CORRELATION OF BODY WEIGHT, SCROTAL CIRCUMFERENCE AND SEXUAL BEHAVIOUR WITH SEMEN QUALITY IN NARI SUWARNA RAMS

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ABSTRACT

The present research investigation was conducted in NARI Suwarna strain of sheep to correlate body weight, scrotal circumference and sexual behaviour with semen quality. The scrotal circumference and the body weight have shown negative and positive correlation with various semen parameters but they were statistically not significant. Moreover, the performance of reproduction was slightly affected by climate in NARI Suwarna rams.

Key words: NARI Suwarna, rams, scrotal circumference, climate, semen

INTRODUCTION

Many factors affect the semen characteristics including nutrition, social environment, presence of females, geographical location, age, testicle and body conformation, libido and management system as reported in many studies (Zamiri and Khodaei, 2005 and Zarazaga et al. 2005). This strain of sheep breed was developed by the Nimbkar Agricultural Research Institute, Phaltan, Satara, Maharashtra, India. In view of this, the present research investigation was conducted in NARI Suwarna strain of sheep to correlate body weight, scrotal circumference and sexual behaviour with semen quality.

MATERIALS AND METHODS

The study was carried out on six mature NARI Suwarna rams (60% Deccani, 30% Madgyal and 10% Garole). The Body Weight (BW) and Scrotal Circumference (SC) of NARI Suwarna rams were measured as per standard procedure at monthly interval for six months. At the time of semen collection, the rams were scored through a reaction time (Hoflack et al. 2006). Apart from this, mating enthusiasm was scored by following the following score: 0: Rams do not mount i.e. show no sexual interest; 1. Sexual interest shown only once (e.g. sniffing of the perineal region); 2. Rams make a mounting attempt with sliding; 3. Mounting between sliding and jumping; 4. Rams mount by jumping and 5. Rams mount with great enthusiasm.

The semen was collected with an artificial vagina (AV) from all the six NARI Suwarna rams twice in a week. Thirty six ejaculates were collected in each month from six NARI Suwarna rams from September to February (six months) and semen was evaluated for gross motility, sperm motility (Loskutoff and Crichton 2001), sperm morphology (Salisbury et al. 1978), sperm concentration, live and dead sperm count (Evans and Maxwell 1987), hypo-osmotic swelling test (Revell and Mrode 1994), semen index and in-vitro sperm penetration test like sperm-cervical mucus contact test (Hafez 1977).

The Mean values (± SE) were computed for various parameters of semen quality. To assess the magnitude of difference in various spermatozoa characteristics of fresh and extended semen, the data was subjected to two way analysis of variance under Completely Randomized Design (CRD) and the difference among means was tested by Turkey's test as per the methods of Steel et al. (1997). The association of various meteorological attributes with semen characteristics was analyzed by Pearson's correlation coefficient test and the level of significance was fixed at 5%.

RESULTS AND DISCUSSION

Correlation of body weight, scrotal circumference, sexual behaviour with semen quality in NARI Suwarna rams:

Month wise correlation: The mean body weight of NARI Suwarna rams increased progressively from September to February except in November but the difference was non-significant. The mean scrotal circumference was lowest in the month of December and was highest in the month of September but the difference was non-significant. The libido test score was variable in September, October, November and February but the difference was non-significant and there was significant difference in libido test score in December and January months, respectively. The reaction time was shorter in September, October and November however; it was higher in January and February with significant difference. The semen volume was lowest in February and highest in October with statistically significant difference. However, there was no significant difference in the semen

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volume in November, December and January months. The gross motility varied in February and December without any significant difference. There was no significant difference in sperm motility among the months. The concentration of sperm (x 106/mL) was lowest in December and highest in September with significant difference. There was no significant difference in concentration of sperm in October, November, January and February months. The semen index (x 109/mL) was lowest in February and highest in October with significant difference and varied in other months without any significant difference. The live sperm percentage varied from September to December and dead sperm percentage from December to September without any statistically significant difference for all the months compared. There was no significant difference in the head abnormality percentage. The mid piece abnormalities were lowest in the month of February and highest in the month of January. The tail abnormalities percentage was highest in October and lowest in the month of November with no significant difference. The total sperm abnormalities percentage was lowest in December and highest in the month of January without any significant difference. The HOST percentage was lowest in December and highest in September without any significant difference. The SCMCT percentage was lowest in December and highest in September and the difference was statistically significant (Table 1).

