

Study on the Quality of Boar Semen in Kandal Province, Cambodia

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Abstract: In pig production, the selection of parent stock with high capacity and quality is a very important factor in order to obtain high-yield offspring. Therefore, a “study on the quality of boar semen in Kandal province” was conducted for the purpose of comparing and evaluating the quality of boar semen (VAC: Volume Activity Concentration) between Duroc breeds, Yorkshire breeds and Landrace breeds. The study was carried out according to an observation study by selecting three breeds of boars around 3 years old, including two Duroc, two Yorkshire and two Landrace. Each boar was observed in three months, three times a month, and the interval was three to four days. The study took place in Takhmao City, Kandal Province, Cambodia. The results showed that the semen volume per ejaculate per head obtained from Yorkshire boar was an average of 250 ± 76.16 mL, which was higher than the semen volume of Landrace with an average of 173.33 ± 59.73 mL. And the semen volume of Duroc was an average of 149.44 ± 72.70 mL. This value indicates that the semen volume per ejaculate per head was significantly different ($p < 0.01$). The activity or mobility of spermatozoa in the semen between the three breeds differed with slightly significant difference ($p < 0.05$), with the spermatozoa scored from the Yorkshire being 0.76 ± 0.06 , Landrace being 0.79 ± 0.05 and Duroc being 0.83 ± 0.03 . The semen concentration showed that the Yorkshire had an average spermatozoa concentration of 568.89×10^6 sperm cells/mL, and the Landrace had an average spermatozoa concentration of 321.11×10^6 sperm cells/mL and the Duroc an average spermatozoa concentration of 568.86×10^6 sperm cells/mL, which further confirmed that there was a significant difference in the statistical meaning ($p < 0.001$). The semen quality (VAC) per one ejaculate between the three breeds showed significant difference ($p < 0.05$), in which the VAC of the Yorkshire was 39.31×10^9 sperms per ejaculate, Landrace was 44.54×10^9 sperm cells per ejaculate and Duroc was 70.28×10^9 sperm cells per ejaculate. Based on the above results, we can conclude that the semen quality (VAC) values of the three breeds of pigs are good, which can save the breeding because it shows the excellent quality of each breed.

Key words: Pig breed, semen volume, spermatozoa mobility, spermatozoa concentration.

1. Introduction

In Cambodia’s agricultural sector, animal husbandry is a factor that can help ensure food security today as well as in the future [1]. Livestock contributed about 7.6% of GDP (Gross Domestic Product) in 2002 and the total value of animal production was about USD 385 million [2] and in 2021, livestock subsector accounted for 11.7% of agriculture GDP and 2.6% of total GDP [3]. However, the current pig production does not meet the needs of the local market, including quantity and quality, due to the lack of good breeds, high yields and

short cycle production due to poor breeding.

Good breed and breeding of pigs is very important in determining the direction of animal production and it can preserve the hereditary heritage from the parent stock to the next generation [1]. In pig production, the selection of capable and quality boars is a very important factor in obtaining high-yield offspring to supply market needs and to generate household income, to contribute national economy growth as well.

Therefore, in order to contribute to the achievement of the goal of supplying good quality and sufficient quantity of pork products to ensure food security, it is

necessary to select good, capable and quality boars that achieve short-term yields.

The study aims to investigate and evaluate the quality of boar semen (VAC: Volume Activity Concentration) between Duroc breeds, Yorkshire breeds and Landrace breeds

2. Material and Method

2.1 Study Area and Design

The study was conducted in at pig breeding farm, located in Takhmao city, Kandal province, 12 km south of Phnom Penh capital city.

Observation study was applied to monitor six boars with three breeds, including two boars per breed, such Duroc, Yorkshire and Landrace breed. Age of all boars was around 3 years old. Semen was collected in 3 months, with 3 ejaculates per month per boar, and three days interval of each ejaculate.

