

## Evaluation of spermogram in domestic pigs

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### SUMMARY

A microscopic assessment was used to estimate sperm morphological structure in 405 ejaculates from 70 boars according to Blom classification. The classification of spermogram quality according to a new 6-degree scale was also established. We found, that male spermograms in domestic pigs were characterized by a large variability both between and within breeds. The estimation of semen quality, only with regard to the mean frequency of occurrence of particular morphological forms of spermatozoa, was not effective for evaluation of individual boar or group of boars. However, the method was effective to evaluate individual ejaculates. The quality classification of the spermogram enabled to evaluate usefulness of ejaculates graded as good and average for insemination. *Reproductive Biology* 2006 **6** Suppl. 2:93–98.

**Key words:** boars, sperm morphology, spermogram classification

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## INTRODUCTION

Semen analyses conducted in insemination stations are usually confined to examination of basic characteristics such as ejaculate volume, sperm concentration and sperm motility percentage. This estimation is sufficient for making immediate decisions concerning ejaculate usefulness for artificial insemination (AI). However, it is not sufficient for evaluating semen biological value, especially regarding spermatozoal morphology.

Many studies showed that the frequency of occurrence of spermatozoa with morphological changes differs among males [4, 7], and sperm traits are related to the semen's fertilizing capacity and its usefulness to storage [3, 8]. For example, ejaculates characterized by a low coefficient of oocyte penetration *in vitro*, contained a high percentage of morphologically changed spermatozoa, especially those with cytoplasmic droplets [2]. The aim of the work was to evaluate the usefulness of a new 6-stage spermogram classification to test the quality of spermatozoal morphology in male domestic pigs.

## MATERIALS AND METHODS

Ejaculates (n=405) collected from 70 boars were tested. All boars were maintained under similar environmental conditions in insemination station at the Mazovian Centre of Animal Breeding and Reproduction. The ejaculates were taken twice a week by means of the gloved-hand technique. Immediately after the collection, slides of each ejaculate were prepared according to Kondracki et al. [5]. Morphological structures of 500 spermatozoa in each slide were evaluated according to Blom classification [1].

In addition, the classification of spermogram quality based on 6-degree scale was also established for comparison between males. This classification enabled to assign the ejaculates to particular classes from class 0 – for ejaculates with the worst sperm morphology to class 5 – for ejaculates with the best sperm morphology:

– class 5 (very good semen) – ejaculates containing at least 90% of spermatozoa with proper morphology and no more than 3% of spermatozoa with major abnormalities;

– class 4 (semen without restrictions to use) – ejaculates containing at least 90% of spermatozoa with proper morphology and 3 – 5% of spermatozoa with major abnormalities or ejaculates containing 85 – 90% of spermatozoa with proper morphology and no more than 3% of spermatozoa with major abnormalities;

– class 3 (semen of acceptable quality) – ejaculates containing 73 – 90% of spermatozoa with proper morphology and no more than 9% of spermatozoa with major abnormalities;

– class 2 (semen of questionable quality) – ejaculates containing at least 73% of spermatozoa with proper morphology and 10 – 15% of spermatozoa with major abnormalities;

– class 1 (low quality semen) – ejaculates containing 15 – 20% spermatozoa with major abnormalities or 65 – 73% of spermatozoa with proper morphology;

– class 0 (semen below acceptable levels) – ejaculates containing less than 65% of spermatozoa with proper morphology or above 20% of spermatozoa with main changes.

Spermograms of the tested ejaculates were estimated and assigned to one of the six classes of the above classification. The frequencies of spermograms in each class for the whole tested material and within each breed were also calculated. Sperm characteristics were compared using analysis of variance. Differences between means were evaluated using Tukey's test.

## **RESULTS AND DISCUSSION**

Frequency of main morphological forms of spermatozoa in boar semen of the analyzed breeds and two-breed crossbreds are presented in Table 1. The initial estimation suggested that morphological quality of boar spermatozoa in individual breeds was relatively high; the average percentage

Table 1. Frequency of sperm abnormalities in semen of crossbreed and purebred boars

