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RELATIONSHIP OF SOME SEMEN CHARACTERISTICS OF THE BOAR
TO FECUNDITY OF THE SOW

W. L. Singleton and D. R. Shelby

As the price-cost squeeze becomes more critical to the pork producer, every factor which affects net profit must be critically weighed. The profit making potential of a swine herd increases directly with an increase in the number of live offspring produced per sow. The production of large litters is dependent on high fertility in both the sow and the boar. The fertility of boars will vary from complete sterility to high fertility. An actual breeding test is the only highly reliable method of those used to measure fertility level in the boar, but boars of complete sterility can usually be detected by semen testing. Since an actual breeding test is a very expensive method of determining the fertility level of a boar, it would be highly desirable to develop a rapid inexpensive method for determining the fertility level of boars so that boars of low to moderate fertility could be eliminated from the herd before use.

The purpose of this study was to determine the relationship between certain measures of semen quality in the boar and fecundity in the sow and to measure the variation among boars with respect to these measures of semen quality.

Experimental Procedure

During June of 1967, semen was collected from six Yorkshire boars unselected for fertility. These boars were collected every 48 hours with three boars being collected each day until all boars had been collected eleven times. The sperm-rich fractions of the ejaculates were extended in a yolk-glucose-bicarbonate extender and aliquots of each collection were incubated for 3 hours at 38° C. in a constant volume respirometer. The remainder of the extended semen from each collection was divided into 50 ml. aliquots and stored at 8° C. until subsequent use for insemination.

The following data were obtained from each semen sample:

- (1) Oxygen uptake by the sperm at 30 minute intervals during the incubation period
- (2) Percent progressive motility (rated on a 0-10 basis and estimated immediately after collection and at the end of the incubation period)
- (3) Sperm concentration (measured by a turbidometric method)
- (4) pH of the extended semen (measured in a pH meter at the beginning and end of the incubation period)
- (5) % normal sperm (all morphology observations were made from aniline blue-eosin B stained smears)
- (6) % abnormal heads
- (7) % midpiece defects
- (8) % bent tails
- (9) % loose heads
- (10) % cytoplasmic droplets

Sixty Duroc-Yorkshire crossbred gilts which had been cycling normally were mated at random to the six Yorkshire boars by artificial insemination. Each gilt was inseminated once with 50 ml. of extended semen which had been collected that day. The gilts were slaughtered and their reproductive tracts were recovered 25 days after insemination. The number of corpora lutea and embryos present in each tract were counted, and the number of normal embryos present in the uterus after 25 days of pregnancy as a percentage of the number of eggs ovulated was used as a measure of fecundity in the gilts. Correlations between the various semen characteristics measured and fecundity of the gilts were computed.

The gilts were self-fed a bulky ration containing 13% crude protein and 30% dehydrated alfalfa meal during the prebreeding and postbreeding periods. The boars were hand-fed 5 lb. of the same ration daily.

Results and Discussion

The correlations between the various semen characteristics and fecundity of the gilts with means and standard deviations for the semen characteristics studied are shown in table 1. Also shown are the levels of significance of the differences among boars and among ejaculates within boars for the semen characteristics measured. Although there were significant differences ($P < .01$) among boars for all semen characteristics measured except percent cytoplasmic droplets and among boar groups of gilts in fecundity, only sperm concentration ($r = .61$, $P < .01$) and percent morphologically normal sperm ($r = .29$, $P < .05$) were significantly correlated with gilt fecundity. The significant differences among ejaculates within boars for most of the semen characteristics measured coupled with the lack of a relationship between these characteristics and fecundity of the gilt suggests that considerable variation in these semen characteristics can exist from one ejaculate to the next without affecting the over-all fertility of the boar.

In this study, only sperm concentration exerted any significant effect on fecundity of the gilts as evidenced by the high correlation between these two factors. This is not to say that some of the other characteristics measured cannot or do not affect fertility level in the boar, but, under the conditions of this study, the other semen characteristics did not appear to be good indicators of fertility level.

Summary

Significant differences in the semen characteristics measured in this study were found to exist among boars and among ejaculates within boars. Of the semen characters measured, only sperm concentration and percent morphologically normal sperm were significantly correlated with fecundity in the gilt.

Table 1. Means and Standard Deviations of Semen Characteristics of Boars and the Relationships Between These Characteristics and Sow Fecundity

Characteristic measured	Mean	Standard deviation	Differences among boars ¹	Differences among ejac./boars ¹	Correlation coefficient ²
O ₂ uptake after 1 hr. ³	40.4	19.0	0.01	0.01	0.09
O ₂ uptake after 2 hr.	62.2	29.7	0.01	0.01	0.04
O ₂ uptake after 3 hr.	79.5	37.7	0.01	0.01	0.01
Initial % motility	79.4	15.7	0.01	0.01	0.06
Final % motility	49.1	25.0	0.01	0.01	-.02
Sperm concentration ⁴	90.4	13.9	--	--	0.61**
Initial pH	7.30	0.27	0.01	0.01	0.21
Final pH	7.61	0.27	0.01	0.01	0.13
% normal sperm	71.2	7.6	0.01	0.01	0.29*
% abnormal heads	6.2	2.7	0.01	NS	-.08
% midpiece defects	6.2	3.6	0.01	0.01	-.17
% bent tails	8.6	7.1	0.01	0.01	-.19
% loose heads	4.5	4.2	0.01	NS	-.11
% cytoplasmic droplets	2.4	2.0	NS	NS	0.07
% eggs ovulated present as embryos	60.5	27.5	0.01	--	1.00

¹ Level of significance of differences among boars or among ejaculates within boars; 0.01 means $P < .01$, NS means not significant.

² Correlation between percent of eggs ovulated which were present as embryos and the semen characteristics listed.

³ Oxygen uptake is measured in microliters per 10^8 sperm.

⁴ Millions of sperm per milliliter.

** Significant at $P < .01$; * Significant at $P < .05$.