

## Verbascoside Affects Rabbit Mineral Profile Parameters

Martin Massányi<sup>1</sup>, Nikola Knížatová<sup>2</sup>, Francesco Vizzarri<sup>3</sup>, Ľubomír Ondruška<sup>4</sup>, Grzegorz Formicki<sup>5</sup>, Marko Halo Jr.<sup>2</sup>, Marko Halo<sup>1</sup>, Peter Massányi<sup>2,5</sup>

<sup>1</sup>Slovak University of Agriculture in Nitra, Faculty of Agrobiological and Food Resources, Department of Animal Husbandry, 949 76-Nitra, Tr. A. Hlinku 2, Slovak Republic

<sup>2</sup>Slovak University of Agriculture, Faculty of Biotechnology and Food Sciences, Department of Animal Physiology, 949 76-Nitra, Trieda Andreja Hlinku 2, Slovak Republic

<sup>3</sup>University of Bari Aldo Moro, Department of Agricultural and Environmental Sciences, 70126-Bari, Italy

<sup>4</sup>National Agricultural and Food Centre Institute, Research Institute for Animal Production, Department of Small Farm Animals, 951 41-Lužianky, Hlohovecká 2, Slovakia, Slovak Republic

<sup>5</sup>Pedagogical University of Kraków, Institute of Biology, Faculty of Exact and Natural Sciences, Department of Physiology, 30 084-Kraków, Podchorążych 2, Poland

---

### Abstract

Verbascoside is a compound that belongs to a group of natural substances present in plants used in traditional medicine. It possesses multiple biological capabilities including anti-inflammatory, anti-bacterial and anti-tumour properties. Aim of the study was to evaluate the effect of verbascoside in two different concentrations (1 g/kg-LVB and 2 mg/kg-HVB in food mixture) on selected parameters of mineral profiles in rabbit blood. In our study the experiment lasted for 120 days and was executed on 45 New Zealand rabbit bucks. The average age of animals was 1 year±2 month. Rabbits were divided into three homogenous groups—first being the control group fed with a feed without any additives (control); LVB group with 5 mg/kg and HVB group supplemented with 10 mg/kg of verbascoside. In our experiment verbascoside did not cause significant changes in parameters of mineral profile in rabbit blood. Levels of sodium in control group were 135.22 mmol/l. The levels of Na in LVB reached 135.64 mmol/l and in HVB group 134.74 mmol/l. Potassium analysis shown concentrations in the range of 4.32 mmol/l-4.68 mmol/l with the lowest concentration in control group. The concentrations of Ca have remained almost unchanged compared to the control group with LVB group having the same concentration of 3.49 mmol/l and HVB group-3.48 mmol/l. Chlorides concentrations ranged from 106.05 mmol/l to 160.61 mmol/l and did not show any significant changes. Magnesium blood levels in our experiment did not show any significant changes either and ranged from 1.32 mmol/l to 1.34 mmol/l. We can state that verbascoside had no effect on mineral profile parameters in rabbit blood, but it has to be emphasized that its effect is more focused on different functions in various targeted organs as stated above.

**Keywords:** blood, minerals, rabbit, verbascoside

---

### 1. Introduction

Food supplements have important effect on animal nutrition in last years. They are not used only to cover the need of essential compounds (aminoacids, vitamins) but also as nonessential

additions to feed (i.e. enzymes) [1]. Verbascoside is a natural compound contained in plants used in traditional medicine. They possess multiple biological activities including anti-inflammatory, anti-bacterial and anti-tumor properties [2]. Verbascoside—a phenylpropanoid glycoside occurs in multiple medicinal plants also possess positive cardiovascular effects [3, 4]. Lately it has been proven that verbascoside has positive effect on skin cell regeneration and helps with skin rashes

---

\* Corresponding author: Martin Massányi  
Tel.+421944360220  
Email: [martinmassanyi@yahoo.com](mailto:martinmassanyi@yahoo.com)

and acne thanks to antioxidant capabilities stimulated by ROS activity and GST [5]. The aim of the study was to evaluate the effect of verbascoside in two different concentrations on selected parameters of mineral profiles in rabbit blood.

## 2. Materials and methods

Experiment that lasted 120 days was executed on 45 New Zealand rabbit bucks in the age of 1

year±2 months. Animals were divided into 3 groups, out of which, each group consisted of 15 rabbits. Control group (K) was fed *ad libitum* by feed without additives. The other two experimental groups were fed by feed containing verbascoside in two different concentrations: LVB group-100 g of verbascoside per 100 kg of feed mixture and HVB group-200 g of verbascoside per 100 g of feed mixture (Table 1). All animals were held at NPPC Nitra in individual cages. Water was given in form of automatized feed-pumps.

