



RESEARCH ARTICLE

The role of dietary bee pollen in antioxidant potential in rats

Marcela Capcarova^{1*}, Adriana Kolesarova¹, Anna Kalafova¹, Branislav Galik²,
Milan Simko², Miroslav Juracek², Robert Toman³

¹Department of Animal Physiology, Faculty of Biotechnology and Food Sciences, ²Department of Animal Nutrition, Faculty of Agrobiolgy and Food Resources, ³Department of Veterinary Disciplines, Faculty of Agrobiolgy and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic

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*marcela.capcarova@uniag.sk

Özet

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Amaç: Mevcut araştırmada ratların oksidatif durum parametreleri üzerine gıda desteği olaral arı poleni ilavesinin etkisi incelendi.

Gereç ve Yöntem: Yetişkin Wistar ratlar 3 gruba ayrıldı: Birinci grup kontrol (C) olarak ayrılırken, diğer iki grup deneme grupları (E1, E2) olarak ayrıldı. Deneme gruplarından E1 grubu diyetine 300 mg/kg arı poleni ilavesi yapılırken, ikinci E2 grubuna 500 mg/kg dozunda ilave yapılarak 90 gün beslendi. Arı poleni ilavesi yapılmayan grup ise kontrol grubu olarak değerlendirildi. Albümin, bilirubin, demir, total antioksidan durum ve süperoksid dismutaz düzeyleri spektrofotometri ile belirlendi.

Bulgular: Ratların diyetlerine 500 mg/kg dozunda arı poleni ilavesinin albümin ve total antioksidan durum düzeylerinin istatistiki olarak (P<0.05) yükselttiği belirlendi.

Öneri: İnsan ve hayvan diyetlerine arı poleni ilavesinin antioksidan kaynağı olabileceği ifade edilebilir.

Anahtar kelimeler: Arı poleni, antioksidanlar, kan.

Abstract

Capcarova M, Kolesarova A, Kalafova A, Galik B, Simko M, Juracek M, Toman R. The role of dietary bee pollen in antioxidant potential in rats. *Eurasian J Vet Sci*, 2013, 29, 3, 133-137

Aim: The present study was designed to determinate the effect of bee pollen as a feed additive on the selected parameters of antioxidant status of rats.

Material and Methods: Adult Wistar rats were randomly divided into 3 groups: One control group (C) and two experimental groups (E1, E2). Experimental groups received dietary inclusion of collected bee pollen at 300 mg/kg in E1 group and 500 mg/kg in E2 group for 90 days. The group received feed without bee pollen addition served as the control group. Contents of albumin, bilirubin, iron, and total antioxidant status and superoxide dismutase activity were determined with spectrophotometer.

Results: Supplementation of the diet with bee pollen in the dose of 500 mg/kg significantly (P<0.05) increased albumin content and total antioxidant status.

Conclusion: Bee pollen addition to diets may be a source for antioxidant in human and animals.

Keywords: Bee pollen, antioxidants, blood.



Introduction

Natural health products are available to the public as food supplements and are promoted as equally or more effective, less toxic than conventional drugs (Martin-Munoz et al 2010, Capcarova et al 2011, Kacaniova et al 2011, Petruska et al 2012) and have gained increased attention in recent years. Bee pollen is an apicultural product composed of nutritionally valuable substances (Aliyazicioglu et al 2005) and has been applied for centuries in alternative medicine as well as in food diets and supplementary nutrition for human and animals due to its nutritional and physiological properties (Kanner et al 1994). Honeybees collect pollen and mix it with their own digestive enzymes. Bee pollen is rich in protein (25%), essential amino acids, oil (6%), containing more than 51% PUFA of which 39% linolenic, 20% palmitic and 13% linoleic acid, 11 enzymes or co-enzymes and also abounds with carbohydrate (35-61%, mainly glucose, fructose and sucrose), lipid, more than 12 vitamins, 28 minerals (Echigo and Yanami 1986, Xu et al 2009) and carotenoids (Izuta et al 2009). Flavonoids and phenolic components of bee pollen (Bonvehi et al 2001) provided for anti-inflammatory action (Akkol et al 2010). In bee pollen was isolated and purified the flavonoids demarcating with strong antioxidant ability as quercetin-7-rhamnoside, kaempferol-3-glucoside, isorhamnetin, kaempferol and quercetin (Maruyama et al 2010). Bee pollen possesses a noticeable source of compounds with health protective potential and antioxidant activity (Saric et al 2009). Thus, bee pollen would be beneficial not only as a dietary supplement but also as a functional food (Maruyama et al 2010).

