RESEARCH COMMUNICATION

Evaluation of some reproductive parameters in the indigenous boar of Zimbabwe

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ABSTRACT

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A number of reproductive parameters were evaluated in 12 adult indigenous boars. The seminal vesicles, prostate and bulbourethral glands had masses of 184,41 ± 18,00 g, 16,69 ± 2,42 g and 142,05 ± 16,12 g, respectively, while the penile length measured 45,71 ± 4,49 cm. The testes and epididymides had masses of 211,82 ± 26,74 g and 108,81 ± 11,49 g. The number of sperm averaged 2,78 ± 0,59 x 10^9 in the testes and 11,76 ± 2,11 x 10^9 in the epididymides. The daily sperm production per gram (DSPG) of testicular tissue and the daily sperm production rate (DSP) were calculated to be 2,98 ± 0,31 x 10^6 and 0,62 ± 0,14 x 10^9 spermatozoa, respectively. The serum level of testosterone measured 11,98 ± 0,81 ng/mℓ. These values suggest a reduced reproductive capacity in these animals. However, appropriate selection techniques may be evolved to upgrade this indigenous stock while nutrition and management may be improved to increase body size, and hence, gonadal development.

Keywords: Reproductive parameter, indigenous boar, Zimbabwe, epididymides, testes, sperm, gonadal development

INTRODUCTION

There is general agreement that in most species, a positive and significant correlation exists between testicular dimensions, gonadal and extragonadal sperm reserves, sperm production and reprodutive capacity (Amann 1970). Evaluation of the male has therefore become necessary in breeding programmes, in order to recognize poor potential breeders, thus providing a basis for selection for high fertility. In the recent past, there has been an increase in the use of cross-bred boars in commercial swine production as they have been known to improve the reproductive performance of herds as a result of heterosis and complementarity (Anderson 1980). To our knowledge, the indigenous boar in Zimbabwe has not been employed in cross-breeding programmes—probably because of a lack of information on its reproductive performance. This study was therefore undertaken to define some aspects of reproductive capacity in the indigenous boar relative to exotic breeds and thereby to provide information that could serve as a basis for the design of selection techniques that will enhance productivity.

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MATERIALS AND METHODS

The 12 adult boars used for this study were obtained from communal farmers around Chinhoyi, Zimbabwe.

The animals' ages were estimated at 12–18 months and their masses were between 38,5 and 53,5 kg. Even though the sexual histories of the animals were not known, they were usually rested for at least 7 d before slaughter. The accessory sex glands with the penis and testes were obtained at slaughter and quickly transported to the laboratory. Each organ was then trimmed of adhering connective tissue and fat and the masses determined on a mettler analytical balance. Penile length was measured with a ruler calibrated to 0,01 m. Testes volume was determined by water displacement in a 0,9% NaCl solution. After each testis was rid of its capsule and the epididymis divided into the three parts of caput, corpus, and cauda, the number of spermatozoa in each portion was determined according to the method of Amann & Almquist (1961). Briefly, each testis was cut into smaller pieces and put into a homogenizer with 250 mℓ of normal saline and homogenization was done for a few seconds. The epididymal portions were thoroughly macerated by use of a grinding and maceration technique, until a homogenous suspension was obtained into 50 mℓ normal saline. Eosin was added to each solution to aid identification of stained spermatids and sperm heads during counting. Counting was done with the aid of the new, improved Neubauer haemocytometer, under the optical microscope. The total number of spermatozoa was calculated according to Bialy & Smith (1958):

$$\text{Total number} = \text{Average haemocytometer count} \times \text{dilution rate} \times \text{volume of sample} \times 10^4$$

The daily sperm production per gram (DSPG) testicular tissue was calculated according to the formula:

$$\text{DSPG} = \frac{\text{Sperm in the testes}}{\text{Testes mass} \times 4{,}27}$$

(Amann 1970)

The daily sperm production (DSP) rate was then derived from the DSPG according to Wildeus & Entwistle (1982), assuming that mediastinal mass represents 1% of testicular parenchymal mass (DSP = DSPG x 0,99 x testes mass). Tissue from the testis was also fixed in Bouin's fluid and processed by the usual paraffin method. Sections of 5-μ thickness were stained by the H & E technique and the seminiferous tubule diameter was measured under a binocular microscope, with a calibrated ocular micrometer. Blood, collected at slaughter, was separated by centrifugation to obtain serum which was stored at –20 °C until analysis. The serum level of testosterone (T) was determined by the radio-immuno-assay technique, by means of a commercially available kit (Code TRK 600, Amersham, UK). The intra-assay coefficient of variation was 4,12 %. Counting was done in a liquid scintillation counter programmed to calculate concentrations. The slight variations in the measurements from the right and left testes were not statistically significant, hence the paired values were employed in analysing the data.