Breed	Number of ejaculates	Spermatozoa with normal morphology (%)			Spermatozoa with abnormal morphology (%)					
					with major abnormalities			with minor abnormalities		
		$\bar{x}$	SD	V%	$\bar{x}$	SD	V%	$\bar{x}$	SD	V%
Landrace	136	86.71 <sup>Aa</sup>	12.29	14.17	3.69	5.93	160.70	9.60	16.80	175.00
Large White	46	86.36 <sup>A</sup>	6.01	6.96	4.62 <sup>A</sup>	2.82	61.04	9.02	4.97	55.10
Pietrain	69	90.42	5.59	6.18	3.21	2.72	84.74	6.37	4.36	68.45
Belgian Landrace	21	91.63 <sup>AC</sup>	4.51	4.92	1.97 <sup>B</sup>	1.12	56.85	6.39	4.18	65.42
Duroc	19	93.15 <sup>BCb</sup>	3.34	3.59	2.16	2.29	106.02	4.69 <sup>A</sup>	2.46	52.45
Hampshire	17	85.05 <sup>A</sup>	10.32	12.13	2.94	2.86	97.28	12.00 <sup>B</sup>	8.63	71.92
Duroc × Pietrain	65	89.37	7.49	8.38	1.73 <sup>B</sup>	1.66	95.95	8.90	7.32	82.25
Hampshire × Pietrain	32	93.75 <sup>BC</sup>	4.78	5.10	1.80 <sup>B</sup>	1.44	80.00	4.45 <sup>A</sup>	2.85	64.04

within lines means bearing different superscripts differ significantly at  $p \leq 0.01$  (capital letters) or  $p \leq 0.05$  (small letters)

of spermatozoa with main morphological changes did not exceed 20%, which is considered as a critical level [6]. However, there were significant differences between breeds in relation to both percentage of spermatozoa with proper and with abnormal morphology. The semen of Hampshire × Pietrain and Duroc contained the highest percentage of spermatozoa with proper morphology (over 93%), by 7% more than in semen of Poland's most popular breeds, such as the Polish Large White and Polish Landrace, and by over 8% more than in semen of the Hampshire breed. A high variability in spermatozoal morphology within breeds was observed (tab. 1). The coefficient of variation (V%) for the percentage of spermatozoa with

Table 2. The classification of ejaculates according to the 6-degree scale

Breed	Number of ejaculates in each class of spermiogram												
	Number of ejaculates	Class 5		Class 4		Class 3		Class 2		Class 1		Class 0	
	n	n	%	n	%	n	%	n	%	n	%	n	%
Landrace	136	63	46.32	25	18.38	32	23.53	4	2.94	7	5.15	5	3.68
Large White	46	11	23.91	10	21.74	22	47.83	3	6.52	0	0.00	0	0.00
Pietrain	69	29	42.03	18	26.09	18	26.09	3	4.35	1	1.45	0	0.00
Belgian Landrace	21	14	66.67	5	23.81	2	9.52	0	0.00	0	0.00	0	0.00
Duroc	19	15	78.95	3	15.79	0	0.00	1	5.26	0	0.00	0	0.00
Hampshire	17	7	41.18	1	5.88	7	41.18	0	0.00	2	11.76	0	0.00
Duroc × pietrain	65	31	47.69	24	36.92	8	12.31	0	0.00	1	1.54	1	1.54
Hampshire × pietrain	32	26	81.25	5	15.62	1	3.12	0	0.00	0	0.00	0	0.00
Total	405	196	48.40	91	22.46	90	22.22	11	2.72	11	2.72	6	1.48

major abnormalities amounted from 56.8% for Belgian Landrace, to 160.7% for Polish Landrace, whereas the percentage of spermatozoa with minor abnormalities ranged from 52.5% for Duroc to 175.0% for Polish Landrace. Such a large variability in percentages of morphological forms may lead to false conclusions regarding the quality of boar semen. Such mistakes would not be made when classifying the ejaculates into the quality groups according to the new 6-degree scale.

A large variability of the spermiogram classes was observed (tab. 2), 70.86% of ejaculates were assigned to the 5<sup>th</sup> and 4<sup>th</sup> classes, which comprised semen of high quality and of unquestionable usefulness for insemination. More than 22% of ejaculates were classified into the 3<sup>rd</sup> class (semen of acceptable but not the best quality), whereas approximately 7% of ejaculates were classified into the 0 - 2<sup>nd</sup> classes (questionable usefulness or even uselessness of the ejaculates for insemination). High variability could be noticed within particular breeds. According to the spermiogram,

the best quality of ejaculates was found in Belgian Landrace boars, because more than 90% of the ejaculates were grouped into the 5<sup>th</sup> or 4<sup>th</sup> class and no ejaculates of the 0 - 2<sup>nd</sup> class was found. The highest variability in the spermogram was found in Polish Landrace boars, because all classes of ejaculates were found.

In summary, male spermograms in domestic pigs were characterized by a large variability within and between breeds. Estimating semen quality, only with regard to the mean frequency of occurrence of particular morphological forms of spermatozoa, was ineffective for series ejaculate-based evaluation semen quality of individual boars or a group of boars. However, this method was effective to estimate the quality of individual ejaculates. The new quality classification of the spermogram enabled to prove the frequency of occurrence of ejaculates with good and average usefulness, questionable usefulness or totally no usefulness for insemination within a group.

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