Ram wise correlation: The body weight was highest in Ram no. 4668 and lowest in Ram no.5514 with statistically significant difference. There was no significant difference in between the body weight of Ram no. 4668 and Ram no. 5200. Likewise there was also no significant difference in the body weight of Ram no.5514 and Ram no. 5597. The libido test score was highest in Ram no. 5514 and lowest in Ram no. 4668 with statistically no significant difference among all the rams compared. The scrotal circumference was highest in Ram no. 4931 and lowest in Ram no. 5200 with significant difference. There was significant difference in scrotal circumference among rams. The reaction time was shorter in ram no. 5597 and longer in ram no. 4931 without any significant difference. The semen volume was higher in ram no. 5514 and lowest in ram no. 5550 with significant difference. There was significant difference in semen volume in ram no. 5514, 5550 and among the rams no. 4668, 4931, 5200 and 5597 there was no significant difference in semen volume. The gross motility score was highest in ram no. 5597 and lowest in ram no. 5550 and there was no significant difference in the gross motility score between the rams. The sperm motility was higher in ram no. 5514 and lower in ram no. 4931 and there was no significant difference in any of the rams. The sperm concentration (x 106/mL) was lower in ram no. 5597 and higher in ram no. 4668 and there was no significant difference in any of the rams. The semen index was higher in ram no. 5514 and lower in 5550 and the difference was non- significant among the rams. The live sperm percentage was lesser in ram no. 5550 and higher in ram no. 4931 with significant difference. There was significant difference in the live sperm percentage in ram nos. 4668, 4931, 5200, 5514 and 5550. The head abnormality percentage was lower in ram no. 5200 and higher in ram no. 5514 without any significant difference among all the rams. There was significant difference in the mid piece abnormality percentage in ram no. 4668 and ram no. 5597 but there was no significant difference in the mid piece abnormality percentage in ram nos. 4931, 5200, 5514 and 5550. There was no significant difference in the tail abnormalities percentage in ram nos.

Table 1: Month wise correlation of mean body weight, scrotal circumference and sexual behaviour with semen quality of NARI Suwarna rams

