Seasonal Effects on Semen Quality in Boars

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Abstract : Environment factors are important for reproductive efficiency. Therefore, a study on the effects of season on semen quality traits was conducted. Semen quality from three Duroc boars at Rajamangala University of Technology Lanna Nan was evaluated during winter, summer and rainy seasons. Results showed that the maximum temperature in the summer season (37.35 ± 0.02 ℃) was significantly higher than in the rainy (35.34 ± 0.02 ℃) and winter seasons (33.89 ± 0.02 ℃) ($P<0.01$), respectively. The humidity in the rainy (91.45 ± 0.45 %) and the winter seasons (92.84 ± 0.45 %) were significantly higher than in the summer season (86.05 ± 0.45 %) ($P<0.01$). Season had a significant effect on semen quality traits. In the summer season, the sperm motility (3.86±0.07) was significantly lower than in the rainy (4.33±0.07) and the winter seasons (4.33±0.07) ($P<0.01$). In addition, the percentage of head abnormal morphology in the summer season (3.73 ± 0.31 %) was significantly higher than in the rainy (2.44 ± 0.31 %) and winter seasons (1.6 ± 0.31 %) ($P<0.05$), respectively. Similarly, the percentage of tail abnormal in the summer season (11.70 ± 0.81 %) was also significantly higher than in the rainy (6.97 ± 0.81 %) and winter seasons (6.60 ± 0.81 %) ($P<0.05$), respectively. Moreover, sperm concentration in the winter (236 ± 17.50 x 106 sperm/mL) and the summer seasons (229 ± 17.50 x 106 sperm/mL) were significantly higher than in the rainy seasons (149 ± 17.50 x 106 sperm/mL) ($P<0.05$). However, the semen volume in the winter (170.35 ± 5.57 mL), the summer (176.33 ± 5.57 mL) and the rainy seasons (182.64 ± 5.57 mL) were not significantly different ($P>0.05$). This study concluded that season affected sperm motility, percentage of abnormal sperm and sperm concentration, but had no effect on semen volume.

Keywords : Boar, season, semen quality.

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1. Introduction

The consumption of meat from pig is growing rapidly [1]. The pig production efficiency is influenced by many factors, such as breed, nutrition, health status and reproductive performance. Male reproductive plays important role in pig production. The prediction of sperm fertilizing ability by evaluation of semen quality has great economic importance for pig production when artificial insemination (AI) is used.

Sperm production takes place in the testes by a process known as spermatogenesis [2]. Generally, the testicular temperature must be 4 to 7 degrees Celsius below deep body temperature for the production of fertile spermatozoa, and the scrotal skin is well furnished with sweat glands to keep the temperature down by evaporative heat loss [3]. The small increases in testicular temperature cause a major disturbance in spermatogenesis [4], which leads to adverse effects on semen quality [5], can results in reduced fertility [6] and the efficiency of animal production. Exposure of the testis to high temperature causes germ cells loss [7, 8]. However, the mechanisms underlying this process are unknown. It has been shown in experiments that elevated ambient temperatures have a negative effect on semen quality, such as sperm motility and percentages of abnormal spermatozoa [9]. Local heating to the scrotum has been shown to cause sperm defect in bull [5]. Similar effects can be produce by covered the scrotum with a textile-aluminum foil insulation device for 100 hours. Pronounced changes in sperm characteristics, e.g. decreased sperm motility and high numbers of proximal cytoplasmic droplets, abnormal sperm head shapes and abnormal acrosomes, were seen during week 3 to 5 after scrotal insulation in the mature boars [10].

Climatic heat may interfere with thermoregulation of the testicles. Therefore, better knowledge of factors influencing quality of semen may help to improve the efficiency of AI organizations and pig production. So, this study was carried out to investigate the effects of season influencing semen quality in Duroc boars.

2. Materials and Methods

2.1 Semen collection

Semen was collected from three Duroc boars (3-5 years of age) at Rajamangala University of Technology Lanna Nan. Semen samples were collected for 5 consecutive weeks during winter (Nov-Dec), summer (Mar-Apr) and rainy (Jun-Jul) seasons. The ejaculates were taken by means of the gloved-hand technique.

2.2 Semen evaluation

Semen quality traits were evaluated as described by Vongpralab [11]. Semen volumes were determined with a graduated cylinder. Sperm motility was subjectively estimated under a microscope at x400 magnification. Sperm concentration was assessed with haemocytometer.

Sperm morphology and sperm viability were studied in smears stained with eosin-nigrosin. Two hundred spermatozoa were examined for sperm morphology to assess normal, head abnormal and tail abnormal sperm, under a light microscope, at a magnification of x1000. Five hundred

spermatozoa were used to assess sperm viability, at a magnification of x1000, under a light microscope.

2.3 Climatic recording

The temperature and humidity data were come from the meteorological station in Nan province.

2.4 Statistical analyses

The Analysis of Variance (ANOVA) was carried out to assess the effects of season on semen quality traits. The semen quality traits included semen volume, mass movement, sperm concentration, head abnormal and tail abnormal sperm. Duncans multiple range test was used to compare mean values of individual treatments, when the F-value was significant ($p<0.05$).

3. Results and Discussion

Descriptive data for the temperature and humidity for the experimental year from the meteorological station in Nan province are presented in Table 1. The maximum temperature in the summer season was significantly higher than in the rainy and winter seasons ($P<0.01$), respectively. The relative humidity in the rainy and the winter seasons were significantly higher than in the summer season ($P<0.01$).