**Table 1.** Experimental groups and verbascoside doses

| Group       | Verbascoide content (g) per 100 kg of feed | Number of animals | Experiment duration |
|-------------|--|-------------------|---------------------|
| Control (K) | 0  | 15                | 120                 |
| LVB         | 100  | 15                | 120                 |
| HVB         | 200  | 15                | 120                 |

LVB-Low verbascoside content; HVB-High verbascoside content

During the experiment, the blood was collected from *vena auricularis* into prepared tubes. Samples were centrifuged at 3000 rpm for 15 minutes and blood serum was separated. We analysed mineral profile parameters (Na, K, Ca, Cl, Mg) of blood serum using Genesys 10 spectrophotometer (Thermo Fisher Scientific Inc, USA) and Microlab 300 (Vilat Scientific, Dieren, The Netherlands).

### Statistical analyses

Gathered results were statistically processed using programme SAS [6, 7]. All statistical tests were

carried out at levels of significance at \* $p < 0.05$  and results were interpreted as means.

## 3. Results and discussion

Aim of the study was to evaluate the effect of verbascoside added into rabbit feed on the levels of mineral profile (Na, K, Ca, Cl, Mg) in rabbit blood. Concentrations used in the experiment can be found in Table 2.

**Table 2.** Parameters of mineral profile in the experiment

| Parameter | Unit   | Control | LVB    | HVB    |
|-----------|--------|---------|--------|--------|
| Na        | mmol/l | 135.5   | 135.64 | 134.74 |
| K         | mmol/l | 4.32    | 4.46   | 4.68   |
| Ca        | mmol/l | 3.49    | 3.53   | 3.48   |
| Cl        | mmol/l | 106.05  | 106.61 | 106.23 |
| Mg        | mmol/l | 1.34    | 1.35   | 1.32   |

$p < 0.05$

Sodium concentration stayed the same over the course of the experiment, where it differed by less than 1 mmol/l in both experimental groups. Thus, there have been no significant differences between the concentrations of sodium between the groups. Evaluating potassium concentration-average levels have ranged between 4.32-4.68 mmol/l where the lowest concentrations was in the control group without additive. We can see an increasing tendency with the rising concentration of

verbascoside in the feed, but the changes were not significant.

We have not observed any significant changes in calcium levels. The highest value was in the LVB group (3.53 mmol/l).

Chloride ion concentration in rabbit blood ranged from 106.05-106.61 mmol/l with the lowest concentration in the control group. Highest measured concentration was in the group fed with 1 mg of verbascoside per kg of feed.

Magnesium levels have also not shown any significant changes in rabbit blood – concentrations ranged from 1.32 mmol/l in HVB group to 1.35 mmol/l in LVB group.

In our experiments verbascoside did not have statistically significant effect on observed mineral profile parameters and all basic parameters remained in the reference range, same trend was observed by multiple other authors [2, 8, 9]. Even though the mineral profile parameters shown normal values within reference ranges [9, 10] certain other parameters were affected by experimental supplementation-especially an improvement in lipid profile [2]. It results from significant decrease of triglycerides, total cholesterol, LDL cholesterol, hepatic enzymes, bilirubin and increase of HDL cholesterol. Increase of plasmatic HDL concentrations after addition of verbascoside can be caused by polyphenols effect that are included in regulation of lipid a glucose metabolism and certain aminoacids activation [11, 12]. Bursill and Roach (207) [13] proved a significant improvement of blood lipid profile in hares whose feed contained verbascoside. Improvement of oxidative status in plasma is also connected with verbascoside-connected probably by antioxidant effect of polyphenols capable of oxidation and reduction of highly reactive free radicals and thus causing protective activity against ROS [2]. Anti-inflammatory activity of different phenylpropanoids has been proven in multiple cell models with micromole concentrations [14, 15]. Other than that, various phenylpropanoids (including *verbascoside*) shown strong antioxidant activity in microsomes and determination of LDL lipid peroxidation [16, 17].

#### 4. Conclusions

Observing the effect of verbascoside added into feed of New Zealand white rabbits on mineral profile parameters in the dose of 100 and 200 mg per kilogram of feed shown us no significant changes in levels of any of the observed parameters. Thus, we can state that verbascoside does not have any significant effect on mineral profile in blood, though it can have multiple positive effects on different organs and on antioxidant activity in cells as it has already

proven anti-inflammatory, antibacterial, antitumor and antioxidant properties.