Parameters / Month	September	October	November	December	January	February
Body weight (kg)	40.2±3.03^{a}	41.9±3.13^{a}	41.3±2.76^{a}	43.3±3.08^{a}	46.2±2.16^{a}	47.6±2.03^{a}
Scrotal circumference (cm)	28.1±0.880^{a}	27.3±1.07^{a}	27.0±1.00^{a}	25.5±0.730^{a}	26.8±1.44^{a}	27.8±1.08^{a}
Libido Test Score (0-5)	4.87±0.0450^{a}	4.84±0.0746^{a}	4.75±0.160^{a}	4.81±0.109^{ac}	4.32±0.119^{b}	4.50±0.0468^{a}
Reaction time (sec)	1.30±0.05^{b}	1.30±0.05^{b}	1.30±0.03^{b}	1.40±0.04^{b}	1.60±0.12^{ab}	1.90±0.12^{a}
Volume (mL)	0.64±0.04^{a}	0.68±0.05^{a}	0.57±0.046^{ab}	0.58±0.028^{ab}	0.51±0.02^{ab}	0.50±0.01^{b}
Gross motility (0-5)	4.73±0.20^{a}	4.54±0.15^{a}	4.58±0.14^{a}	4.83±0.07^{a}	4.62±0.11^{a}	4.51±0.14^{a}
Sperm motility (%)	99.00±0.34^{a}	99.00±0.80^{a}	96.00±1.2^{a}	99.00±0.51^{a}	98.00±0.80^{a}	98.00±0.75^{a}
Sperm concentration (x 10^{6}/mL)	3071.00±57.6^{a}	2978.00±73.5^{ab}	2873.00±82.9^{ab}	2629.00±120^{b}	2694±149^{ab}	2729±53.3^{ab}
Semen index (x 10^{9})	16847±1065^{ab}	17499±1745^{a}	14095±1413^{ab}	13393±1211^{ab}	12035±999^{b}	11829±252^{b}
Live sperm (%)	86.80±1.15^{a}	87.10±1.33^{a}	87.10±1.35^{a}	88.60±0.56^{a}	88.20±1.38^{a}	87.90±1.09^{a}
Dead sperm (%)	13.20±1.15^{a}	12.90±1.32^{a}	12.90±1.35^{a}	11.40±0.59^{a}	11.80±1.38^{a}	12.0±1.09^{a}
Head abnormality (%)	2.93±0.32^{a}	2.67±0.19^{a}	2.73±0.22^{a}	2.63±0.19^{a}	3.32±0.39^{a}	2.72±0.19^{a}
Mid piece abnormality (%)	3.43 ±0.38^{a}	3.16±0.27^{a}	3.11±0.32^{a}	2.79±0.11^{a}	3.72±0.31^{a}	2.76±0.20^{a}
Tail abnormality (%)	3.00±0.29^{a}	3.42±0.23^{a}	2.69±0.37^{a}	2.94±0.20^{a}	3.72±0.34^{a}	2.99±0.11^{a}
Total abnormality (%)	9.35±0.49^{a}	9.25±0.50^{a}	8.52±0.71^{a}	8.38±0.45^{a}	10.7±0.97^{a}	8.46±0.32^{a}
HOST (%)	71.90±0.42^{a}	71.30±0.88^{a}	71.20±0.44^{a}	69.70±0.23^{a}	71.30±0.55^{a}	71.20±0.75^{a}
SCMCT (%)	87.3±0.669^{ab}	86.1±1.44^{ab}	84.8±1.16^{ab}	82.5±0.981^{b}	83.9±0.833^{ab}	84.1±0.785^{ab}

1. Common superscript in row a, b, c, d.
2. Means bearing any one common superscript in row do not differ significantly with each other

5200, 5550 and 5597 and also among the ram nos. 4668 and 4931. There was significant difference in the tail abnormalities percentage in ram no. 5514 and ram nos. 4668, 4931, 5200, 5550 and 5597. The total sperm abnormalities were significantly different in ram nos. 4668, 5200 and 5597 and ram nos. 4931 and 5550. The HOST percentage was lowest in ram no. 5550 and highest in ram no. 5597 with non-significant difference. The SCMCT percentage was higher in ram no. 5550 and lower in ram no. 4668 with no significant difference (Table 2).

Pearson's correlation coefficient between scrotal circumferences, body weights and semen evaluation tests in NARI Suwarna rams: The scrotal circumference has shown negative correlation with body weight, dead sperm percentage, concentration of spermatozoa, sperm motility, gross motility and libido test score and positive correlation with sperm cervical mucus contact test, semen index, hypo-osmotic swelling test, live sperm percentage, total sperm abnormalities, tail sperm abnormalities, mid piece abnormalities, head abnormalities, reaction time and semen volume however it was statistically not significant. The body weight has shown positive correlation with live sperm percentage, concentration of sperm, mid piece abnormalities and reaction time but negative correlation with sperm cervical mucus contact test, semen index, hypo-osmotic swelling test, dead sperm percentage, total sperm abnormalities, tail abnormalities, head abnormalities, sperm motility, gross motility, volume and libido test score but it was statistically non-significant (Table 3).

On contrary, Moghaddam et al. (2012) showed that there were no significant differences between crossbred rams in terms of semen characteristics except for spermatozoa progressive motility, semen volume and pH.

