FERTILITY IN THE STALLION AS ACCESSED BY THE SPERMATOZOA MORPHOLOGY

FERTILIDADE NO GARANHÃO AVALIADA ATRAVÉS DA MORFOLOGIA ESPERMÁTICA

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SUMMARY

In a breeding farm, 129 mares were bred to 4 stallions and had an overall pregnancy rate of 76.7%. Stallions were submitted to semen examination for at least two times at the beginning of the breeding season and the percentage of morphologically normal spermatozoa were used for statistical analysis in relation to the percentage of pregnancy at the end of the breeding season. A regression analysis revealed that the percentage of pregnancy (y) can be estimated by the percentage of normal spermatozoa (x) in the ejaculate according to the following equation: y=52.38+0.44x; r2=97.8%; P<0.01. We concluded that the pregnancy rate can be estimated by the percentage of morphologically normal spermatozoa in the ejaculate of stallions, since it is an important characteristic of the semen quality that is strongly associated with fertility, in conditions of uniform management procedures for mares and stallions.

Key words: *stallion, semen, fertility, spermatozoa ,morphology.*

RESUMO

Em um haras, 129 éguas foram cobertas por 4 garanhões, apresentando uma percentagem de prenhez média de 76,7%. Os garanhões foram submetidos a exame de sêmen duas vezes durante a temporada de monta e a percentagem de espermatozóides morfologicamente normais foi utilizada para análises estatísticas em relação a percentagem de prenhez, ao final da estação reprodutiva. Uma análise de regressão revelou que a percentagem de prenhez (y) pode ser estimada pela percentagem de espermatozóides morfologicamente normais (x) no ejaculado, conforme a seguinte equação: y=52,38+0,44x; r2=97,8%; P<0,01. Conclui-se que a percentagem de prenhez pode ser estimada com base na percentagem de espermatozóides morfologicamente normais no ejaculado de garanhões, uma vez que se trata de uma importante característica da qualidade do sêmen e que está fortemente associada a fertilidade, sempre que as condições de manejo forem uniformes para garanhões e éguas.

Palavras-chave: *garanhão, sêmen, fertilidade, morfologia espermática.*

INTRODUCTION

To achieve maximum reproductive efficiency in a horse breeding farm, it is important that the stallions are free of infectious agents that can affect the genital tract and free of genital abnormalities that can impair the normal reproductive processes. They should have the ability to perform normal copulatory behavior and produce gametes in numbers an quality enough for fertilization. The variables used to access fertility in the stallion are: the percentage of pregnancy; the foaling rate (KENNEY ***et al.***, 1971); percentage of pregnancy per cycle (DOWSETT & PATTIE, 1982; JASKO ***et al.***, 1990) and the percentage of pregnancy per service (DOWSETT & PATTIE, 1982).

Although many studies have been devoted to this subject there is some controversy on specific topics of the semen evaluation. Some researchers stress the importance of the total number of viable spermatozoa in the ejaculate (KENNEY, 1975; VOSS

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Recebido para publicação em 27.12.96. Aprovado em 23.04.97

et al., 1982; PICKETT *et al.*,1983) and the percentage of progressively motile spermatozoa (VOSS *et al.*, 1981). Other researchers, besides considering all aspects of semen evaluation, devoted special attention to spermatozoa morphology (MC LEOD & MC GEE, 1950; NISHIKAWA, 1959; BIELANSKI *et al.*, 1982; JASKO *et al.*, 1990; FRIEDMAN *et al.*, 1991), while others questioned the importance of spermatozoa abnormalities on stallion fertility. Recently, it has been demonstrated that morphological abnormalities have some association with fertility in stallions (JASKO *et al.*, 1990; GASTAL *et al.*, 1991; FRIEDMAN *et al.*, 1991). FRIEDMAN *et al.* (1991) demonstrated that it was possible to correlate spermatozoa morphology with the deleterious effects of high temperature on the testicles in stallions. The aim of this study is to present some results about a significant relationship between spermatozoa morphology and fertility in stallions.

MATERIAL AND METHODS

The experiment was developed in a breeding farm belonging to the Jockey Club of Rio Grande do Sul - Brazil (30° S), where four stallions were bred to 171 mares (Table 1) during one breeding season (Southern Hemisphere breeding season - August 15 to January 15).

Table 1 - Distribution of the according to their reproductive status.

Mare"s Status	Number	%
Lacting	60	46.5
Barren	45	34.0
Maiden	24	18.6
Total	129	100.0

One hundred and twenty nine mares and 4 stallions were used in this study. The mares were stratified according to their reproductive status as shown in Table 1. From the reproductive point of view, it can be considered that the mares were randomly assigned to each stallion, because the only criteria for breeding a specific mare to a stallion was the pedigree and stud fee (owners decision). The stallions (Thoroughbred) were known to be fertile (based on previous years) and ranged from 7 to 14 years old. The mares, also Thoroughbred, ranging from 3 to 17 years old. The breeding management was based on rectal control of follicular development and the mares were bred as close as possible to the estimated time of ovulation. The stallions were submitted to two semen examination at least, during the peak of the breeding season. (November). The following characteristics were recorded: volume (gel free portion), motility (total), total viable spermatozoa per ejaculate (KENNEY *et al.*, 1983), pH and morphology. The following abnormalities were recorded for spermatozoa morphology in percentages: morphologically normal spermatozoa, head abnormalities (pear shaped, narrow at the base, underdeveloped, small abnormal), mid peace abnormalities (hypoplasia, mitochondria sheath lesions - fibrillation, denuded, pseudo-droplet), tail abnormalities (bent and coiled tails, tail coiled around the head), acrosomal abnormalities (knobbed spermatozoa, ruffled, lost), proximal cytoplasmic droplet, distal cytoplasmic droplet, normal loose heads (tailess heads) (FRIEDMANN *et al.*, 1991).