TABLE 1 Testicular dimensions and sperm reserves in the indigenous boar of Zimbabwe (n = 12)

Characteristics	Mean values ± SD
Testes mass (g)	211,82 ± 26,74
Testes volume (mℓ)	230,04 ± 28,55
Capsule mass (g)	12,52 ± 2,08
Epididymal mass (g)	108,81 ± 11,49
Testes sperm (x 10^9)	2,78 ± 0,89
Epididymal sperm (x 10^9)	11,76 ± 2,11
% Epid. sperm in caput	12,86 ± 2,68 (31,59 ± 2,56)
% Epid. sperm in corpus	3,28 ± 0,72 (18,02 ± 1,53)
% Epid. sperm in cauda	83,85 ± 2,76 (49,93 ± 5,48)
DSPG (x 10^6)	2,98 ± 0,31
DSP (x 10^9)	0,62 ± 0,14
Seminiferous tubule diameter (μ)	186,39 ± 13,39
Serum testosterone ng/mℓ	11,98 ± 0,81

Note: Values in parentheses indicate percentage of total epididymal mass

RESULTS

The masses of the seminal vesicles, prostate and bulbourethral glands were determined to be 184,41 ± 18,00 g, 16,69 ± 2,42 g and 142,05 ± 16,12 g, respectively, while the penis measured 45,71 ± 4,49 cm in length. Testicular dimensions and sperm content are shown in Table 1. The total number of sperm amounted to 14,53 ± 2,57 x 10^9, with 19,11 ± 2,21% of this in the testes and 80,87 ± 2,21 % in the epididymides, respectively. The body mass was significantly ($P < 0,01$) correlated with testes mass ($r = 0,92$) and sperm ($r = 0,84$). Testes mass was also significantly ($P < 0,01$) correlated with seminiferous tubule diameter ($r = 0,86$) and DSP ($r = 0,88$).

DISCUSSION

The mass of the accessory sex glands with the testicular dimensions and sperm reserves obtained in this study is lower than that reported for exotic breeds and also for cross-bred boars bred and maintained in the humid tropics (Egbunike & Elemo 1978) even though it is generally agreed that the flushing technique yields a higher sperm count than the maceration technique, possibly as a result of breakdown of spermatozoa during homogenization or failure to recover all sperm from the homogenate (Bialy & Smith 1958; Igboeli & Rakha 1971). This means that the sperm reserves obtained in this study could be a little higher. These lower values were apparently due to the smaller body size of these animals. However, the relative distribution of epididymal sperm agrees with earlier reports. The cauda epididymides hold 83,85% of epididymal sperm which suggests that a large percentage of epididymal sperm is available for collection in a short time. The number of sperm in an ejaculate of the boar is estimated to be 0,2 to 0,3 x 10^9/mℓ (Anderson 1980). This implies that an ejaculate of the indigenous boar would contain a much lower number of sperm cells. The relatively low

serum levels of testosterone are probably the result of the reduced reproductive capacity in these animals. The indigenous boar has not been reared on a commercial basis and the semi-intensive system of management does not provide such levels of nutrition as can adequately enhance body growth. These nutritional restrictions have been reported to not only delay the onset of puberty, but also to depress semen production and characteristics (Anderson 1980). Nevertheless, knowledge of the epididymal sperm reserves and other information from this study could provide a basis, not only for designing appropriate selection techniques or physiological experiments on reproduction, but also for utilizing available sperm resources in breeding programmes, by indicating how much sperm may be removed before any demand is put on testicular sperm.

The significant correlations between various parameters, as obtained, are in general agreement with other reports (Coulter & Foote 1977; Entwistle, Winantea & Holroyd 1980). The positive and significant ($P < 0,05$) correlation between testicular and epididymal sperm reserves suggests that sperm production and sperm storage are associated. However, the relatively low correlation between the testes mass and DSPG, in contrast to DSP, is probably due to the occurence of tubular and mediastinal connective tissue which does not contribute to the spermatogenic capacity of the testis.

Previous reports (Egbunike & Elemo 1978; Anderson 1980) indicate that comparisons of reproductive characteristics of purebred and crossbred boars show that testes from crossbreds are significantly heavier and contain more spermatozoa than those from purebred boars. Appropriate selection techniques may therefore be evolved to upgrade this indigenous stock by crossbreeding, while also improving management and nutrition to increase body and testicular dimensions (Killian & Amann 1972).

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