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SHORT COMUNICATION

EFFECT OF THE HERBAL ADDITIVE "YUCCA" ON RABBIT SPERMATOZOA CHARACTERISTICS

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ABSTRACT

The aim of present study was to evaluate the effect of the plant additive “Yucca” on rabbit spermatozoa characteristics. Rabbit males of New Zealand White line were used in the experiments. Males in control group were fed with commercially available normal granular feed. In experimental group (E1) 5 g of plant *Yucca shidigera* was added to the 100 kg of the normal feed. In the second experimental group (E2) 20 g of *Yucca shidigera* was added to 100 kg of the normal feed. The males were fed from weaning until they reached the sexual maturity. Semen samples from 5 New Zealand White (NZW) rabbit males in each group were collected using an artificial vagina and evaluated using the CASA system for concentration and motility. The males in E2 group had significantly higher sperm motility in comparison with the control group (91.54±1.84% vs. 74.08±5.97%). The males in E1 and E2 group had significantly higher progressive motility in comparison with the control group (72.56±4.75% and 82.84±2.55% vs. 53.98±6.49%, respectively). This preliminary study suggests that the addition of *Yucca shidigera* plant into the normal feed had positive effects on male’s spermatozoa parameters.

Keywords: rabbit, Yucca, spermatozoa, concentration, motility

INTRODUCTION

Yucca shidigera is a medicinal plant native to Mexico. According to folk medicine, yucca extracts have anti-arthritic and anti-inflammatory effects. The plant contains several physiologically active phytochemicals. It is a rich source of steroidal saponins, and is used commercially as a saponin source. Saponins have diverse biological effects, including anti-protozoal activity. It has been postulated that saponins may have anti-arthritic properties by suppressing intestinal protozoa which may have a role in joint inflammation. Yucca is also a rich source of polyphenolics, including resveratrol and a number of other stilbenes (yuccaols A, B, C, D and E). These phenolics have anti-inflammatory activity (**Cheeke *et al.*, 2006**). Saponins contained in the Yucca plant it just one of the many natural biosecurity substances which increase the efficiency of farm animals (**Jasques, 1989**). Saponin-containing yucca extracts are currently used in the feed industry for control of ammonia and odour. The active components in this function are probably carbohydrates, rather than saponins. Specific roles of saponins in yucca and *Quillaja* products may involve modification of gut microbes, particularly in ruminants. Saponins suppress ruminal protozoa by binding to cholesterol in the protozoal cell membrane, causing the organism to lyse and die. Saponins inhibit Grampositive bacteria and have antifungal properties. Antiprotozoal activity against pathogenic protozoa such as giardia by saponins has been observed. When used as feed additives, saponins have multifaceted beneficial properties (**Cheeke, 1999**). In recent time, this plant and its extract have been used to produce drugs that are applied to treat various human diseases. It also improves performance and health of the livestock in addition to feed in various concentrations (**Duffy *et al.*, 2007**). **Duffy *et al.*** (**2007**) reported that preparations and extracts of desert plants *Yucca shidigera* have a number of beneficial effects, which are included in the dietary plants for people and domesticated animals. This product is on the list of certified biotechnological preparations used for reduction of ammonia emissions and odour and it serves the same purpose when applied to feed, to deep litter, screens, dump excrement etc. (**Tyl *et al.*, 2010**). Ammonia is one of the microbial products that are known to be toxic to animals (**Visek, 1978**). **Cervera *et al.*** (**2008**) noticed that feed with increased fibre during the second half of pregnancy could increase the number and weight of liveborn pups. Yucca products are applied primarily in animal nutrition, where they reduce the ammonia content in

the environment and animal faeces odour. The positive effect supplementation of Yucca product has been shown to accelerate the growth and health of the population (**Piacente *et al.*, 2005**). **Cline *et al.* (1996)** found that feeding a yucca extract containing commercial feed additive to sows prior to farrowing resulted in a significant reduction in numbers of pigs born dead (stillbirths). Blood oxygen levels were higher in piglets at birth from sows fed the yucca extract. **Cline *et al.* (1996)** suggested that the reduction in stillbirths was a result of improved blood oxygen supply to the foetuses during birth. Equally preweaning mortality was also reduced. Reproduction and feeding have very close relationship. One of the essential requirements of broiler rabbits is high, synchronous and balanced reproduction (**Bulla *et al.*, 2008**).

