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Dietary inclusion of Quebracho (*Schinopsis lorentzii*) tannins on productive performances of growing pheasant females

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RIASSUNTO – Effetto dell'aggiunta di tannini di Quebracho (*Schinopsis lorentzii*) alla dieta sulle performance produttive di fagiane in accrescimento. All'età di sessantacinque giorni, 72 fagiane furono scelte casualmente e assegnate a due gruppi sperimentali alimentati con la stessa dieta commerciale. 2% di tannino di provenienza dal Quebracho (*Schinopsis lorentzii*), sotto forma di un prodotto commerciale per uso zootecnico (MGM-S), fornito dalla Unitan s.a.i.c.a. Buenos Aires, è stato aggiunto nella miscela alimentare di un gruppo. Ogni quattordici giorni è stato misurato l'incremento ponderale e valutato l'I.C.A. Dopo quattro e sette settimane dall'inizio della prova è stato valutato il contenuto plasmatico di proteine totali ed eseguita la valutazione della sostanza secca degli escreti. A centoventi giorni è stato eseguito un controllo parassitologico sulle feci e successivamente, cinque animali per gruppo sono stati sacrificati per la valutazione delle rese di macellazione e della lunghezza dell'intestino tenue. L'uso dietetico del tannino del Quebracho non ha influenzato le performance di accrescimento e il contenuto plasmatico di proteine totali. Le rese del busto e fegato sono risultati significativamente diversi nei due gruppi. L'esame del contenuto fecale ha evidenziato una diversa resistenza ai parassiti: il gruppo tannino è apparso indenne dalla presenza di elminti.

Key words: Pleasant, Quebracho-tannin, growth.

INTRODUCTION – Tannins are a group of phenolic compounds which have received a lot of attention with respect to their possible nutritional and physiological actions. Tannins can be grouped into condensed and hydrolysable tannins, widely distributed in the plant kingdom. Hydrolysable tannins are polyester of phenolic acids such as gallic acid or ellagic acid or their derivatives and D-glucose. The condensed tannins are polymer of flavan-3-ols, flavan-3,4-diols or related flavanol residues linked via carbon-carbon bonds. There is evidence that high levels of tannins could produce adverse effects in animals. These effects can be instantaneous like astringency or a bitter or unpleasant taste or can have a delayed response related to antinutritional/toxic effects. The response depends on many factors including species, metabolic stage and age of the animal, level of exposure and structure of tannins (Makkar, 1993). On the other hand, studies performed on sheep, seemed to indicate the efficacy of condensed tannins, from several plants like the *Hedysarum coronarium* (sulla), in reducing gastrointestinal nematode infections (Niezen *et al.* 2002). Quebracho is a known source of condensed tannin, but little is known about the effects of this tannin on avian species. Hand-reared pheasants can be used for the release into the wild, where they sometimes go towards a high mortality due to the wrong choice and the limited presence of adequate natural food, which can lead to the intake of tanniferous plant parts. Thus, it could be of interest to get hand-reared birds used to the tannin compounds by offering them on the diet, developing in this way the ability to detoxify tannins. So, the aim of the present study is to examine eventual detrimental and/or positive effects of the dietary inclusion of Quebracho tannin on the pheasant growth.

MATERIAL AND METHODS – Sixty five-day-old female pheasants (*Phasianus colchicus mongolicus*) were randomly housed in six 18m² sandy pens (twelve females each pen) and assigned to two dietary groups of 36 birds each. One group was fed a commercial diet (control diet), and the other was fed the same diet added with 2% Quebracho-tannin (Tannin diet). Commercial Quebracho-tannin powder for animal feed use (MGM-S product, manufactured by Unitan s.a.i.c.a., Buenos Aires), extracted from the heartwood of *Schinopsis* sp., contained 58% tannins, 20% phlobaphenes, 14% non-tannic compounds and 8% water. Feed and water were supplied *ad libitum*. Caloric content of the diet was 2970 kcal/kg and crude protein content was 26%; protein source was heated soybeans. Every fourteen days, body weight changes were individually recorded and feed consumption from each pen registered. Four and seven weeks after the beginning of the trial, twenty-seven blood samples per dietary group were collected to evaluate the total protein content of plasma by using the Lowry assay (Lowry *et al.*, 1951); plasma aliquote from three birds were pooled, thus, 9 samples for each dietary group were analyzed. The day after each blood sampling, 27 pheasants/group were caged for 18 hours (from 16:00 until 10:00). Each cage housed 3 females of the same pen and under each cage a tray was used to collect the excreta. The dry matter of the excreta was determined by the AOAC (1990). At the end of the trial, when birds reached 120 days of age, a faecal parasitological examination was performed. At the same time, five pheasants inside each dietary group were sacrificed. Slaughtering traits and length measurements of small intestine and caeca were recorded.

