







Short Communications

## Use of the breeding soundness examination scoring system in Santa Inês and Dorper rams

Uso do sistema de pontuação *breeding soundness examination* em carneiros das raças Santa Inês e Dorper

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### ABSTRACT

This study evaluates the use of the Breeding Soundness Evaluation (BSE) scoring system in Santa Inês and Dorper rams. 89 Santa Inês ( $n = 48$ ) and Dorper ( $n = 41$ ) rams were submitted to andrological examination and classified with the BSE scoring system. The proportion of Santa Inês sheep with satisfactory and questionable performance in the BSE scoring system was 66.6% (32/48) and 33.34% (16/48), respectively. The average BSE value was higher ( $p < 0.05$ ) in rams with satisfactory performance ( $15.83 \pm 1.24$ ), compared to those with questionable performance ( $12.00 \pm 0.87$ ). The proportion of Dorper rams with excellent and satisfactory performance in the BSE scoring system was 26.83% (11/41) and 73.17% (30/41), respectively. The average value of BSE was higher ( $p < 0.05$ ) in rams with excellent performance ( $19.29 \pm 0.45$ ) in relation to those with satisfactory performance ( $16.77 \pm 0.99$ ). In Santa Inês sheep there was a strong positive correlation between BSE and scrotal perimeter ( $r = 0.75$ ;  $p < 0.01$ ) and a moderate negative correlation between BSE and sperm morphology ( $r = -0.52$ ;  $p < 0.01$ ). In Dorper sheep there was a strong positive correlation between BSE and scrotal perimeter ( $r = 0.69$ ;  $p < 0.01$ ) and a moderate negative correlation between BSE and sperm morphology ( $r = -0.60$ ;  $p < 0.01$ ). BSE can therefore be used as a complementary tool for andrological examination. It was possible to classify and rank Santa Inês and Dorper sheep according to the parameters adopted by BSE.

### RESUMO

O presente estudo teve como objetivo avaliar a utilização do sistema de pontuação Breeding Soundness Evaluation (BSE) em carneiros das raças Santa Inês e Dorper. Foram utilizados 89 carneiros das raças Santa Inês ( $n=48$ ) e Dorper ( $n=41$ ), submetidos ao exame andrológico e classificados pelo sistema de pontuação BSE. A proporção de carneiros Santa Inês com desempenho satisfatório e questionável no sistema de pontuação BSE foi de 66,6% (32/48) e 33,34% (16/48), respectivamente. O valor médio do BSE foi maior ( $P<0,05$ ) nos carneiros de desempenho satisfatório ( $15,83\pm1,24$ ), em relação aos de desempenho questionável ( $12,00\pm0,87$ ). A proporção de carneiros Dorper com desempenho excelente e satisfatório no sistema de pontuação BSE foi de 26,83% (11/41) e 73,17% (30/41), respectivamente. O valor médio do BSE foi maior ( $P<0,05$ ) nos carneiros de desempenho excelente ( $19,29\pm0,45$ ) em relação aos de desempenho satisfatório ( $16,77\pm0,99$ ). Nos carneiros Santa Inês foi observado correlação positiva e alta entre o BSE e o perímetro escrotal ( $R=0,75$ ;  $P<0,01$ ) e correlação negativa e moderada entre o BSE e a morfologia espermática ( $R=-0,52$ ;  $P<0,01$ ). Nos carneiros Dorper foi verificada correlação positiva e alta entre o BSE e o perímetro escrotal ( $R=0,69$ ;  $P<0,01$ ) e correlação negativa e moderada entre o BSE e a morfologia espermática ( $R=-0,60$ ;  $P<0,01$ ). O BSE pode ser utilizado como ferramenta complementar ao exame andrológico. Foi possível a classificação e o ranqueamento dos carneiros Santa Inês e Dorper de acordo com os parâmetros adotados pelo BSE.

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## INTRODUCTION

Sheep fertility is one of the most important factors for the reproductive efficiency of herds. The selection of breeders through the andrological examination aims to obtain information that allows estimating the reproductive potential of animals (MAIA et al., 2015). Kastelic & Thundathil (2008) found that the individual potential of each animal should not be determined by analyzing only one indicator, but through the evaluation of several parameters.