The objective of this study was to examine the influence of plant Yucca on selected rabbit spermatozoa parameters.

MATERIAL AND METHODS

Manipulations with animals

Sexually mature males of New Zealand White (NZW) line were used in our experiments. Rabbit males were divided into three groups: control group (C) with 5 males, first experimental group (E1) with 5 males and second experimental group (E2) with 5 males. Males in control group were fed with commercially available plain granular feed. In experimental group (E1) 5 g of plant *Yucca shidigera* was added to the 100 kg of the normal feed. In the second experimental group (E2) 20 g of *Yucca shidigera* was added to 100 kg of the normal feed. The males were fed from weaning until they reached the sexual maturity (age 4.5 months, weight 4-4.5 kg). At that time semen sample from each male was collected and semen analysis were conducted. The treatment of the animals was approved by the Ministry of Agriculture and Rural Development of the Slovak Republic, no. SK P 28004 and Ro 1488/06-221/3a.

Semen collection and analysis

Semen samples from males of 15 New Zealand White line were collected using an artificial vagina. Each sample of fresh ejaculate was evaluated using the CASA (Computer Assisted Semen Analysis; MiniTüb, Tiefenbach,Germany) system for concentration and

motility. The semen samples from the control group, E1 and E2 group were placed into Standard Count Analysis Chamber Leja 20 micron (MiniTüb, Tiefenbach, Germany) and evaluated using the CASA system (Sperm Vision™) under a Zeiss Axio Scope A1 microscope. In each sample the following parameters were evaluated: concentration (10^9 per ml); percentage of motile spermatozoa (motility >5 μm/s) and percentage of progressively motile spermatozoa (motility >20 μm/s).

Statistics

Obtained data were statistically analysed using χ^2 test in Sigma Plot 11 (Systat Software Inc., Germany). Results of motility and progressive motility are presented as means and expressed in %. Results of concentration are presented as means and expressed as a number of spermatozoa in 1ml semen x 10^9. *P*-values at $p<0.05$ were considered as statistically significant.

RESULTS AND DISCUSSION

CASA system provided realization of spermatozoa analysis. We observed three basic spermatozoa parameters: spermatozoa concentration, motility and progressive motility. The highest spermatozoa concentration was observed in the second experimental group versus control group (4.02 x 10^9 vs. 2.65 x 10^9; Fig. 1) and differences were statistically significant. In E1 group was concentration lower than in control group (2.02 x 10^9 vs. 2.65 x 10^9), but the differences were not statistically significant. The highest motility was in the second experimental group versus control group (91.64% vs.74.08%; Fig. 2) and differences were statistically significant. In E1 group was motility higher than in control group too (86.62% vs.74.08%)), but the differences were not statistically significant. The progressive motility was higher in both experimental groups versus control group (E1 72.56%, E2 82.84% vs. control 53.97%) and differences were statistically significant (Fig. 3). Our experiments suggest that *Yucca shidigera* addition to the feed can increase spermatozoa concentration, motility and progressive motility in rabbit ejaculate.