Data were analysed by one-way analysis of variance to test the effect of the different diets using JMP software (2002). Percentage data were arcsine transformed prior to analysis.

RESULTS AND CONCLUSIONS – Mortality during the trial was 9% for both experimental groups. Death causes of the six females were due to traumatic events occurred during initial adaptation to a new habitat. The use of Quebracho tannin powder in the diet for a period of almost eight weeks, did not affect growing performances (table 1). At the end of the trial, similar body weight of the 120-day-old females was observed (control diet: 893 g, tannin diet: 881 g). Moreover daily weight gain as well as daily feed intake resulted similar (7.61 g, 50.1 g and 7.55 g, 53.5 g for control and tannin group, respectively).

Table 1. In vivo performances of the growing pheasant in the feeding trial.

Diet group	Body weight (g)		Weight gain (g/d)	Feed/gain ratio	Daily feed intake (g/d)
	65 days (n=33)	120 days (n=30)	65-120 days (n=30)	65-120 days (n=3)	65-120 days (n=3)
Control	474.3±53.69	892.7±66.89	7.61±0.972	6.73±0.705	50.06±2.604
Tannin	466.2±50.77	881.2±71.24	7.55±0.858	7.32±0.201	53.54±1.540

Obviously, feed conversion efficiency did not differ between groups, even if a slightly lower feed-gain ratio for the control group (6.73) was obtained. It has to be observed that the palatability of the diet was not affected by the astringent taste of the 2% Quebracho tannin inclusion.

Table 2. Morphological features (mean±s.d.) obtained after the feeding trial (n=5).

Diet group	Live Body weight (BW, g)	Ready to cook carcass (RCC, % BW)	Breast (% RCC)	Liver (% BW)	Empty gizzard (EG, % BW)	Gizzard mucosa (% EG)	Small intestine (cm)	Caeca total length (cm)
Control	897.3±15.73	65.7 ^a ±1.13	33.4±0.73	1.6 ^a ±0.21	1.9±0.10	14.1±3.14	107.4±10.47	39.8±5.33
Tannin	887.8±13.20	67.7 ^a ±0.73	33.4±1.32	1.3 ^b ±0.11	1.8±0.22	14.3±3.40	96.9±9.40	34.2±5.10

^{a, b}: P<0.05.

Morphological features (table 2) obtained after eight weeks of trial differ significantly only for the liver weight, which resulted lighter in the tannin group (12.0 g *vs.* 14.5 g). Gizzard weight and small intestine length as well

as caecal total length were slightly reduced for the tannin group, contrasting with the findings of Liukkonen-Anttila *et al.* (2001) on six-month-old grey partridges fed on a pelleted diet containing 6% Quebracho tannin powder during a four weeks period. The ready to cook carcass and the liver yields differed significantly between the Quebracho tannin and the control groups (67.7 vs. 65.7% and 1.3 vs. 1.6%). It is evident from the present study that Quebracho tannin at the level of 2% in the diet did not have adverse effects on growing pheasant, starting from 65 up to 120 days of age. During this period, characteristics of growth and breast muscles were similar in both experimental groups, so Quebracho tannin does not appear to have a detrimental effect and to decrease drastically the nutrient availability in the pheasant intestine, probably due to the high protein content of the feed. These results agree with the observations from Becker and Makkar (1999) on carps. After four and seven weeks of tannin intake, total plasma protein content showed no significant differences between groups (table 3). Similarly, dry matter content of excreta was not affected by the presence of Quebracho tannin in the diet, however after seven weeks of treatment more dehydrated excreta were observed in the Tannin group. Visual examination of droppings evidenced dark reddish-brown excreta in this group due to the Quebracho-tannin powder, as observed in grey partridges by Liukkonen-Anttila *et al.* (2001).

Table 3. Plasma total protein and excreta dry matter (mean±s.d.) obtained after the feeding trial (n=9).

Diet group	Plasma total protein (g/dl)		Excreta dry matter (%)	
	93 days	114 days	93 days	114 days
Control	3.42±0.281	3.24±0.188	34.04±3.867	35.43±3.408
Tannin	3.22±0.188	3.27±0.269	34.50±4.168	39.34±4.513

The faecal examination highlighted a different parasitic resistance for both groups, resulting the tannin group free from the presence of helminths. This aspect agrees with the observation of a direct anthelmintic activity of Quebracho tannin, as observed in small ruminants (Butter *et al.* 2000; Athanasiadou *et al.* 2000). Thus, this compound could be usefully employed in animal husbandry, because of the positive effect on the healthy status of animals.

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