbourethral gland							
Left height	6	1.91 ± 0.40^{a}	1.83 ± 0.11^{a}	1.68 ± 0.40^{b}	1.45 ± 0.33^{b}	1.40 ± 0.33^{b}	1.39 ± 0.30^{b}
Left width	6	1.82 ± 0.30^{a}	1.82 ± 0.31^{a}	1.53 ± 0.50^{b}	1.41 ± 0.32^{c}	1.40 ± 0.41^{c}	1.37 ± 0.31^{c}
Right height	6	1.84 ± 0.20^{a}	1.67 ± 0.31^{a}	1.63 ± 0.51^{a}	1.41 ± 0.22^{b}	1.36 ± 0.30^{b}	1.35 ± 0.52^{b}
Right width	6	1.76 ± 0.40^{a}	1.53 ± 0.40^{a}	1.60 ± 0.40^{a}	1.33 ± 0.20^{b}	1.32 ± 0.31^{b}	1.27 ± 0.30^{b}
Urethral diameter							
Diss. prostate	6	3.34 ± 0.20^{a}	3.32 ± 0.40^{a}	2.93 ± 0.43^{a}	2.01 ± 0.33^{b}	2.34 ± 0.22^{b}	2.11 ± 0.44^{b}
Cali. seminalis	6	3.44 ± 0.40^{a}	3.43 ± 0.41^{a}	2.84 ± 0.44^{a}	2.13 ± 0.53^{b}	2.51 ± 0.22^{b}	2.33 ± 0.40^{b}
Prostate body	6	3.13 ± 0.30^{a}	3.01 ± 0.50^{a}	2.83 ± 0.30^{a}	2.34 ± 0.63^{b}	2.42 ± 0.32^{b}	2.40 ± 0.51^{b}
Vesicular gland							
Left height	6	1.60 ± 0.40^{a}	1.64 ± 0.30^{a}	1.63 ± 0.21^{a}	1.53 ± 0.33^{b}	1.43 ± 0.33^{b}	1.50 ± 0.34^{b}
Right height	6	1.87 ± 0.50^{a}	1.83 ± 0.20^{a}	1.79 ± 0.33^{a}	1.61 ± 0.32^{b}	1.45 ± 0.43^{b}	1.48 ± 0.34^{b}

n : Number of measurements

Means with different alphabetica superscripts in the same horizontal column are significantly different from each other at level ($P < 0.05$)

section, the urethralis muscle was visualized as an anechoic band which nearly surrounded the hyperechoic urethral wall. The urethralis muscle gradually diminished in thickness and dorsal extent as it was followed cranially toward the bladder neck.

The glandular parenchyma of the disseminate prostate was visible within the pelvic urethra caudal to the prostate body. It appeared as a number of hyperechoic streaks radiating dorsomedially between the urethralis muscle. The prostatic body was a uniformly hyperechoic structure located dorsal to the neck of the bladder (Figure, 6).

The paired vesicular glands were visualized from their proximal ends near the bladder neck to their distal ends dorso-lateral to the bladder. The vesicular glands were irregular in shape, with isoechoic lobes of glandular tissue separated by more hypoechoic regions. A distinct hyperechoic membrane surrounded the perimeter of each gland. Available number of small (1 to 4 mm), anechoic, fluid filled vesicles were seen throughout the glandular tissue (Figure, 7).

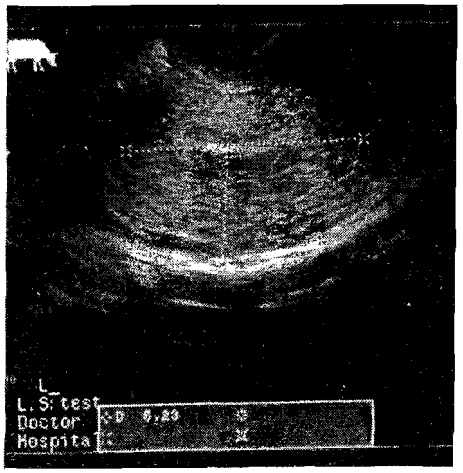


Figure (1): Ultrasonic image of the testis (normal), note enlarged tail of moderate echogenic of epididymis and some echogenicity of testicular parenchyma.