In addition, Taha et al. (2000) reported greater SC and testosterone concentrations in Awassi rams during the late summer months. Seasonal changes in SC are probably regulated by the melatonin action on gonadotrophin release during declining photoperiod (Lincoln et al. 1990). Janos Olah (2010) reported that the largest scrotal circumference was measured in the autumn for the Awassi (35.5 cm), in the spring for the Suffolk (35.8 cm) and in the winter for the prolific Merino (32 cm).

Kridli et al. (2007) also did not see difference in body weight between spring and autumn seasons, while scrotal circumference was greater ($P<0.05$) during the autumn than the spring season.

Peter et al. (1999) stated that seasonal influence both in scrotal circumference and in testosterone content of serum (two hours after GnRH treatment) can be observed in the case of mature rams.

It was observed in the present study that the body weight of rams, scrotal circumference, semen volume, live sperm percentage, mid piece abnormalities percentage, tail abnormalities percentage and total sperm abnormalities percentage of NARI Suwarna rams varied between the rams and months.

In contrast, Kafi et al. (2004) reported no monthly variations in BW of Persian Karakul rams throughout the year, while Avdi et al. (2004) reported monthly variation in BW of Chios and Serres rams.

Similarly, Janos Olah et al. (2013) reported highest semen volume by Ile de France breed in the autumn (1.75 mL), in the winter (1.89 mL) and in the spring (1.75 mL). The lowest volume of semen was produced by Suffolk in the autumn (1.33 mL), in the winter (1.36 mL) and in the summer (1.0 mL) and by Barbados Black belly in the spring (19.19 mL). Ingrid et al. (2007) reported that environmental factors identified as affecting semen production showed, in general, the same trend for all categories of animals and breeds.

Arasindaki et al. (2006) mentioned the significant correlation between sexual behaviour, sperm volume, viscosity, mass motility, sperm motility, sperm concentration and abnormal rate of sperm and testis diameter, testis length, scrotal circumference, scrotum length and testosterone concentration in Norduz male lambs.

In conclusion, scrotal circumference has shown negative correlation with body weight, dead sperm percentage, concentration of spermatozoa, sperm motility, gross motility and libido test score and positive correlation with sperm cervical mucus contact test, semen index, hypo-osmotic swelling test, live sperm percentage, total sperm abnormalities, tail sperm abnormalities, mid piece abnormalities, head abnormalities, reaction time and semen volume however it was statistically not significant. The body weight has shown positive correlation with live sperm percentage, concentration of sperm, mid piece abnormalities and reaction time but negative correlation with sperm cervical mucus contact test, semen index, hypo-osmotic swelling test, dead sperm percentage, total sperm abnormalities, tail abnormalities, head abnormalities, sperm motility, gross motility, volume and libido test score but it was statistically non-significant in NARI Suwarna rams.

Table 2: Ram wise correlation of body weight, scrotal circumference, sexual behaviour with semen quality of NARI Suwarna strain of sheep

