

Effect of herbal supplements (nettle and rosehip) on the sperm quality in Danube White breed boars

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Abstract

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An experiment with 5 boars from the Danube White breed, raised and fed individually, was conducted in Agricultural Institute – Shumen. The experiment was divided into two sub-periods – a 40-day control period and an experimental period with the same duration. During the control period the animals were fed with combined fodder, containing 16.4% crude protein, 0.80% lysine, 1.3% calcium, 0.68% phosphorus, and during the second sub-period – 15.5% crude protein, 0.85% lysine, 0.63% calcium and 0.45% phosphorus. In the experimental period the boars were fed with the same combined fodder, to which was added 20 g of herbal supplement (nettle and flour from rosehip) per day per boar. From each boar was taken 10 ejaculates during the control period and 11 ejaculates during the experimental period. The following traits were controlled: health condition (daily), volume of ejaculate (ml), density of the semen, which is determined by sperm cell concentration (10⁶/ml), pH, mobility of spermatozoa (%), pathological spermatozoa (%) and survival of spermatozoa (%) after 24, 48, 72 h of storage. The herbs tested do not affect the main quality traits of semen – volume, density and motility, but they do decrease the percentage of agglutination ($p = 0.043$) and tend to decrease the number of pathological spermatozoa with 14.56%. There is a tendency for lower survival of the 72nd hour in boars that were given the herbal supplement, which requires additional studies.

Keywords: pigs; boars; feed; additives; nettle; rosehip; quality of sperm

Introduction

With the introduction of artificial insemination of swine into the technologies for pig production, the value of boars used for breeding increases sharply and this requires optimal feeding and breeding conditions (Fayzulin, 1996). On the other hand, the identification and use of new food components and supplements could have a positive effect on animal development. The new resources should be easy to assimilate, with effective conversion, they should contain vitamins, micro and macro elements, plant pigments, etc. In this aspect, the use of biologically active substances has a positive

influence on sex intensity, including the improvement of the function of the reproductive system (Yordanova et al., 2014).

The quality of sperm is one of the factors that have a significant influence on the reproductive results. The optimization of the intensity of breeding requires selection of boars, distinguished by good sexual activity and high quality ejaculates (Rupanova, 2006).

The level of nutrition has a strong influence on the sexual activity, quantity, quality and fertility of sperm. When ejaculating, boars produced a significantly greater amount of semen (an average of 350 cm³), compared to other animal species of agricultural importance. For this reason, compound

feedings must be nutritionally balanced, to provide a stable breeding condition (Boychev & Marchev, 2012).

Grela et al. (2006), Peris et al. (2007), Kistanova et al. (2009), Frydrychova et al. (2011) have applied various herbal supplements in the compound feed for boars, which successfully improve semen indicators.

Lin et al. (2007) indicates that a ration involving traditional Chinese fungus *Cordyceps militaris* leads to improvement in spermatozoa production and quality in Duroc and Landrace breeds. Another ecological source for correction of reproductive function in domestic animals is algae *Spirulina platensis* (Kistanova et al., 2009).

One of the most popular plants used in herbal mixtures for pigs is nettle. Due to its high content of nutrients, such as amino acids, minerals, vitamins (primarily those with significant antioxidant influence – A and C) and active ingredients such as tannins, formic acid and salicylic acid, nettle is often used in medicine (Viegi et al., 2003; Hanczakowska et al., 2007). The antioxidant system, which is described as a protective mechanism against sperm lipid peroxidation (LPO) is important for maintaining the viability and mobility of spermatozoa. It corrects the imbalance between the production of reactive oxygen species (ROS) and boosts the ability of biological systems to detoxify reactive metabolites (Agarwal et al., 2003; Plessis et al., 2008). Todorov and Todorova (2016) came to the conclusion that the addition of various antioxidants like L-cysteine, glutathione and water-soluble vitamin E improve the viability of spermatozoa.

Rosehip fruits are used for healing purposes. They contain Vitamin C, which improves cell processes and strengthens capillaries. Rosehip fruits are used in avitaminosis and other sicknesses, related to the decrease of immunological defense and vital tonicity of the organism. They contain Vitamin C, which accumulates in large quantities at the beginning of ripening, after which its content quickly decreases. In addition to Vitamin C, they also contain carotene, Vitamin B2, K1 and P, sugars, pectic substances, organic acids (citric and malic). Seeds contain oils rich in Vitamin E, which have a positive influence on the reproductive system (<https://bilkabg.com/2017/05/24>).

With the current study we aimed to determine the influence of herbal supplement (nettle and rosehip flour) on the health condition, the quantity and quality of semen in boars.

Materials and Methods

An experiment was conducted in Agricultural Institute, Shumen with five boars from the Danube White breed, which were raised and fed separately. The experiment was divided into two sub-periods: control and experimental, each one with 40 days duration.

During the first sub-period, the animals were fed with compound feed containing 16.4% crude protein, 0.80% lysine, 1.3% calcium and 0.68% phosphorus (Table 1).