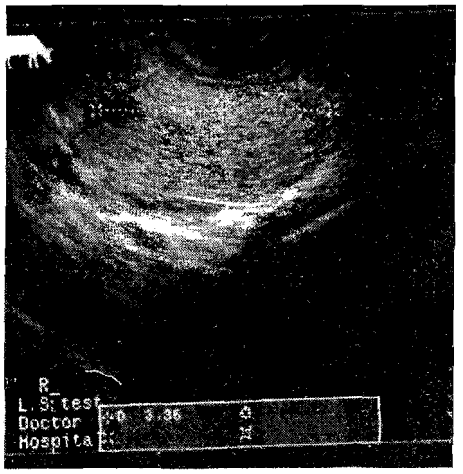


Figure (2): Ultrasonogram of testis after excitation, show many blood vessels of the spermatic cord "upper left anechoic fluid filled vessels".

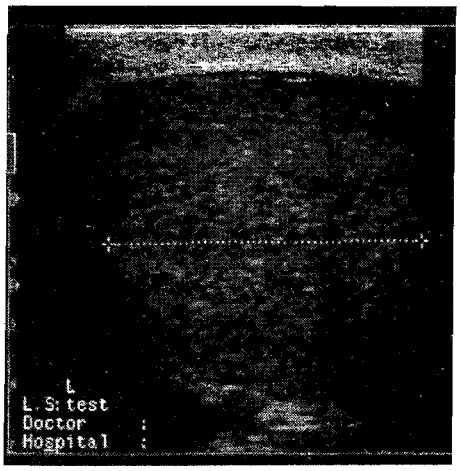


Figure (3): Ultrasonic image of the testis just before ejaculation showing moderate echogenicity of head and tail of epididymis and anechoic small particles within testicular parenchyma.

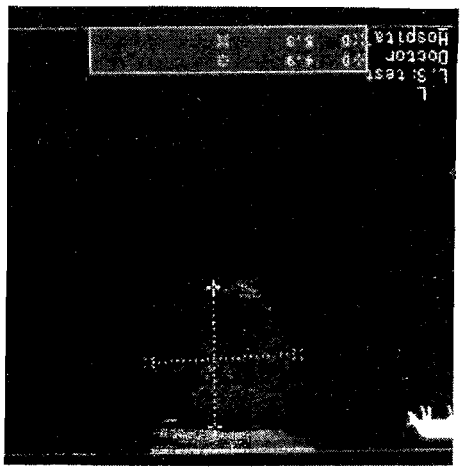


Figure (4): Ultrasonic image of testis after ejaculation (mounting), note echogenic testicular parenchyma.

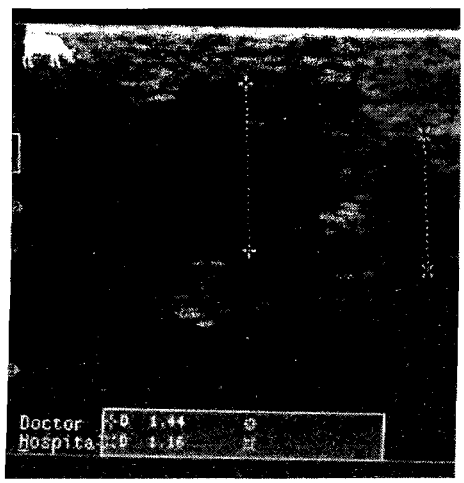


Figure (5): Ultrasonic image of the paired bulbo urethral glands, note a uniformily hyperechoic structures embedded within the bulbospongiosis muscle.

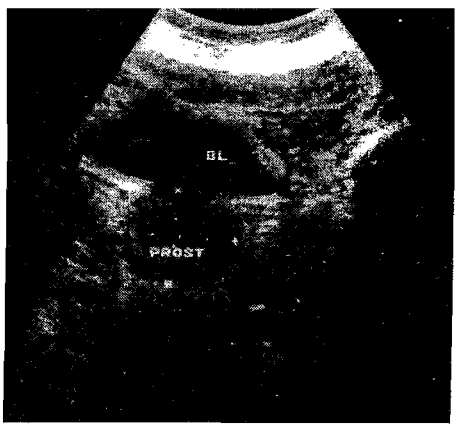


Figure (6): Ultrasonic image of the prostate body, note a uniformly hyperechoic structure located dorsal to the urinary bladder.

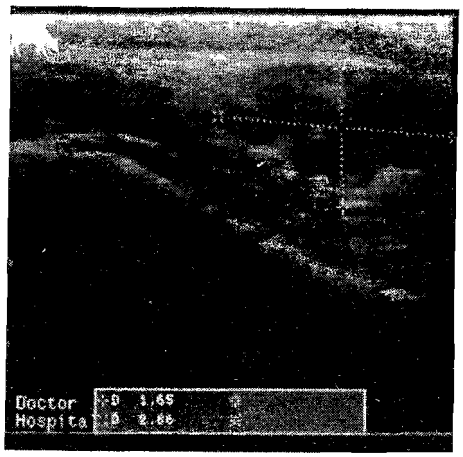


Figure (7): Ultrasonic image of the vesicular glands, note the irregular shape vesicular glands with isoechoic lobes of glandular tissue separated by more hypoechoic regions.