Parameters	Ram 4668	Ram 4931	Ram 5200	Ram 5514	Ram 5550	Ram 5597
Body weight (kg)	50.20±1.32^{a}	46.20±1.20^{ac}	49.70±0.79^{a}	36.0±1.52^{b}	42.0±1.63^{bc}	36.3±2.12^{b}
Libido Test Score (0-5 score)	4.67±0.116^{a}	4.73±0.135^{a}	4.72±0.127^{a}	4.81±0.0673^{a}	4.40±0.140^{a}	4.75±0.134^{a}
Scrotal circumference (cm)	26.3±0.479^{bc}	30.1±1.05^{a}	24.6±0.676^{c}	27.3±1.25^{abc}	28.1±0.327^{ab}	26.2±0.703^{bc}
Reaction time (s)	1.4±0.045^{a}	1.7±0.16^{a}	1.5±0.12^{a}	1.5±0.16^{a}	1.5±0.14^{a}	1.4±0.03^{a}
Volume (mL)	0.57 ±0.02^{ab}	0.61±0.03^{ab}	0.58±0.04^{ab}	0.65±0.05^{a}	0.46±0.01^{b}	0.62±0.04^{ab}
Gross motility (0-5 score)	4.6±0.15^{a}	4.5±0.19^{a}	4.8±0.10^{a}	4.7±0.12^{a}	4.4±0.16^{a}	4.8±0.067^{a}
Sperm motility (%)	98.70±0.80^{a}	97.00±0.69^{a}	98.10±0.67^{a}	99.20±0.38^{a}	97.80±1.30^{a}	98.60±0.80^{a}
Sperm concentration (x 10^{6}/mL)	2998±156^{a}	2818±108^{a}	2784±120^{a}	2899±27.2^{a}	2752±113^{a}	2722±103^{a}
Semen index (x 10^{9})	13927±890^{a}	15283±1218^{a}	14308±1715^{a}	16416±1472^{a}	10747±778^{a}	15018±1654^{a}
Live sperm percentage (%)	86.60±1.20^{bc}	90.50±0.334^{a}	88.60±0.523^{ab}	86.80±0.499^{b}	83.90±1.05^{c}	89.40±0.246^{b}
Head abnormality (%)	2.95±0.42^{a}	2.68±0.079^{a}	2.55±0.12^{a}	3.50±0.20^{a}	2.68±0.28^{a}	2.64±0.18^{a}
Mid piece abnormality	3.87±0.45^{a}	3.20±0.22^{ab}	2.80±0.15^{ab}	3.44±0.23^{ab}	3.07±0.26^{ab}	2.59±0.12^{b}
Tail abnormality (%)	3.51±0.37^{ab}	3.28±0.16^{ab}	2.68±0.21^{b}	3.83±0.25^{a}	2.70±0.26^{b}	2.75±0.09^{b}
Total abnormality (%)	10.30±0.88^{a}	9.15±0.31^{ab}	8.02±0.29^{b}	10.8±0.62^{a}	8.45±0.50^{ab}	7.98±0.15^{b}
HOST (%)	70.70±0.63^{a}	71.5±0.58^{a}	71.0±0.64^{a}	71.2±0.43^{a}	70.4±0.84^{a}	71.9±0.52^{a}
SCMCT (%)	83.80±1.01^{a}	85.50±0.391^{a}	84.60±1.76^{a}	85.40±1.41^{a}	85.60±0.93^{a}	83.80±1.14^{a}

1. Common superscript in row a, b, c, d.
2. Means bearing any one common superscript in row do not differ significantly with each other

Table 3: Pearson's correlation coefficient between scrotal circumferences, body weight and semen evaluation tests in NARI Suwarna rams

Parameters	BW (kg)	SCMCT	SI	HOST	DS	LS	CS	TOA	TA	MA	HA	SM	RT	GM	V	LT
Scrotal circumference (cm)	- 0.161	0.644	0.02 39	0.10 8	- 0.064	0.06 3	- 0.024	0.2 30	0.2 93	0.2 15	0.1 02	- 0.578	0.6 88	- 0.697	0.0 16	- 0.185
Body weight (kg)	-	- 0.178	- 0.255	- 0.439	- 0.081	0.08 51	0.3 63	- 0.042	- 0.112	0.3 28	- 0.427	- 0.432	0.1 19	- 0.293	- 0.357	- 0.164

BW: Body Weight, SCMCT: Sperm Cervical Mucus Contact Test, SI: Semen Index, HOST: Hypo-Osmotic Swelling Test, DS: Dead Spermatozoa, LS: Live Spermatozoa, CS: Concentration of Sperm, TOA: Total Abnormalities, TA: Tail abnormalities, MA: Mid piece Abnormalities, HA: Head Abnormalities, SM: Sperm Motility, RT: Reaction Time, GM: Gross Motility, V: Volume and LT: Libido Test

REFERENCES

Arasindaki K and Firat C. (2006). Correlations between some reproductive characteristics in Norduz Male lambs. *Journal of Agricultural Science* **16** (1):69-75.