Reactive oxygen species (ROS) are implicated in a wide range of human diseases. When an imbalance between generated ROS and available antioxidants occurs, oxidative damage will spread *via* free radical generation in many cellular materials (Buck et al 1990). Various reports have previously confirmed

the antioxidative effects of bee products (Moreira et al 2008, Ahn et al 2009) and of bee pollen of various plant species (Leja et al 2007, Saric et al 2009). Bee pollen contains considerable amounts of polyphenol substances (Aliyazicioglu et al 2005) that are responsible for the antioxidative and radical scavenging activity (Vinson and Hontz 1995). It was published that bee pollen had fairly strong antioxidant effects, especially against the hydrogen peroxide and superoxide radical (Nakajima et al 2009) and had ability for inhibition of nitric oxide production (Maruyama et al 2010).

The susceptibility of iron (Fe)-deficient rat intestine to oxidative damage during Fe depletion was published by Srigiridhar and Nair (2000). Duodenal Fe²⁺ uptake is essential to body Fe²⁺ homeostasis (Smith et al 2002).

The objective of present study was to determine the effect of bee pollen as a feed additive on the selected parameters of antioxidant status of rats.

Material and Methods

In the present study, thirty adult Wistar rats (40 days, Dobra voda, Slovakia) were involved. Rats were healthy and their condition was judged as good at the commencement of the experiment. In this animal study institutional and national guidelines for the care and use of animals were followed and all experimental procedures involving animals were approved by the State Veterinary and Food Institute of Slovak Republic, no.SVPS SR 2072/08-221/3. Rats were randomly divided into 3 groups: One control group (C) and two experimental groups (E1, E2). Rats were fed with complete feed mixture M3 (Biokron, Blucina, Czech Republic, Table 1). Experimental groups received dietary inclusion of collected bee pollen at 0.2% in E1 group and 0.5% in E2 group for 90 days. Control group received feed without bee pollen addition.

Dry matter	88%
Nitrogen matters	215g/kg
Fat	22 g/kg
Fiber	30 g/kg
Ash	55 g
Copper	25 mg
Retinol	20000 m.u.
Cholecalciferol	2000 m.u.

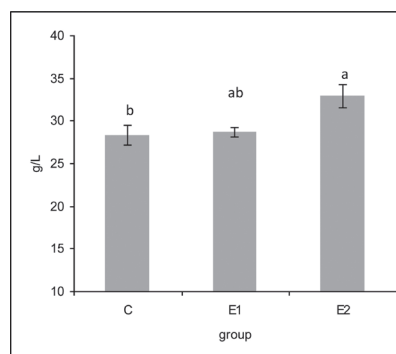


Figure 1. Albumin contents of control (C) and experimental groups (E1: 0.2% and E2: 0.5% dietary bee pollen). a-b: Different letters mean significant differences at level $P < 0.05$.

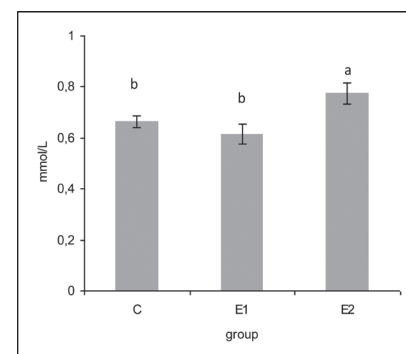


Figure 2. TAS contents of control (C) and experimental groups (E1: 0.2% and E2: 0.5% dietary bee pollen). a-b: Different letters mean significant differences at level $P < 0.05$.