Statistics

For statistical analysis purposes, the only semen variable considered was the percentage of morphologically normal spermatozoa (NOR) and the mean value was used. The data was subjected to analysis of variance and linear regression (STEEL & TORRIE, 1960). The variables considered were: the percentage of normal spermatozoa (independent variable) and the pregnancy rate of the mares bred to each stallion during the whole breeding season (dependent variable).

RESULTS AND DISCUSSION

Other seminal variables (KENNEY *et al.*, 1983) besides the percentage of morphologically normal spermatozoa (NOR) showed a random variation among stallions and semen collections. For this reason, the data is not included in this paper.

The reproductive status of the mares (maiden, barren or lactating) can significantly affect stallion fertility. According to GINTHER (1992), the fertility rate was decreased by approximately 10 percentage points in barren mares as compared to lactating mares. In our study, the reproductive status (barren or lactating) did not affect fertility rate, probably because there was a reduced number of certain categories (maiden) and because there was an uniform distribution of those categories among stallions. The overall pregnancy rate was 76.7 %, and the number of services per conception was 3.3 (Table 2). The pregnancy rate and the number of services per

conception per stallion were associated to the NOR in the ejaculate (Table 2.)

Table 2 - Fertility of stallions in relation to the percentage of normal spermatozoa in the ejaculate.

Stallions	Normal Spermatozoa	No. of Mares bred/pregnant	Pregnancy (%)	Services/ Pregnancy
1	40	42/28	69	4.1
2	68	40/33	83	3.2
3	82	8/7	87	2.1
4	61	39/31	80	3.7
Mean	63	129/99	76.7	3.3

Regression analysis of this data indicated a significant trend ($p<0.01$) for an increase in pregnancy rate when the percentage of normal spermatozoa increased in the ejaculate, that is, for each unit of increment on the percentage of normal spermatozoa in the ejaculate it can be expected an increment of 0.44 % on the pregnancy rate ($Y = 52.38 + 0.44 X$, $R2 = 97.79$ %).

The numbers of services per conception were also correlated to the pregnancy rate ($r = 0.82$, $P<0.01$) and subsequently associated to the percentage of normal spermatozoa in the ejaculate. These results agree with previous reports that indicated the importance of the spermatozoa morphology for the breeding soundness examination of stallions (NISHIKAWA, 1959; BIELANSKI *et al.*, 1982; DOWSETT *et al.*, 1984). Other researchers were not able to identify an association between spermatozoa morphology and fertility (VOSS *et al.*, 1981), while others found minor and, sometimes non significant associations (KENNEY *et al.*,1971; DOWSETT & PATTIE, 1982; KENNEY *et al.*,1983). This could indicate a wide range of management conditions between farms where data were collected. Data for this work was obtained from a considerable number of mares (n = 129) and 4 stallions with a wide range in the number of morphologically normal spermatozoa. Both stallions and mares were kept in the same farm and submitted to the same management procedures, with the least possible confounding effects. Some researchers reported significant coefficients of correlation between fertility indexes and percentage of normal spermatozoa in the ejaculate: JASKO *et al.*,(1990) and GASTAL *et al.*,(1991) reported $r = 0.84$ and $r = 0.65$, respectively. KENNEY *et al.*,1971, DOWSETT & PATTIE (1982) and PICKETT *et al.*,(1989) evaluated several characteristics in the stallion's semen and concluded that, although the spermatozoa morphology is an important variable, the total number of viable spermatozoa in the ejaculate was the most important seminal characteristic associated with fertility in the stallion. In a recent work (FERNANDES & PIMENTEL, 1996), the coefficient of correlation between the total number of viable spermatozoa corrected (TVC), the fertility indexes, the correlation between the percentage of motility (M) and fertility were not significant. However, the coefficient of correlation between percentage of normals and fertility indexes (percentage of pregnancy, percentage of pregnancy per cycle and percentage of pregnancy per service) were all significant (0.33; 0.50 and 0.36 respectively). Other factors that could have affected the stallion's fertility were the reproductive status (GINTHER, 1992) and age of the mares (VANDERWALL & WOODS, 1990), however, in that particular farm, mares were randomly assigned to each stallion, avoiding confounding effects.

In summary, it can be concluded that the percentage of morphologically normal spermatozoa in the ejaculate is an important characteristic of the semen quality which is strongly associated with fertility, whenever management procedures are kept uniform for mares and stallions.

ACKNOWLEDGMENTS

Supported in part by CNPq and Universidade Federal de Pelotas.

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