DISCUSSION

From the present investigation, it was observed that there was a significant increase in both scrotal circumference and testicular dimensions in dominant buffalo-bulls compared to dominated ones. These results coincided with **Younis et al. (2003)** who indicated that the SC was higher in adult buffalo-bulls than in younger ones. It was observed in field conditions, that buffalo-bull start to have high dominance to fight after 3 years of age (**Baruselli, 1994**).

The dominant animals showed earlier reaction time than dominated one. Social hierarchy was gradually shown with dominance of two animals over the others. The others bulls were completely inhibited by dominant bulls. **Blockey (1978)** and **McDiarmid (1984)** in a review of the socio-sexual behavior of bulls during multiple joining. Discussed how older dominant bulls could reduce herd fertility by inhibiting the serving capacity of younger bulls, especially when the sexually active group is small.

It has been proved by the results of the present study that there was a positive correlation between the dominant bulls and dominated ones in relation to testicular dimensions, SC and various steps of MSCT **(Boyd et al., 1989 and God-Frey and Lunstre, 1989).**

The normal semen characteristics could be available only in older dominant bulls. These results might be attributed to the fact that the testis in younger bulls exhibit a parallel increase in both size and spermatogenic activity until sexual maturity is attained thereafter the semen characteristics remain relatively stable until the age of senility where they began to decline **(Kumi-Diaka et al., 1981 and Sundararaman et al., 2002).**

Ultrasonographic evaluation of the normal testis was found useful for breeding evaluation of the adult boar **(Cartee et al., 1986)** and bull **(Cartee et al., 1989)**. Our investigation revealed that the normal testis showed an enlarged tail of epididymis with moderate echogenicity of epididymis and some echogenicity of testicular parenchyma. After excitation shows many blood vessels (pampiniform) of the spermatic cord. The testis just before ejaculation showed moderate echogenicity of head and tail of epididymis and anechoic small particles within testicular parenchyma **(Pechman and Eilts, 1987 and Chandolia et al., 1997).**

The ampullae, vesicular glands, pelvic urethra, prostate body, disseminate prostate and bulbourethral glands of the buffalo-bulls were visualized using transrectal ultrasonography. Physical dimensions of the measured accessory sex gland structures in our study were similar to those previously published reports **(Blom and Christiansen, 1947 and Bagshaw and Ladds, 1974)**. The function and growth of the prostate and vesicular gland in the male is very androgen dependent **(Rocha et al., 1994)**. This might explain the high normal measurements of the prostate and seminal vesicles in the dominant bulls than the dominated ones. Also the increased values of testosterone reflected cellular proliferation and increased echogenicity due to fluid accumulations in these glands **(Gupta et al., 1984 and Setchell et al., 1994).**

Our observations led us to suggest that 1) the M.S.C.T offers a good idea to assess buffalo-bulls libido and mating ability in a good manner. The culling of sires of poor serving capacity can significantly raise a herd's conception rate. 2) the ultrasonograph can be used to accurately measure the testis and accessory sex organs of buffalo-bulls. Knowledge of the ultrasonographic appearance of the normal genital tracts of the bulls may lead to the recognition of abnormal conditions of these organs.

REFERENCES

Almquist, J.O.; Branas, R.J. and Barber, K.A. (1976): Post pubertal changes in semen production of charolais bulls ejaculated at high frequency and the relation between testicular measurements and sperm output. Journal of Animals Science. 42, 670.

Bagshaw, P.A. and Ladds, P.W. (1974): A study of the accessory sex glands of bulls in abattoirs in northern Australia. Austrian Veterinary Journal. 50: 489.

Barnabe, V.H.; Molerofilho, J.R.; Barvselli, P.S. and Barnable, R.C. (2000): Modified serving capacity test in Murrah buffalo bulls (Bubalus Bubalis). Buffalo Journal, 2: 231.

Baruselli, P.S. (1994): Sexual behaviour in buffaloes. In: IV World Buffalo Congress, Sao Paulo, Brasil, V.I., pp. 158-173.

Blockey, M.A. de B. (1978): Bull management. Proceedings of kendall Hall Seminar on Cattle Production. Univ. Fe Melbourne School of Vet. Sci. and Australian Ass. of Cattle veterinarians, pp. 99-126.