From the start of the experiment intervention, the rats were maintained in an environment of controlled temperature (20-22 °C), humidity (55±10%) and light-dark cycle (12 h-12h), with *ad libitum* food and water available. After 90 days rats were anaesthetised by intraperitoneal injection of sodium pentobarbital (5/100 mg/g, Sigma, St Luis, MO, USA). After cervical dislocation the rats were totally bled. Blood samples with EDTA (0.5 mL) were analysed to measure superoxide dismutase (SOD). The rest of the blood was centrifuged for 30 min at 3000xg and blood serum was obtained. Contents of albumin, bilirubin, iron, total antioxidant status (TAS) and SOD activity were determined using Randox kits (Randox Labs., Crumlin, UK) on spectrophotometer Genesys 10 (Thermo Fisher Scientific Inc, USA) according to manufacturer conditions.

Data of between control and experimental groups were analysed by one-way ANOVA (Sigma Plot 9.0 Jandel, Corte Madera, USA). Differences were compared for statistical significance at the level $P < 0.05$.

Results

Dose of 500 mg/kg bee pollen was significantly ($P < 0.05$) increased albumin content (Figure 1) and TAS (Figure 2). The values of this parameter ranged in similar levels in control (0.66±0.02 mmol/L) and E1 group (0.62±0.04 mmol/L) and were significantly lower ($P < 0.05$) than those in E2 group (0.77±0.04 mmol/L). The lowest activity of SOD in the blood of rats was found in the control group (393±33.4 U/g Hb) when compared to experimental groups (458±22.7 U/g Hb in E1; and 479±20.6 U/g Hb in E2 group). However, no significance was determined ($P > 0.05$). The levels of serum bilirubin (C group: 21.9±1.74 mmol/L, E1 group: 19.2±13.0 mmol/L, E2 group: 22.0±6.67 mmol/L) and iron (C group: 46.7±6.19 µmol/L, E1 group: 37.6±5.71 µmol/L, E2 group: 41.2±5.86 µmol/L) were no differ statistically significance.

Discussion

Many biological and antioxidant activity were reported for bee products (Bankova 2009, Missima et al 2009, Münstedt and Bogdanov 2009, Naik et al 2009). High antiradical activity of bee pollen was manifested by high content of polyphenols (Fatrcova-Sramkova et al 2008). In our study, bee pollen inclusion to the diet insignificantly ($P > 0.05$) increased the activity of SOD in both experimental groups. Bee pollen inclusion in the diet for mice in the dose of 100 mg/kg body weight modulated antioxidant enzymes in the liver, brain and lysate of erythrocytes and reduced hepatic lipid peroxidation (Saric et al 2009) in dose of 500 mg/kg antilipidperoxidant activity (Akkol et al 2010). Administration of bee pollen reduced the plasma concentration of malondialdehyde, an in-

dicator of lipid peroxidation (Ishikawa et al 2009). Improvement in total antioxidants (TAS) and increase of activity of SOD in rats was noted after treatment with various natural plants or products, as *Etingera elatior* (Jackie et al 2011). In this paper, addition of bee pollen in the dose of 500 mg/kg of feed mixture significantly ($P < 0.05$) increased TAS (Figure 2) when compared to the control and E1 groups. Negative changes in most of the oxidative stress markers caused by carbaryl or propoxur given orally to rats were alleviated with the administration of bee pollen (50 or 100 mg/kg/day) (Eraslan et al 2009a, 2009b).

The dietary bee pollen addition increased albumin content in both experimental groups, significantly ($P < 0.05$) in the group with 0.5 g/kg of bee pollen inclusion (Figure 1). Bee pollen significantly increased plasma albumin in rabbits in the doses of 200 mg and 300 mg/kg body weight twice per week in diet (Attia et al 2011). The increase in serum albumin may be due to increasing in protein and amino acids supply due to bee pollen administration (Bell et al 1983).

Bilirubin may serve a cytoprotective function as an antioxidant (Fu et al 2010) and is known to have anti-inflammatory effects linked to its ability to scavenge free radicals (Stocker 2004). In this study, addition of bee pollen had no effect on content of bilirubin in blood serum of rabbits.

Iron has been reported to mediate oxidative stress (Valko et al 2005). A high production of free radicals occurs in animal models of iron overload (Stohs and Bagchi 1995). In this study, the content of iron did not differ among the groups, thus bee pollen added to the diet did not cause any changes regarding this parameter.

Conclusions

In conclusion, bee pollen addition may be a promising source for improving antioxidant status in human and animals. In addition, it seems that the best appropriate dose was 500 mg/kg.

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