NATIONAL AGRICULTURAL AND FOOD CENTRE
RESEARCH INSTITUTE FOR ANIMAL PRODUCTION NITRA

Slovak J. Anim. Sci., 49, 2016 (3): 137-140

ISSN 1337-9984

Short communication

THE EFFECT OF GREEN TEA ADDITION TO DIET ON WEIGHT GAINS OF RABBIT FEMALES

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ABSTRACT

The aim of present study was to evaluate the effect of different concentrations of green tea plant (*Camellia sinensis*) addition to the diet on the weight gains of rabbits. Rabbit females (n = 31) of New Zealand White breed were used in the experiment. Rabbit does in the control group (C; n = 12) were fed with a commercially available feed. In the experimental groups, 5 g (E1; n = 9) and 20 g (E2; n = 10) of green tea dried powder were added to 100 kg of commercially available feed. The lower weight gains per week (g) were observed in both experimental groups (E1; 229.7 ± 21.95 and E2; 223.09 ± 24.00 g, respectively) when compared to control (C; 242.58 ± 19.76 g). Total average weight gain was the highest in control (C; 2668.3 ± 97.61 g) when compared to the both experimental groups (E1, 2526.67 ± 79.64 g; E2, 2454.0 ± 118.09 g).
In conclusion, addition of green tea powder to the commercial diet for rabbit does had negative effect on the weight gains (g) per week and on the total average weight gains (g) during the fattening period.

Key words: rabbit females; green tea; weight gains

INTRODUCTION

Nowadays, biologically active substances and extracts are used worldwide particularly in terms of their stimulation and therapeutic effects (Park *et al.*, 2014).

More suitable composition of feed mixture or administration of natural additives at an appropriate concentration might be beneficial in livestock farming without negative effect on the environment and the animals as an individual (Abdel-Wareth *et al.*, 2014). Plant polyphenols are natural antioxidants and most of their pharmacological properties are considered to be due to their antioxidant action (Ames *et al.*, 1995). The most important polyphenolic compounds in green tea are catechins: epigallocatechin-3-gallate (EGCG), epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC), catechin and gallocatechin (GC) (Wang *et al.*, 2013). Green tea contains also high levels of other bioactive phenols, such as caffeine. EGCG, the most abundant catechin in green tea, accounts for 65 % of the total catechin content. A cup of green tea may contain 100–200 mg of EGCG. Catechin and gallocatechin are present in trace amounts (Chu and Juneja, 1997).

Green tea polyphenols (GTPP) are known for their preventive, antibacterial and therapeutic effects, anticancer and apoptosis inducing-properties. These molecules prevent neural cell death and induce chromosomal damage in lymphoblastoid cell lines (Reznichenko *et al.*, 2005; Sugisawa and Umegaki, 2002).

Some epidemiological and clinical studies have shown the health benefits of EGCG on obesity

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Received: August 31, 2016
Accepted: September 20, 2016

and diabetes (Rains *et al.*, 2011) and the underlying mechanisms involve modulations of energy balance, endocrine systems, food intake, lipid and carbohydrate metabolism (Chacko *et al*., 2010).

The studies have suggested that the extent of absorption of dietary polyphenols in the small intestine is relatively small (10–20 %). The majority of ingested polyphenols will reach the large intestine where they encounter the colonic microflora (Spencer, 2003). The colon contains microorganisms having an enormous catalytic and hydrolytic potential. This enzymatic degradation of flavonoids by the colonic microflora results in a huge array of new metabolites. These polyphenols do not interfere with the microflora of the colon (Zdunczyk *et al*., 2002).

Multiple *in vitro* studies on catechins report mechanisms consistent with protection against degenerative diseases (Crespy and Williamson, 2004). Green tea catechins (GTC) have been reported to possess multiple properties, such as cancer prevention, hypotensive effects, anti-viral and antioxidant properties, inhibition of plaque formation, anti-allergic potential and blood glucose-lowering effects (Katiyar and Mukhtar, 1996; Matsumoto *et al*., 1993).

Green tea has not been tested in rabbits yet, so the objective of this study was to evaluate the effect of different concentration of green tea powder addition to the diet on the total and average weight gains of the rabbit does.

MATERIAL AND METHODS

Animals

Two months old clinically healthy rabbit does of the New Zealand White line (NAFC Nitra, SR) were used in this experiment. The animals were housed in individual cages, under a constant photoperiod of 14 hours of light. 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 ºC). The rabbits were fed *ad libitum* and water was provided *ad libitum* with nipple drinkers.

Rabbit does (n = 31) were divided into three groups: control (C; n = 12) and two experimental groups (E1; n = 9 and E2; n = 10). The does in the control group were fed with a commercially available complete feed mixture. Green tea (right loose green tea, made in China and distributed by Oxalis, Czech Republic) was added at two different concentrations (E1: 5 g; E2: 20 g) to the 100 kg of the complete feed mixture in both experimental groups. The animals were fed for 77 days and weighted weekly.

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.

Statistical analysis

All values are expressed as means ± S.E.M. Differences between the control and experimental groups were evaluated by one-way ANOVA test using the SigmaPlot 11 software (Systat Software Inc., Erkharth, Germany).

RESULTS AND DISCUSSION

In our study the effect of different concentrations of green tea plant powder added to the diet on the total and average weight gains (g) of the rabbit does was evaluated.