#### Acknowledgements

The research was financially supported by projects VEGA 1/0539/18, VEGA 1/0392/20, APVV-16-0289 and KEGA 010/SPU-4/2018.

#### References

1. Petrikovič, P., Chrenková, M., Produkčné efektívne a environmentálne tolerantné využitie nutričných zdrojov. Slovenské centrum poľnohospodárskeho výskumu- Výskumný ústav živočíšnej výroby, Nitra, 2008, 15-21.
2. Casamassima, D., Vizzarri, F., Palazzo, M., Massányi, P., Ondruška, Ľ., Corino, C., Effect of the addition of a verbascoside-based food supplement in feed, on some blood parameters and plasma oxidative status in white new zealand rabbits, *Animal physiology* 2011, 272–286.
3. Jimenez, C., Riguera, R., Phenylethanoid glycosides in plants: structure and biological activity, *Natural Product. Reproduction*, 1994, 12, 591–606.
4. Pennacchio, M., Syah, Y. M., Ghisalberti, E. L., Alexander, E., Cardioactive compounds from *Eremophila* species, *Journal of Ethnopharmacology*, 1996, 53, 21–27.
5. Feng, R., Lu, Y., Bowman, L. L., Inhibition of activator protein-1, NFkappaB, and MAPKs and induction of phase 2 detoxifying enzyme activity by chlorogenic acid, *Journal of Biology and Chemistry*, 2005, 280, 27888–27895.
6. Massányi, P., Toman, R., Valent, M., Čupka, P., Evaluation of selected parameters of a metabolic profile and levels of cadmium in reproductive organs of rabbits after an experimental administration, *Acta Physiologica Hungarica*, 1995, 83(3), 267–273.
7. Massányi, P., Slamečka, J., Lukáč, N., Capcarová, M., Mertin, D., Jurčík, R., Seasonal variations in the blood biochemistry of brown hare. In *Medycyna weterynaryjna*, 2009, 65(6), 389-393.
8. Cervera, C., Juncos, A., Martínez, E., Ródenas, L., BLAS, E., Pascual, J. J., Effect of different feeding systems for young rabbit does on their 42 development and performance until first weaning: preliminary results. 9th World Rabbit Congress, June, Verona, Italy, 2008.
9. Ahamefule, F. O., Eduok, G. O., Usman, A., Amaefule, K. U., Obua, B. E., Oguike, S. A., Blood biochemistry and haematology of weaner rabbits fed sundried, ensiled and fermented cassava peel based diets, *Pakistan Journal of Nutrition*, 2006, 5(3), 248-253.
10. Hewitt, C. D., Innes, D. J., Savory, J., Wills, M. R., Normal biochemical and hematological values in New

Zealand white rabbits, *Clinical Chemistry*, 35(8), 1989, 1777-1779.

11. Norata, G. D., Pellegatta, F., Catapano A. L., Peroxisome proliferators activated receptors and cardiovascular pathology, *Italian Heart Journal*, 2003, 4, 8-18.

12. Bursill, C., Roach, P., A green tea catechin extract upregulates the hepatic low density lipoprotein receptor in rats, *Lipids*, 2007, 42, 621-627.

13. Palazzo, M., Vizzarri, F., Cinone, M., Corino, C., Casamassima, D., Assessment of a natural dietary extract, titrated in phenylpropanoid glycosides, on blood parameters and plasma oxidative status in intensively reared Italian hares (*Lepus corsicanus*), *Animal*, 2011, 5(6), 844-850.

14. Diaz, A. M., Abad, M. J., Fernandez, L., Silvan, A. M., De Santos, J., Bermejo, P., Phenylpropanoid

glycosides from *Scrophularia scorodonia*: In vitro antiinflammatory activity, *Life Sciences*, 2004, 74(20), 2515-2526.

15. Matsuda, H., Morikawa T., Managi H., Yoshikawa, M., Antiallergic principles from *Alpinia galanga*: Structural requirements of phenylpropanoids for inhibition of degranulation and release of TNF-alpha and IL-4 in RBL-2H3 cells, *Bioorganic and Medicinal Chemistry Letters*, 2003, 13(19), 3197-3202.

16. Cos, P., Rajan, P., Vedernikova, I., Calomme, M., Pieters, L., Vlietinck, A. J, In vitro antioxidant profile of phenolic acid derivatives, *Free Radical Research*, 2002, 36(6), 711-716.

17. Wong, I. Y. F., He, Z. D., Huang, Y., Chen, Z. Y., Antioxidative activities of phenylethanoid glycosides from *Ligustrum purpurascens*, *Journal of Agricultural and Food Chemistry*, 2001, 49(6), 3113-3119.