

YUCCA SCHIDIGERA AND ITS EFFECT ON RABBIT REPRODUCTION

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ARTICLE INFO

Received 11. 9. 2013
Revised 13. 11. 2013
Accepted 15. 11. 2013
Published 1. 12. 2013

Short communication



ABSTRACT

The aim of this study was to evaluate the effect of *Yucca schidigera* plant on rabbit reproduction parameters. Six weeks old New Zealand White rabbit females (n=36) and males (n=20) were used in the experiment. Animals in the control groups (C does; n=12 and C bucks; n=7) were fed with commercially available diet and the diet in the experimental groups was enriched with 5g/100kg (E1 does; n=12 and E1 bucks; n=7) or 20 g/100kg (E2 does; n=12 and E2 bucks; n=6) of *Yucca schidigera* powder extract. The rabbits were fed for 280 days and weighed weekly. The highest semen concentration was in the second experimental group E2 ($3.80 \pm 0.57 \times 10^9$ /ml) compared to control group C ($2.84 \pm 0.33 \times 10^9$ /ml) and experimental group E1 ($1.9 \pm 0.35 \times 10^9$ /ml). Semen motility (E2- 85.55 ± 6.19 %; E1- 85.28 ± 2.27 %) and progressive motility (E2; 73.45 ± 9.63 %; E1; 71.16 ± 3.43 %) were higher in the experimental groups compared to the control groups (motility -78.69 ± 5.17 %; progressive motility -61.34 ± 6.69 %).

The highest conception and kindling rate was found out in the control group C (83 % and 83 %, respectively), slightly lower values were reported in the both experimental groups E1 and E2 (for conception rate - 63% and 63%, respectively; and for kindling rate - 63% and 63%, respectively). Evaluation of the number of liveborn young rabbits showed, in the experimental group 2 the number of liveborn young rabbits (9.43 ± 1.65) was higher than in the control (C; 8.0 ± 0.97) and the experimental group 1 (6.0 ± 1).

Keywords: Rabbits, *Yucca schidigera*, semen concentration, semen motility, conception rate, kindling rate, liveborn young rabbits

INTRODUCTION

Yuccas are an easily recognizable constituent of the vegetation of the International Four Corners; an area made up of portions of Arizona, New Mexico, Sonora and Chihuahua (Lenz et al., 2000). This plant belongs to the family *Agavaceae* that includes about 40 species of perennial and mostly evergreen plants with dominant occurrence in the drier areas of North America (Brickell, 2007).

Yucca contains sarsaponin which can influence ruminant productivity (Francis et al., 2002), polyphenolics, resveratrol and a number of the other stilbenes (yuccaols A, B, C, D and E) (Cheeke et al., 2006).

Yucca products are well known for its positive effect on growth (Hussain et al., 1996; Cabuk et al., 2004), increase laying rate, egg weight of laying quails and decreased serum glucose, cholesterol and triglyceride level in laying quails (Kaya et al., 2003), rabbit weight gains (Földešiová et al., 2013), increased milk yields (Singer et al., 2008), reduction blood cholesterol levels (Oakenfull and Sidhu, 1989) and atmospheric ammonia (Santacruz-Reyes and Chien, 2010). Extracts of the *Yucca schidigera* plant have been used for many years in the food, feed, and cosmetics industries (Cabuk et al., 2004).

The objective of our study was to evaluate the effect of *Yucca schidigera* on rabbit males and females reproduction. Information about yucca and its effect on reproduction have never been published.

MATERIAL AND METHODS

Animals

Forty two days old, clinically health rabbit males (n=20) and females (n=36) of New Zealand White rabbit breed were used in this experiment. The animals were housed in individual cages, under a constant photoperiod of 14 hours of light day. Temperature and humidity in the building were recorded continuously by means of a thermograph positioned at the same level as the cages (average relative humidity and temperature during the year was maintained at 60 ± 5 % and 17 ± 3 °C). The rabbits were fed *ad libitum* and water was provided *ad libitum* with nipple drinkers.

Rabbits were divided into three groups: control (C: does- 12, bucks- 7) and two experimental groups (E1: does- 12, bucks- 7; E2: does- 12, bucks- 6). Control group animals were fed with commercially available diet. In the experimental group E1, 5 g of a powder of plant *Yucca schidigera* (KONFIRM, Brno) was added to the 100 kg of the diet and in the E2 experimental group, 20 g of a powder of *Yucca schidigera* was added to the 100 kg of the diet. The animals were fed for 6 months days and weighed weekly. All experiments were approved according to ethical permission No. SK P 28004.

Semen collection, rabbit does superovulation and insemination

Ejaculates were collected from bucks using an artificial vagina. Obtained ejaculates were mixed to make heterospermic pool and routinely diluted in a commercial diluent (MiniTüb, Tiefenbach, Germany) in ratio 1:6. The diluent was prepared as follows: the original MiniTüb pack of soluble powder (6 g) was diluted in 100 ml MiniTüb bi-distilled apyrogen and sterile water. CASA (Computer-assisted semen analysis) was used for semen quality analysis. The conception rate of inseminated does was observed using palpation on 15th day after insemination.