Table 1. Components and nutrients in kg compound feed

Components	%
Corn	12.0
Wheat	30.1
Barley	20.5
Wheat Bran	14.0
BK – 16	23.0
Dicalcium phosphate	0.1
Table salt	0.3
Total	100
<i>1 kg compound feed contains:</i>	
Digestible energy, MJ	12.99
Exchange energy, MJ	12.47
Crude protein %	16.4
Lysine %	0.83
Methionine + Cystine %	0.66
Calcium %	1.03
Phosphorus %	0.69

In the second sub-period according to experimental scheme (Fig. 1) the boars were given the same compound feed, to which was added 20 g per day of herbal mixture (flour from nettle and rosehip) for each animal.

Indicators	Periods	
	I	II
Compound feed	+	+
Herbal mixture (nettle + rosehip) 20 g per day for each animal	–	+

I – Control period; II – Experimental period

Fig. 1. Experiment scheme

Ten ejaculates were obtained from each boar during the control period and eleven during the experimental period. The receiving of ejaculates was carried out according to the modified Amdal method, by separating the first fraction (Instruction for artificial insemination of pigs, 1985). Examining the sperm was performed using methods described by Dimitrov et al. (2000).

Ejaculate volume (ml), mobility (%), sperm concentration ($10^6/\text{ml}$), pathological spermatozoa (%), sperm agglutination (%) and spermatozoa survival at 24th, 48th and 72nd hours after receiving were controlled.

Results and Discussion

Data in Table 2 represents the values of the traits, characterizing the quantity and quality of ejaculate in Danube White boars during the two reported periods (control and experimental). The average quantity of ejaculate (260.00 ml for the control period and 244.74 ml for the experimental period), reflecting their quantitative characteristics is approximately the same and does not show any dependence on the type of feed. It is well known that the values of this trait are determined mainly by testicular development, additional sex glands and their secretions, sexual regimen and to a lesser extent, their sexual activity (Marchev et al., 2011). The results obtained show that the ejaculate volume is in normal physiological limits and with higher value during the control period (3.63%) compared to the experimental period, but the difference of 15.26 ml is minimal and insignificant.

Sperm mobility is kept approximately within constant limits irrespective of the diet chart, indicating that the herbal mixture of nettle and rosehip flour has no effect on the level of expression of this indicator. According to us this result is logical, because mobility is a significant biological factor, which guarantees the movement of spermatozoa to the insemination place and its maintenance in constant high limits, irrespective of environmental factors, which is a guarantee for successful fertilization.

Table 2. Sperm quality in boars from the Danube White breed

Indicators	Control n = 48	Experimental n = 57
	x±Sx	x±Sx
Volume, ml	260.00±7.74	244.74±6.73
Mobility, %	77.92±1.15	74.56±0.97
Pathological spermatozoa, %	15.88±1.73	13.56±1.08
Density, 10 ⁶ / ml	158.35±10.89	144.62±8.38
Agglutination, %	5.63±0.78	5.53±0.63
Survival rate at 24 h, %	61.87±1.67	61.06±1.26
Survival rate at 48 h, %	48.96±2.17	46.81±1.55
Survival rate at 72 h, %	36.87±2.63	26.41±2.04

The percentage of pathological spermatozoa (15.88% and 13.56%) does not exceed the norm of 20%. A tendency for decrease the value with 14.56% was observed in boars during the experimental period compared to control period, but the difference is not statistically significance and does not give any grounds for conclusions that the supplement of nettle and rosehip flour influences the percent of pathological changes in spermatozoa.

The process, in which the suspended in the liquid spermatozoa, bacteria, cells and other particles are clustered into small masses (agglutination), is lower during the experimental period. The results obtained show that the percentage of agglutinated spermatozoa is low and with insignificant difference between the two periods – 5.63% for the control period and 5.53% for the experimental period. On the other hand, agglutination of sperm cells is mainly influenced by factors of a different nature – genetic, autoimmune diseases, infection factors (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis*) and high temperature. In this aspect, we do not think that the supplement used in the compound feed will affect the performance level of this indicator.

Spermatozoa survival after 24, 48 and 72 hours of storage, expressed through reporting the percentage of motile sperm cells follows the established motility when receiving of ejaculates. The data in Table 2 indicates that at the 24th and 48th hour significant differences between the control and experimental periods are not observable, they are preserved in the same amount as those in the established motility immediately after receiving the ejaculates. Reliably higher survival rate is observed at 72nd hour during the control sub-period (p = 0.002). Probably, despite the credibility of the differences in some of the tested indicators, the amount of supplement used is insufficient to exert a noticeable effect on the quality of ejaculates. In this sense, we believe that further research is needed to achieve definite results.

Conclusions

In the tested nutrition scheme the used supplement of flour from nettle and rosehip does not affect the main quality indicators of sperm quality in boars from Danube White breed – volume, density and motility, but decreases the percentage of pathological spermatozoa with 14.56% and insignificantly the percentage of agglutination.

Additional studies for the dosage are necessary, as well as for the duration of use of the tested supplement.

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