2.2 Parameters of Comparison

During the study period, the semen collection was done three times per month for three months. For the evaluation of the quality of semen in all three breeds it was necessary to collect the semen from the boars through the use of artificial semen collection equipment. The semen collected was measured: the semen volume, sperm activity or mobility, concentration and VAC.

The semen volume was measured by dry calibrated flask after collection of the semen.

The assessment of sperm activity or mobility of spermatozoa were determined by observation of the three different motions as straight-up, circulation-motion and motionless, by using an electronic microscope to calculate the activity score (Table 1).

The sperm was counted by using the Haemocytometer. Dilution pipette was used to pump the filtrated semen up to 0.5 calibrate point, then pump sodium chloride 3% up to 101 calibrate point to dilute solution 3 to 5 min. After that drop this solution 4 to 5 drops into the chamber channel of hemacytometer and count the sperm with optic $\times 20$ or $\times 40$ with Z line counting.

Table 1 Spermatozoa mobility or activity score [4].

Percent of spermatozoa	Score
1	100-95
0.9	95-85
0.8	75-85
0.7	65-75
0.6	55-65
0.5	45-65
0.4	35-45
0.3	25-35
0.2	15-25
0.1	5-15

Source: Nguyen Thien and Nguyen Than Anh [5].

The formula for calculating the sperm concentration followed guideline [6] as below:

$$C = N \times b \times 5 \times 10 \times 1,000$$

where:

C = sperm concentrate in mL.

N = number of sperm counted.

b = dilution factor/volume (1:200).

5 = 400 small squares/80 small squares.

10 = 10 mL/0.1 mL (0.1 mL: Deep of counting chamber).

2.3 Statistical Analysis

The collected data were recorded and analyzed. All data are shown as the mean ($\bar{X}$) standard deviation ($s\pm$). ANOVA (Analysis of Variance) was used with statistical method.

3. Result

3.1 Semen Volume

The results of Table 2 showed that the average volume per ejaculate per head of Yorkshire was 250.00 mL,

Table 2 Comparison of pig semen volume (mL/head).

Parameters	Boar breeds		
	Yorkshire	Landrace	Duroc
n	9	9	9
$\bar{X}$	250.00	173.33	149.40
$S\pm$	76.16	59.70	72.70
p-value	< 0.01		

$S\pm$: standard deviation

which was higher than Landrace and Duroc (173.33 mL and 149.40 mL, respectively). This value indicates that the volume of semen per ejaculate per head was high significant different among the breeds ($p < 0.001$).

3.2 Activity of Spermatozoa

For the spermatozoa activity or mobility, the results showed that (Table 3), spermatozoa mobility in semen between breeds was statistically different ($p < 0.05$), in which the Duroc had the highest mobility.

3.3 Concentration of Spermatozoa

Concentration of spermatozoa showed that the Yorkshire semen had an average spermatozoa concentration of 568.89×10^6 sperm cell/mL, the Landrace semen had an average spermatozoa concentration of 321.11×10^6 sperm cell/mL, and the Duroc semen had an average spermatozoa concentration of 568.86×10^6 sperm cell/mL, which further indicates significant differences in statistical meanings ($p < 0.01$) (Fig. 1).

Table 3 Activity of spermatozoa.

Parameters	Boar breeds		
	Yorkshire	Landrace	Duroc
<i>n</i>	9	9	9
$\bar{X}$	0.76	0.79	0.83
<i>S</i> ±	0.06	0.05	0.08
<i>p</i> -value	0.02		

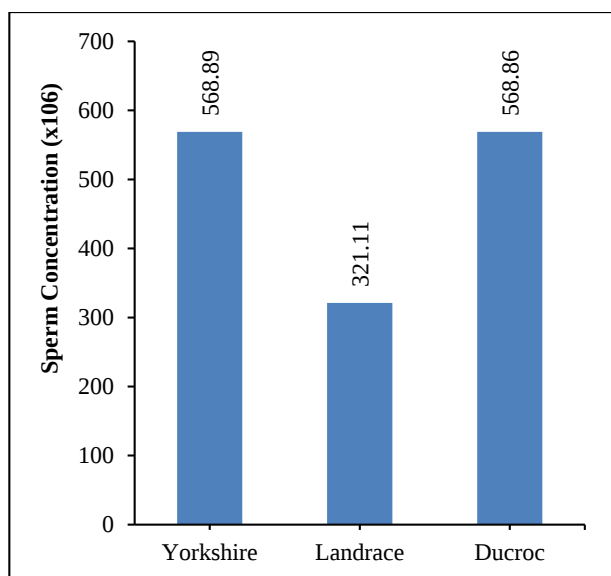


Fig. 1 Concentration of spermatozoa.