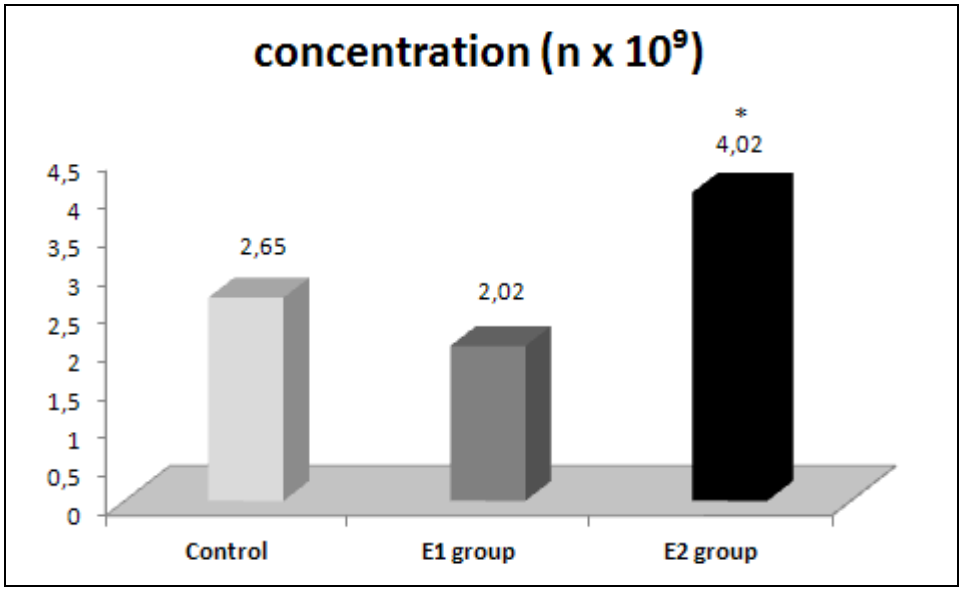

Figure 1 Differences in spermatozoa concentration amongst observed experimental groups and control group

* - difference is significant at $P < 0.05$

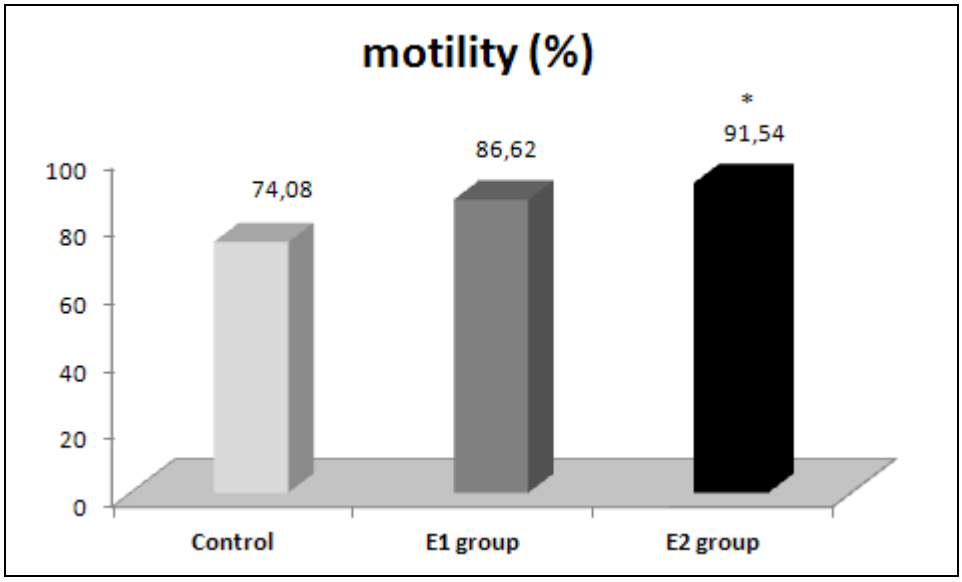

Figure 2 Differences in spermatozoa motility amongst observed experimental groups and control group