Sexually mature rabbit females (New Zealand White line) were treated subsequently:

- 1) intramuscular application of hormonal preparation SERGON (PMSG) / 25 IU/rabbit
- 2) after 48 h intramuscular application SUPERGESTAN (HCG) / 100 µl/rabbit

Before the HCG injection, all rabbit does were artificially inseminated with heterospermic dose of rabbit semen (0.5 ml/doe).

Statistical analysis

Obtained data were analysed using Chi-Quadrat-Test and Student's t-test in a SigmaPlot Systat Software Inc., Germany).

RESULTS AND DISCUSSION

The highest semen concentration was observed in the second experimental group E2 when compared to the control group C and experimental group E1. The results of our preliminary experiments showed that the higher concentration of YS (20g/100 kg) has a positive effect on semen concentration compared to the lower concentration (5g/100 kg) of YS extract. In the both experimental groups semen motility and progressive motility were higher than in the control groups (Table 1).

Table 1 Reproductive parameters of the rabbit males

Parameter	Concentration (x 10 ⁹ /ml)	Motility (%)	Progressive motility (%)
C (n=7)	2.84±0.33	78.69±5.17	61.34±6.69
E1 (n=7)	1.9±0.35	85.28±2.27	71.16±3.43
E2 (n=6)	3.80±0.57*	85.55±6.19	73.45±9.63

Legend: C - control; normal diet, E1 - 5g of *Yucca schidigera* added to 100 kg of normal diet, E2 - 20 g of *Yucca schidigera* added to 100 kg of normal diet, E1vs.E2, P<0.05

The highest conception and kindling rate was found out in the control group C (83 % and 83 %, respectively), slightly lower values were reported in the both experimental groups E1 and E2 (for conception rate - 63% and 63%, respectively; and for kindling rate - 63% and 63%, respectively). Analysis of the number of the liveborn young rabbits showed that significantly higher (P<0.05) numbers of pups were in the experimental group 2 (9.43±1.65) and control group (C; 8.0±0.97) when compared to the experimental group 1 (6±1) (Table 2).

Table 2 Reproductive parameters of the rabbit females

Parameter	Conception rate (%)	Kindling rate (%)	No. of liveborn young rabbits
C (n=12)	83	83	8±0.97 ^a
E1 (n=12)	63	63	6±1 ^b
E2 (n=12)	63	63	9.43±1.65 ^a

a vs. b P< 0.05

Legend: C - control; normal diet, E1 - 5g of *Yucca schidigera* added to 100 kg of normal diet, E2 - 20 g of *Yucca schidigera* added to 100 kg of normal diet

The positive influence of the addition of the herbal plant *Yucca schidigera* on growth, health, metabolism and reproductive activity of livestock was studied by several authors (Amber et al., 2004; Anthony et al., 1994; Duffy and Brooks, 2007; Földešiová et al., 2013).

The diet containing *Yucca schidigera* extract and probiotics had an effect on growth, digestibility, nitrogen balance and caecal microbial activity of growing New Zealand White rabbits. In the rabbits who were fed with yucca extract enriched feed, average daily weight gain increased when compared to the control (Anthony et al., 1994).

It was proposed that the *Yucca schidigera* plant extract has the ability to increase performance of animals. Feeding of young chickens with plant preparation containing *Yucca schidigera* extract increased the average weight gains of chicks (Giffard et al., 2001).

Positive effect of *Yucca schidigera* plant extract was found also in pigs. Daily average weight gains in the group fed with *Yucca schidigera* group were significantly higher when compared to the control group (Duffy and Brooks, 2007).

Yucca schidigera supplementation also improved efficiency of nitrogen utilization by reducing nitrogen losses in urine and reduced emission of methane from sheep fed with *Yucca schidigera* enriched basal diet (Santoso, et al., 2006). Chrenková et al. (2012) found out positive influence in the case of the highest apparent protein and fat digestibility when 5 g of yucca extract was added to the 100 kg of rabbit feed mixture.

In our previous experiment (Földešiová et al., 2012) we found out that the highest (P<0.05) conception rate of rabbit females was in the group treated with 20 g of *Yucca schidigera* per 100 kg normal diet (E2). Slightly lower values were in the group treated with 5 g of *Yucca schidigera* additive per 100 kg normal diet (E1). The lowest conception rate was observed in the control group. The kindling rate was also significantly higher (P<0.05) in the experimental groups (E1 and E2, respectively) than in the control group (C).

Examination of the effect of *Yucca schidigera* herbal additive on rabbit spermatozoa characteristic suggested that *Yucca schidigera* addition in the feed mixture can increase spermatozoa concentration, motility and progressive motility in the rabbit ejaculate (Baláži et al., 2013).

CONCLUSION

On the base of our preliminary experiments we can concluded that the addition of *Yucca schidigera* plant to the standard feed had a positive but in this case not statistically significant effect on the rabbit reproduction.

Acknowledgments: The authors thank Ing. Ladislav Tyl from KONFIRM, Brno, Czech Republic for providing technologically processed *Yucca schidigera* plant. This work was supported by the project: APVV-0854-11 and RPVV 3.

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