Blom, E. (1950): Enhurting-Farvning smetode till adskillelse of Levende ogdodr spermier vedhjaelp.

Blom, E. and Christiansen, N.O. (1947): Studies on the pathological conditions in the testis, epididymis and accessory sex glands in the bull. Skand Vet. Tidsskr. 37 : 1.

Boyd, G.W.; Lunstre, D.D. and Corah, l.R. (1989): Serving capacity of crossbred yearling bulls. 1. Single sire mating behavior and fertility during average and heavy mating loads at pasture. Journal of Animal Science, 67: 60.

Cartee, R.E.; Gray, B.W.; Powe, T.A.; Hudson, R.S. and Whitesides, J. (1989): Preliminary implications of B-mode ultrasonography of the testicles of beef bulls with normal breeding soundness examinations. Theriogenology, 31: 1149.

Cartee, R.E.; Powe, T.A.; Gray, B.W.; Hudson, R.S. and Kuhlers, D.L. (1986): Ultrasonographic evaluation of normal boar testicles. American Journal of Veterinary Research., 47: 2543.

Chandolia, R.K.; Honaramooz, A.; Omek, B.C.; Pierson, R.; Beard, A.P. and Rawlings, N.C. (1997): Assessment of development of the testes and accessory glands by ultrasonography in bull calves and associated endocrine changes. Theriogenology, 48: 119.

Coulter, G.H. and Foote, R.H. (1976): Relationship of testicular weight to age and scrotal circumference of Holstein bulls. Journal of Dairy Science., 59: 730.

Godfrey, R.W. and Lunstre, D.D. (1989): Influence of single or multiple sires and serving capacity on mating behavior of beef bulls. Journal of Animal Science, 67: 2897.

Gupta, R.C.; Sharma, A.K. and Khurana, N.K. (1984): Testosterone levels and libido in buffalo bulls. In: International Congress on Animal Reproduction and Artificial Insemination. 10, Urbana Champaign, Illinois, Anais, P. 271.

Kotaya, K. and Narasimba Rao, A.V. (1990): Testosterone levels and libido in buffalo bulls. In: International congress on Animal reproduction and Artificial insemination. 10., Urbana Champagin, Illinois, Anais, P. 271.

Kumi-Diaka, J.; Nagaratam, V. and Rwuaan, J. (1981): Seasonal and age related changes in semen quality and testicular morphology of bulls in a tropical environment. Veterinary Record. 108, 13.

McDiarmid, J.J. (1984): Observations on the Modified serving capacity test for beef bulls. New Zealand Veterinary Journal 32, 149.

NRC (1970): Nutrient requirements of domestic animals No. 4, Nutrient requirements of beef cattle; National Research Council Washington DC.

Pechman, R.D. and Eilts, B.E. (1987): B-mode ultrasonography of the bull testicle. Theriogenology, 27: 431.

Rocha, A.; Carpenter, B.B.; Hawkins, H.E.; Sprou, L.R. and Forrest, D.W. (1994): correlation of in vivo testicle and seminal vesicle gland size with postmortem dimensions in bull. Theriogenology. 42: 1171.

Rodriguez-Martinez, H. (1998): Optimization of sperm quality in AI bulls. Reproduction in Domestic Animal, 33, 233.

Setchell, B.P.; Maddocks, S. and Brook, D.E. (1994): Anatomy, vasculature, enervation and fluids of the male reproductive tract. In: Knobil, E. and Neill, J.D. (eds). The Physiology of Production. Raven Press. Ltd, New York, 2: 1063.

Statistical Analysis System (SAS) (1987): User's Guid "SAS" Institute Carry, North Cardina.

Sundararaman, M.N.; Thangaraju, P. and John-Edwin, M. (2002): Age related changes in testis size of Jersey bulls and its effect on semen production traits. Indian Journal of Animal Science, 72 (7): 567.

Tomar, M.S.; Misra, O.S. and Joshi, C.B. (1966): Season variation in reaction time and semen production and prediction of semen attributes on initial mobility of spermatozoa in Hariana and Murrah bulls. Indian Journal of Dairy Science 19: 87.

Weber, J.A.; Hilt, C.J. and Woods, G.L. (1988): Ultrasonographic appearance of bull accessory sex glands. Theriogenology., 29 (6): 1347.

Younis, M.; Samad, H.A.; Ahmad, N. and Ahmad, J. (2003): Effect of age and season on the body weight, scrotal circumference and libido in Nili-Ravi buffalo bulls maintained at the semen production Unit, Qadirabd. Pakistan Veterinary Journal 23 (2), 59.