* - difference is significant at $P < 0.05$

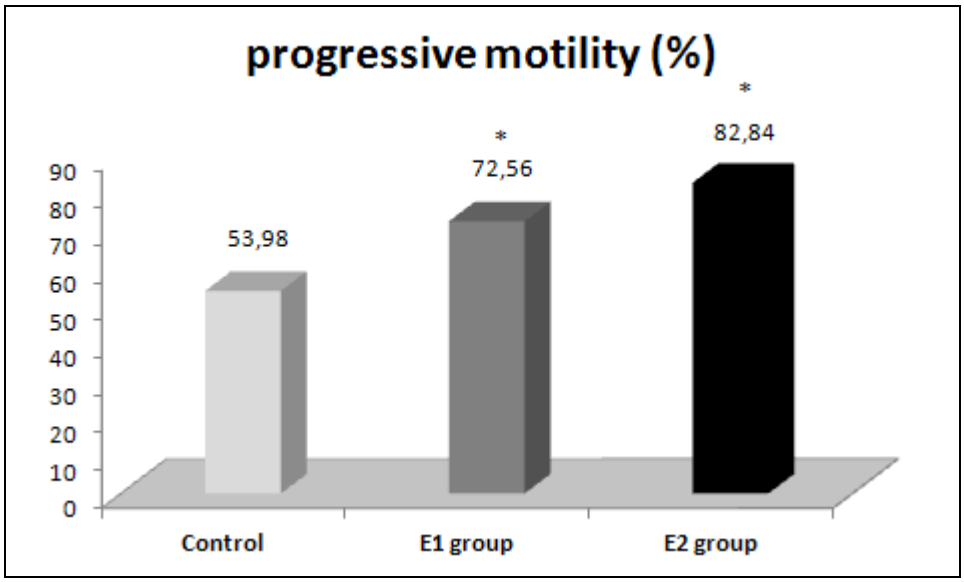

Figure 3 Differences in spermatozoa progressive motility amongst observed experimental groups and control group

* - difference is significant at $P < 0.05$

Yucca shidigera has not been yet tested on rabbit males, the kind of this research study has not been yet published and obtained results are preliminary, therefore they cannot be compared with other relevant research. **Bingham** (**1976**) proposed that yucca saponins have anti-protozoal activity, which suppresses protozoal infection of the intestine. Yucca extracts have anti-arthritic and anti-inflammatory effects too (**Cheeke *et al.*, 2006**). Spermatozoa are very sensitive to inflammation of the testicles. In our opinion this fact may be associated with improved quality of rabbit spermatozoa. *Yucca shidigera* extract has a high ability to bind ammonia. This fact is very important in terms of keeping welfare in breeding. **Amber *et al.*** (**2004**) reported that the effect of *Yucca shidigera* extract appeared to be significantly more effective during reducing the concentration of urea and ammonia as a probiotics. Therefore, it is not excluded that the ammonia in the reproductive system can cause an increase in the pH and thus can reduce sperm motility and survival. *Yucca shidigera* plant is suitable complement compound feed; it has a positive impact on the growth, health and animal production activities (**Anthony *et al.*, 1994**). In the experimental part of our science work we confirmed this fact. **Liu *et al.*** (**2009**) showed that plant extract from *Yucca shidigera* has the ability raise animal performance. **Castellini *et al.*** (**2002**) noticed that the economic efficiency of a rabbitry depends mainly on the reproductive performance of the doe, which in turn is affected by their fertility and prolificacy and by the weight gain and mortality of the young rabbits. During the last decade, numerous in vitro and in vivo studies have suggested that

plants have diverse, potentially beneficial medicinal properties. For example, it is well known that many natural substances in plants contain a wide variety of free radical scavengers, such as phenolic compounds, nitrogen compounds, vitamins, terpenoids, saponins, and some other endogenous metabolites, which are rich in antioxidant activity (**Changwei *et al.*, 2008**). All of these traits are affected by many factors such as genetic strain, feeding, environment and management and a stable balance between them is difficult to achieve.

CONCLUSION

The addition of *Yucca shidigera* plant into the normal feed in rabbits had a positive effect on their semen quality. Particularly higher dose of *Yucca* increased rabbit spermatozoa concentration, motility and progressive motility. However, these are preliminary results therefore further large-scale and long-term experiments are required in order to prove the real positive effect of *Yucca shidigera* on male's spermatozoa characteristics.

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