The highest average weight gain of rabbit does per week (g) was recorded in the control group (C; 242.58 ± 19.76 g) when compared to the experimental (E1; 229.7 ± 21.95 and E2; 223.09 ± 24.00, respectively) groups (Figure 1). Similarly, total average weight gain (g) was the highest in the control group (C; 2668.3 ± 97.61 g) compared to the experimental (E1; 2526.67 ± 79.64 and E2; 2454.0 ± 118.09 g, respectively) groups, although these differences were not statistically significant (Figure 2).

Decreasing of weight in other animal species fed with green tea was also reported. In particular, in the study of Hamdaoui *et al*. (2003) the weight gains were evaluated in rats fed a commonly consumed Tunisian meal 'bean seeds ragout' (BSR), with or without beef and with black or green tea decoction. Both, black and green teas significantly reduced the weight gains, where the black tea decoction had the strongest effect.

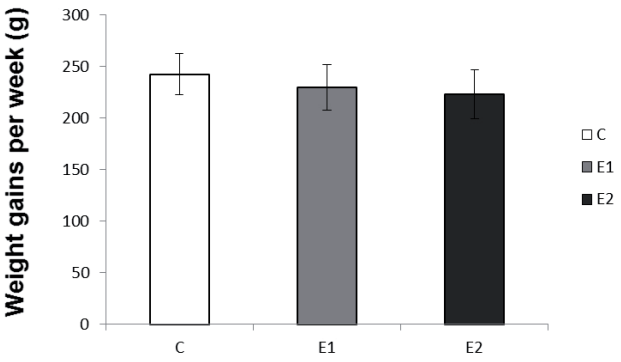

Fig. 1: Average weight gains (g) per week of rabbit does fed with green tea plant added into complete feed mixture

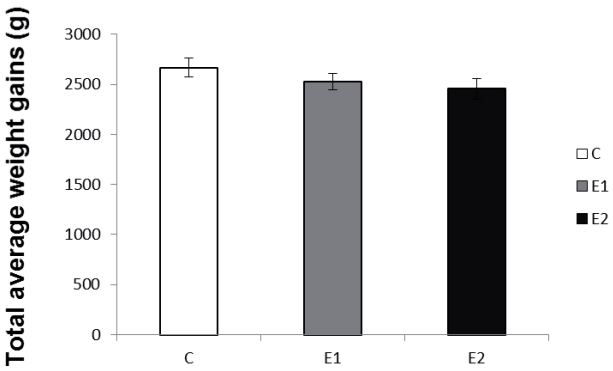

Fig. 2: Total average weight gains (g) of rabbit does fed with green tea plant added into complete feed mixture

Ito *et al.* (2008) found out that the administration of 0.5 % catechins decreased the body fat accumulation and levels of serum cholesterol and bile acids. These results indicate that green tea catechins modulate lipid metabolism in obese, but also in the non-obese subjects.

Snoussi *et al.* (2014) found that chronic administration of green tea decoction (GTD) in rat fed high-fat diet reduced body weight gain, circulating triglycerides and cholesterol and improved glucose tolerance. On the other hand, administration of GTD did not affect food intake, suggesting that the reduced feed intake does not correspond to the reduction in weight gain.

Morita *et al.* (2009) administered green tea catechins to pregnant rats at two concentrations (2000 $mg.kg^{-1}$ and 600 $mg.kg^{-1}$ day) and observed the reduction in the weight gain ($P < 0.05$). However, heat-sterilized green tea catechin (GTC-H) administration did not affect mean gravid uterine weights or intrauterine growth and survival.

The results of Sayama *et al*. (2000) indicated that lipid metabolism in mice was suppressed by the administration of green tea powder and, thereby, the fatty accumulation and body weight increase was suppressed.

In mice fed a high-fat diet (60 % energy as fat), supplementation with dietary EGCG treatment (3.2 $g.kg^{-1}$ diet) for 16 weeks reduced body weight gain, body fat percentage and visceral fat weight ($P < 0.05$) compared to mice without EGCG treatment (Bose *et al*., 2008). Their results indicate that long-term EGCG treatment attenuated the development of obesity, symptoms associated with the metabolic syndrome and fatty liver. Short-term EGCG treatment appeared to reverse pre-existing high-fat-induced metabolic pathologies in obese mice. These effects may be mediated by decreased lipid absorption and decreased inflammation. Similarly, Lu *et al.* (2012) reported beneficial effects of green tea polyphenols (GTP) on body weight via regulating obesity-related genes, anti-inflammation, anti-oxidant capacity and estrogen-related actions in high-fat-induced obese rats.

Weight gains observed in our experiment were slightly lower in the experimental groups compared to the control group, but the differences were not statistically significant. It can be explained by variability between females (very high S.E.M. values).

Similarly as in our study, Juśkiewicz *et al*. (2008) found out, that supplementation of a diet with green tea extract had no significant influence on elevated food intake and body weight loss.

CONCLUSION

In conclusion, addition of green tea powder to the commercial diet for rabbit does can potentially decrease the weight gains per week and the total average weight gains during the fattening period.

ACKNOWLEDGEMENT

This study was supported from the grant of the Slovak Research and Development Agency: APVV-0854-11, by the grants VEGA 1/0611/15 and KEGA-011UPJŠ-412014.

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