Many studies have therefore sought to establish criteria and parameters to assess the reproductive potential of sheep, together with information obtained from andrological examination (LONE et al., 2017). In support of developing complementary tests, Ruttle & Southward (1988) suggest the use of the North American Breeding Soundness Evaluation" (BSE) scoring system to classify and rank breeders. The BSE system aims to scores the breeders by scrotal perimeter according to the age group, along with progressive straight motility and sperm morphology, allowing them to be classified as excellent, satisfactory, questionable, or unsatisfactory (RUTTLE & SOUTHWARD, 1988).

There is, however, little information regarding the use of the BSE scoring system for selecting sheep in Brazil. The present study evaluates andrological characteristics and the use of the BSE scoring system in Santa Inês and Dorper rams.

## MATERIAL AND METHODS

Table 1 – Breeding Soundness Examination (BSE) scoring system for sheep.

Scrotal perimeter (cm)							
≤16 months		>16 months		Motility		Sperm morphology	
cm	Score	cm	Score	%	Score	% normal	Score
>36	08	>39	08	>80	04	>90	08
34-35	07	37-38	07	60-80	03	75-90	06
32-33	06	36	06	30-60	02	60-75	04
31	03	35	05	<30	01	<60	01
30	02	34	04	0	0		
29	01	33	03	Total points		Rating	
<29	0	32	02	19-20		Excellent	
		31	01	14-18		Satisfactory	
		<31	0	11-13		Questionable	
				0-10		Unsatisfactory	

Source: RUTTLE & SOUTHWARD (1988).

Testicular volume of the ram was also measured. Testicular volume was measured by comparing two mathematical equations. After Unanian et al. (2000), testicular volume equals a cylinder defined as  $VOLC = 2 \times [(LARG / 2)^2 \times \pi \times (COMP)]$ ; or after Bailey et al. (1998) the testicular volume equals a spheroid polate defined as  $VOLP = 2 \times [4/3 \times \pi \times (LARG / 2)^2 \times (COMP / 2)]$ . The volume was expressed in  $cm^3$  and represented both testicles.

The data were submitted to descriptive statistics in the

The present study was conducted during the 2016-2018 Londrina Agricultural Show, which took place in the first half of April each year and were located in the city of Londrina, state of Paraná, Brazil, at 23 ° 08' 47" to 23 ° 55' 46" S and 50 ° 52' 23" to 51 ° 19' 11" W (IBGE, 2019).

All procedures used were approved by the Ethics Committee on the Use of Animals (CEUA) of the Pitágoras Unopar University (n° 012/16). 89 Santa Inês ( $n = 48$ ) and Dorper ( $n = 41$ ) rams were submitted to andrological examination and assigned BSE scores. The animals were healthy, with an average age of  $15.33 \pm 6.20$  months and a moderate body score of 3 (on a scale from 1 to 5) (MORAES et al., 2005).

Andrological examination followed the standards recommended by Cbra (2013), being carried out in three stages: stage I, general clinical examination (body weight, respiratory rate, and rectal temperature); stage II, special clinical examination (scrotal perimeter, testicular length, and width); and stage III, seminal examination (volume of ejaculate, vortex, progressive motility, vigor, concentration, and sperm morphology). Semen collection was performed via electroejaculation.

Based on andrological data, the sheep were scored on each parameter in the system: scrotal perimeter ( $\leq 8$  points according to age), progressive rectilinear motility ( $\leq 4$  points), and sperm morphology ( $\leq 8$  points), which were summed to determine the final classification of: excellent (19-20 points), satisfactory (14-18 points), questionable (13-11 points), or unsatisfactory (0-10 points) (RUTTLE; SOUTHWARD, 1988) (Table 6).

form of mean and standard deviation. For the comparison of the studied variables, analysis of variance (ANOVA) was used and the means were compared using the Tukey test. Pearson's correlation test was also performed, correlating the parameters adopted in the BSE scoring system. The significance level used was  $\alpha = 5$  and the statistical package used was Minitab®, version 18.1 (State College, PA, USA).

## RESULTS AND DISCUSSION

This study evaluates, all ram of the Santa Inês and Dorper breeds presented adequate andrological characteristics, being considered apt for reproduction, according to the parameters recommended by Cbra (2013).

The proportion of Santa Inês ram with satisfactory and questionable performance in the BSE scoring system was 66.6% (32/48) and 33.34% (16/48), respectively. The average BSE value was higher ( $p < 0.05$ ) in rams with satisfactory performance ( $15.83 \pm 1.24$ ), compared to those with questionable performance ( $12.00 \pm 0.87$ ).