Table 1: Climatological data for the experimental year from the meteorological station in Nan province.

	Seasons		
	Winter	Summer	Rainy
Temperature (ºC)			
- Mean	25.30b	29.35a	29.67a
- Maximum	33.89c	37.35a	35.34b
- Minimum	16.70c	21.34b	24.00a
Humidity (%RH)			
- Mean	92.84a	86.05b	91.45a

The effects of season on semen quality

Seasonal variations on semen quality traits of Duroc boars collected throughout the year were presented in table 2. There were no significant differences in the semen volume of Duroc boars among winter, summer and rainy seasons. The result indicated that season did not affect semen volume in Duroc boars. Cheon et al. [12] also obtained that the semen volume of Duroc boars in spring, summer, autumn and winter were not significantly different, which are in agreement with our results. Vongpralab [11] reported that semen volume was 150-200 ml, which were relevant ranges in this study.

Table 2: Seasonal variations on semen quality traits of Duroc boars

Semen quality traits	Season			SE
	Winter	Summer	Rainy	
Semen volume (mL)	170.35	176.33	182.64	5.57
Sperm concentration (X106 /mL)	236a	229 a	142 b	17.50
Mass movement score (1-5)	4.33a	3.86b	4.33a	0.07
Head abnormal (%)	1.6b	3.73a	2.44ab	0.31
Tail abnormal (%)	6.60b	11.70 a	6.97 b	0.81
Total abnormal (%)	8.20b	12.72a	9.41b	0.76

The sperm motility in summer season was lower than in winter and rainy seasons. The results are similar to those obtained by Kozdrowski et al. [13] who studied on wild boars. In their study, the spermatozoa motility was also the lowest in summer season. The sperm abnormal including head abnormal, tail abnormal and total abnormal (Figure 1) in the summer season was higher than in winter and rainy seasons. Fuerst-Waltl et al. [9] also obtained that high temperature had effects on sperm morphology in bull. This high abnormal sperm have been caused by disturbance to spermatogenesis, caused by high temperature during the summer. This suggestion is supported by the characterize mechanisms underlying the disruption of spermatogenesis and the induction of apoptosis by heat shock, DNA microarrays were employed in adult male mice [4]. In addition, the observation in boar found that significant increases the proportion of morphologically abnormal spermatozoa were seen for the end of week 2 up to week 5 after the boar were heated for 6 h/day in climate chamber [14]. Furthermore, scrotal insulation has been shown cause increases abnormal sperm in boar [10] and bull [5].

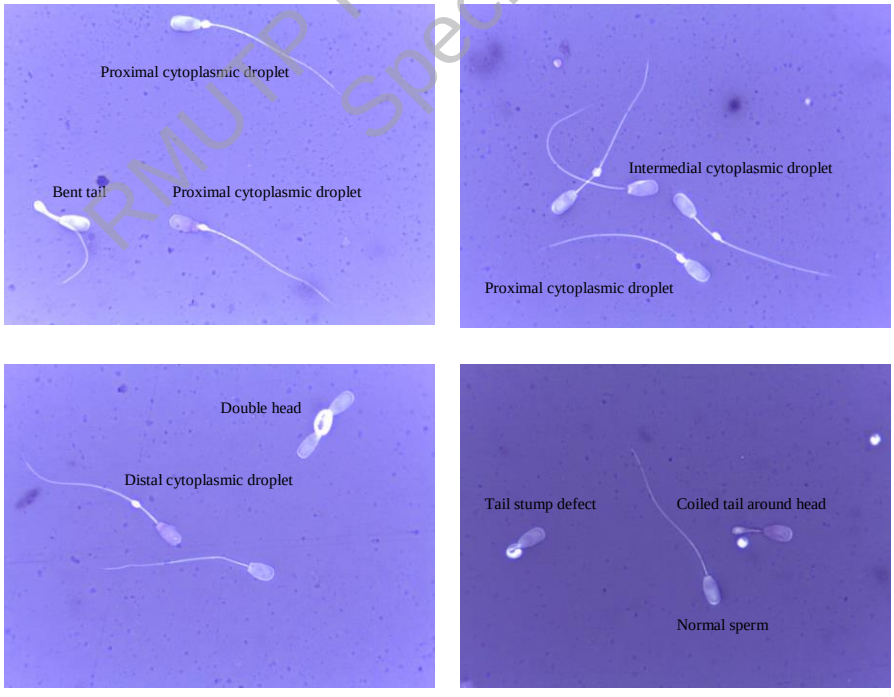

Figure 1: Typical morphologically normal and abnormal spermatozoa

The data indicated that the motility and morphology of spermatozoa were affected by season. The season changes were influenced by temperature and humidity in Thailand. The Highest of abnormal spermatozoa and the lowest of sperm motility in summer season were affected by the elevated temperature during summer season. This study found that the maximum temperature in the summer season was significantly higher than in the rainy and winter seasons (Table 1). High temperature may disturbance to spermatogenesis [4, 14], increase damage in chromatin structure [7], causing germ-cell destruction [7, 8], thus increased abnormal spermatozoa and resulting in a temporary decrease in sperm motility.

4. Conclusion

In summary, our results confirm seasonal effect on boar semen quality characteristics. The sperm motility was lowest in the summer season. In addition, the abnormal spermatozoa were highest in the summer season too. According to the climatological data showed the maximum temperature was highest during the summer season. Thus, high ambient temperature during summer season may result in increase testicular temperatures and thus decrease semen quality.

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