Avdi M; Banos K; Stefos P and Chemineau P. 2004. Seasonal variation in testicular volume and sexual behaviour of Chios and Serres rams. *Theriogenology* **62**: 275 -82.

Evans G and Maxwell W M C. 1987. Salmon's Artificial insemination of sheep and Goats. Australia pp 194.

Hafez E S E 1977, Techniques of human andrology. North Holland Publishing Company, Oxford, Pp. 384.

Hoflack G; Van Soom A; Maes D M; De Kruif A; Opsomer G and Duchateau L. 2006. Breeding soundness and libido examination of Belgian Blue and Holstein Friesian artificial insemination bulls in Belgium and The Netherlands. *Theriogenology* **66**: 207- 16.

Ingrid D; Xavier D; Gilles L; Edurado M; Christele R G and Loys B. 2007. Genetic and environmental effects on semen traits in Lacaune and Manchester AI rams. *Genetics Selection Evolution* **39**: 405-19.

Janos O, 2010. Factors influencing the quality of sheep semen. PhD thesis, University of Debrecen, Debrecen.

Janos O; Szil Via K; Sandor H; Janos P; Andras K; Anna P; Csilla B and Andras J. 2013. Seasonal changes in scrotal circumference, the quantity and quality of ram semen in Hungary. *Archiv Tierzucht* **56**:102-08.

Kafi M; Safdarian M and Hashemi M. 2004. Seasonal variation in semen characteristics, scrotal circumference and libido of Persian Karakul rams. *Small Ruminant Research* **53**:133-39.

Kridl R T; Abdullah A Y; Odeidat B S; Qudsieh R I; Titi H H and Awadeh M S. 2007. Seasonal variation in sexual performance of Awassi rams. *Animal Reproduction Science* **4**: 38-41.

Lincoln G A; Shrestha J N B; Sanford L M and Marcus G J. 1990. Seasonal cycles in the blood plasma concentrations of FSH, Inhibin and testosterone and testicular size in rams of wild, feral and domesticated breeds of sheep. *Journal of Reproduction and Fertility* **88**: 623-33.

Louskutoff N M and Crichton E G. 2001. Standard operating procedures for genome resource banking. The Bill and Bernience Grewcock Centre for Conservation and Research Omaha's zoo. Pp. 1-16.

Moghaddam G; Pourseif M M; Asadpour R; Rafat S A and Jafar R J. 2012. Relationship between levels of peripheral blood testosterone, sexual behaviour, scrotal circumference and seminal parameters in crossbred rams. *Acta Scientiae Veterinarie* **40**: 1049.

Peter P; Sandor B; Miklos M and Janos J. 1999. Estimating reproduction ability of Hungarian merino rams. Arch Tierz, Dummerstorf **42**: 459-68.

Revell S G and Mrode R A. 1994. An osmotic resistance test for bovine semen. *Animal Reproduction Science* **37**: 77 - 86.

Sallisbury G M; Van Denmark N L and Lodge J R. 1978. Semen evaluation: Physiology of reproduction and artificial insemination of cattle. Wheel Freeman and Co., San Francisco, USA. 2nd edn. pp 326-53.

Steel R G D; Torroe J H and Dickey D A. 1997. Principles and Procedures of Statistics- A Biometrical approach. 3rd Edn. McGraw Hill Book Co. New York, USA.

Taha T A; Abdel-Gawad E I and Ayob M A, 2000. Monthly variations in some reproductive parameters of Barki and Awassi rams throughout one year under sub-tropical conditions. Semen characteristics and hormonal levels. *Animal Science* **71**: 317-24.

Zmiri M J and Khodaei H R. 2005. Seasonal thyroidal activity and reproductive characteristics of Iranian fat tailed rams. *Animal Reproduction Science* **88***: 245 –55.*

Zarazagal A; Guzman J L; Dominguez and Priesto R. 2005. Effect of plane of nutrition on seasonality of reproduction in Spanish Payoya goats. *Small Ruminant Research* **87:** 237-67.