Satisfactory ram showed higher ( $p < 0.05$ ) scores for scrotal perimeter (BSESP) ( $5.37 \pm 19.94$ ) and sperm morphology (BSE ME) ( $6.87 \pm 0.99$ ) (Table 2).

Regarding the andrological characteristics, the scrotal perimeter (SP) and testicular volume (VT) presented higher averages ( $p < 0.05$ ) in sheep with satisfactory performance. The percentage of minor (Dm) and total (DT) sperm defects were higher ( $p < 0.05$ ) in sheep with questionable performance. For the other variables, there was no difference ( $p > 0.05$ ) between sheep with satisfactory and questionable performance (Table 2).

Table 2 – Andrological characteristics (mean  $\pm$  standard deviation) of Santa Inês sheep, according to performance in the BSE scoring system.

Variable	BSE performance	
	Satisfactory (n=32)	Questionable (n=16)
Age (months)	15,10 $\pm$ 5,79	14,19 $\pm$ 4,82
Scrotal perimeter (cm)	34,00 $\pm$ 2,34 <sup>a</sup>	30,50 $\pm$ 1,06 <sup>b</sup>
BSE PE (0-8)	5,37 $\pm$ 19,94 <sup>a</sup>	1,87 $\pm$ 0,93 <sup>b</sup>
Testicular volume (cm <sup>3</sup> )	477,25 $\pm$ 124,26 <sup>a</sup>	396,65 $\pm$ 99,81 <sup>b</sup>
Ejaculate volume (mL)	0,75 $\pm$ 0,44	0,98 $\pm$ 0,43
Whirlwind (1-5)	4,63 $\pm$ 0,66	4,88 $\pm$ 0,33
Motility (%)	85,67 $\pm$ 5,27	85,80 $\pm$ 3,17
BSE Mot. (0-4)	3,60 $\pm$ 0,49	3,87 $\pm$ 0,33
Stamina (1-5)	4,63 $\pm$ 0,66	4,88 $\pm$ 0,33
Concentration ( $\times 10^9$ /ml)	2,16 $\pm$ 0,48	2,23 $\pm$ 0,54
Major defects (%)	5,30 $\pm$ 1,68	6,06 $\pm$ 1,39
Minor defects (%)	3,93 $\pm$ 2,17 <sup>b</sup>	5,25 $\pm$ 1,25 <sup>a</sup>
Total defects (%)	9,23 $\pm$ 2,74 <sup>b</sup>	11,31 $\pm$ 2,20 <sup>a</sup>
BSE ME (1-8)	6,87 $\pm$ 0,99 <sup>a</sup>	6,25 $\pm$ 0,66 <sup>b</sup>
Final BSE (0-20)	15,83 $\pm$ 1,24 <sup>a</sup>	12,00 $\pm$ 0,87 <sup>b</sup>

BSE PE = score received for scrotal perimeter; BSE Mot = score received for progressive motility; BSE ME = score received for sperm morphology and final BSE = total points received. a, b Average followed by different letters on the same line differs significantly ( $P < 0.05$ ), by the Tukey test.

The proportion of Dorper rams classified with excellent and satisfactory performance in the BSE scoring system was 26.83% (11/41) and 73.17% (30/41), respectively. The average value of BSE was higher ( $p < 0.05$ ) in rams

with excellent performance ( $19.29 \pm 0.45$ ) in relation to those with satisfactory performance ( $16.77 \pm 0.99$ ). The excellent sheep showed higher ( $p < 0.05$ ) scores for BSE SP ( $7.29 \pm 0.45$ ) and BSE ME ( $8.00 \pm 0.00$ ) (Table 3).

Table 3 – Andrological characteristics (mean  $\pm$  standard deviation) of Dorper sheep, according to performance in the BSE scoring system.