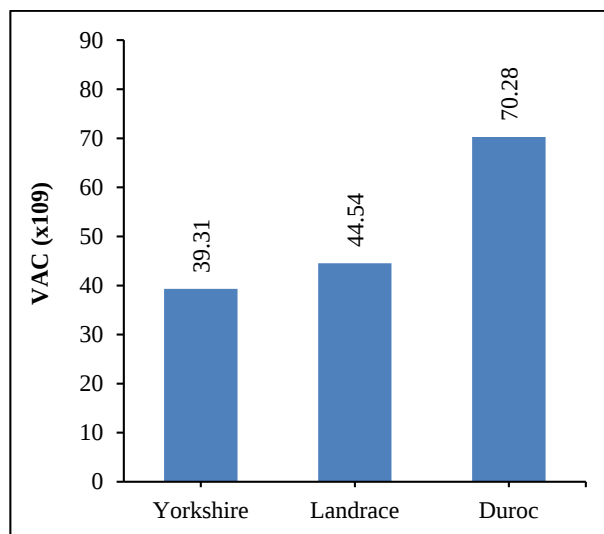


Fig. 2 Semen quality.

3.4 Semen Quality

From Fig. 2, the quality of the semen (VAC) in a ejaculate between breeds was significantly different ($p < 0.01$), Yorkshire has 39.31×10^9 sperm cell/ejaculate; Landrace has 44.54×10^9 sperm cell/ejaculate and Duroc has 70.28×10^9 sperm cell/ejaculate.

4. Discussion

The volume of fresh semen of Yorkshire was 250.00 mL/ejaculate/head, Landrace was 173.33 mL/ejaculate/head and Duroc was 149.40 mL/ejaculate/head. The volume of fresh semen exotic pig breed can produce was 150 to 400 mL and can be reach to 1,200 mL/ejaculate/head [5]. Semen collection by hand can be 92.80 mL in local pig breeds [7]. The mobility of spermatozoa between breed, Yorkshire, Landrace and Duroc was scored 0.76, 0.79 and 0.83; respectively and slightly significantly different ($p < 0.05$). Some previous studies showed that the mobility of spermatozoa in the Yorkshire's semen was scored 0.9 to 1 [8], and concentration of spermatozoa in current study indicates significant differences in statistical meanings ($p < 0.01$). This result was similar to the result of Hafez [9, 10] but higher compared with the study in Vietnam which were 30×10^6 to 50×10^6 spermatozoa/mL in rainy season and 20×10^6 to 30×10^6 sperm cell/mL in dry season [5]. It is also reported that

puberty occurred between 5 and 8 months, and the number of spermatozoa and volume of ejaculate increase until the boar reaches 18 months. The ejaculate this time is between 20×10^9 and 80×10^9 spermatozoa in 200 to 400 mL of semen [11]. Breed differences in spermatozoa production and generally the large breed, such as Yorkshire tended to produce more volume of semen per ejaculate [12].

5. Conclusion

In conclusion, the quality of semen for all breeds is mostly good for breeding. As for the semen quality (VAC), the Duroc is good quality according to the mobility and concentration of spermatozoa, however the volume of the semen per ejaculate of this breed was less than another two breeds, Landrace and Yorkshire.

The presence of spermatozoa in the semen was low to moderate for all three breeds, which may be due to direct factors and environmental factors, because during the study period it was raining heavily and some parts of the farm and this sinking can cause an infection.

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