Variable	BSE performance	
	Excellent (n=11)	Satisfactory (n=30)
Age (months)	13,00 $\pm$ 3,16 <sup>a</sup>	16,90 $\pm$ 7,16 <sup>b</sup>
Scrotal perimeter (cm)	36,28 $\pm$ 1,82 <sup>a</sup>	34,80 $\pm$ 1,15 <sup>b</sup>
BSE PE (0-8)	7,29 $\pm$ 0,45 <sup>a</sup>	6,10 $\pm$ 1,42 <sup>b</sup>
Testicular volume (cm <sup>3</sup> )	527,98 $\pm$ 104,72	497,51 $\pm$ 95,01
Ejaculate volume (mL)	0,50 $\pm$ 0,32	0,78 $\pm$ 0,47
Whirlwind (1-5)	5,00 $\pm$ 0,00	4,80 $\pm$ 0,40
Motility (%)	91,43 $\pm$ 2,26	88,17 $\pm$ 4,37
BSE Mot. (0-4)	4,00 $\pm$ 0,00	3,80 $\pm$ 0,40
Stamina (1-5)	5,00 $\pm$ 0,00	4,80 $\pm$ 0,40
Concentration ( $\times 10^9$ /ml)	2,39 $\pm$ 0,18	2,56 $\pm$ 0,28
Major defects (%)	4,71 $\pm$ 1,03 <sup>b</sup>	6,26 $\pm$ 1,12 <sup>a</sup>
Minor defects (%)	1,28 $\pm$ 0,83 <sup>b</sup>	3,36 $\pm$ 1,49 <sup>a</sup>
Total defects (%)	6,00 $\pm$ 1,64 <sup>b</sup>	9,63 $\pm$ 1,87 <sup>a</sup>
BSE ME (1-8)	8,00 $\pm$ 0,00 <sup>a</sup>	6,87 $\pm$ 0,99 <sup>b</sup>
Final BSE (0-20)	19,29 $\pm$ 0,45 <sup>a</sup>	16,77 $\pm$ 0,99 <sup>b</sup>

BSE PE = score received for scrotal perimeter; BSE Mot = score received for progressive motility; BSE ME = score received for sperm morphology and final BSE = total points received.

As for the andrological characteristics, the percentage of minor, major, and total sperm defects were higher ( $p < 0.05$ ) in sheep with satisfactory performance. For the other variables, there was no difference ( $p > 0.05$ ) between sheep with satisfactory and questionable performance (Table 3).

In this study, the sheep with the best BSE performance had a higher scrotal perimeter and a lower percentage of sperm morphology. There was no difference ( $p < 0.05$ ) in progressive motility between Santa Inês and Dorper rams. These results suggest that the progressive motility did not directly influence the classification of the ram. Ley et al. (1990) found greater relevance of progressive motility and total sperm defects due to the satisfactory performance (71.1%) of 583 Dorset, Hampshire, and Suffolk rams. Rutte et al. (1988) found greater importance of scrotal perimeter in the unsatisfactory performance (16.0%) of 3,167 mixed-breed rams.

Additionally, correlations were made between the parameters adopted for the scoring system and the BSE. In Santa Inês ram there was a strong positive correlation between BSE and SP ( $r = 0.75$ ;  $p < 0.01$ ) and a moderate negative correlation between BSE and ME ( $r = -0.52$ ;  $p < 0.01$ ). In Dorper ram there was a strong positive correlation between BSE and SP ( $r = 0.69$ ;  $p < 0.01$ ) and a moderate negative correlation between BSE and ME ( $r = -0.60$ ;  $p < 0.01$ ). There was no correlation ( $p > 0.05$ ) between BSE and progressive motility in Santa Inês and Dorper ram.

In the present study, SP and ME were of fundamental importance in determining the classification of rams. The lack of correlation for progressive motility may have been owing to the similarity in the values found between Santa Inês and Dorper rams. Chenoweth (2011), Moghaddam e Pourseif (2014), and Lone et al. (2017) working with *Bos taurus taurus* bulls found a positive correlation between BSE and scrotal perimeter, and the physical aspects of the semen and a negative correlation with the morphological aspects of the semen. Similar correlations have been described by Lopes et al. (2013a), Lopes et al. (2016), and Ronda et al. (2019) working with *Bos taurus indicus*, and Lopes et al. (2013b) with synthetic bulls.

In view of this information and the scarcity of studies on sheep, further studies are needed to determine safe and efficient systems for the selection of sheep with better reproductive potential, where the score table can be adjusted for a specific breed.

Some authors, such as Moghaddam & Pourseif (2014) and Garcia-Paloma (2015) suggest the use of BSE with the service capacity test to calculate the male:female ratio in a breeding station.

## CONCLUSIONS

The BSE scoring system can be used as a complementary tool to andrological examination. It was possible to

classify and rank Santa Inês and Dorper sheep according to the parameters adopted by the BSE scoring system.

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