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Effect of early experience and adaptation period on voluntary intake, digestion, and growth in Barbarine lambs given tannin-containing (*Acacia cyanophylla* Lindl. foliage) or tannin-free (oaten hay) diets☆

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Abstract

Our objective was to determine whether experience early in life and adaptation time (up to 72 days) to tannin-rich diets affect feed intake, digestion, nitrogen balance, and growth in Barbarine lambs given tannin-containing (*Acacia cyanophylla* Lindl., acacia) or tannin-free (oaten hay) diets later in life. Twelve experienced lambs (live-weight, LW: 13.2 ± 2.0 kg) were divided into two equal groups. Each group received air-dried acacia (tannin-containing diet) or oaten hay (hay, tannin free-diet) ad libitum. Twelve other inexperienced lambs (LW 12.3 ± 2.5 kg) were also divided into two equal groups. Each group received one of the above two diets. All animals were 4 months old at the start of this experiment and were supplemented with 300 g concentrate. To investigate the carry-

Abbreviations: CP, crude protein; CT, extractable condensed tannins; DM, dry matter; DOMI, digestible organic matter intake; DCPI, digestible crude protein intake; LW, live weight; N, nitrogen; NDFom, neutral detergent fibre exclusive of residual ash; OM, organic matter; TP, total extractable phenols; TT, total extractable tannins; $W^{0.75}$, metabolic weight

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over effect of tannins, the acacia-diet was removed on day 73, thus all lambs received thereafter the hay-diet for a further 24 days before starting a 6-day faecal collection period. Irrespective to early experience and adaptation time, the nutritive value of hay-diet was higher than that of acacia-diet and consequently lambs given hay performed better than those receiving acacia ($P = 0.0001$). Animals exposed to tannins early in life exhibited higher digestible crude protein intake ($P = 0.0389$), retained more N ($P = 0.0963$) and excreted more allantoin in urine ($P = 0.0248$) than the inexperienced lambs. Except plasma urea ($P = 0.2923$), the adaptation period to experimental diets affected significantly all measured parameters ($P = 0.0001$). Animals adapted to diets for only 6 days exhibited the lowest acacia or hay intake and the highest diet digestibility compared to those adapted to these diets for 24, 48 or 72 days. Weight losses of inexperienced lambs adapted to acacia-diet for 6 days were associated with negative nitrogen balance. Sheep which received the acacia-diet, followed by the hay diet, had similar hay intake, diet digestibility, N balance and growth rate as compared to those offered the hay diet since the commencement of this experiment. It is concluded that the decreased performance of lambs when fed acacia leaves is due to its high lignin and tannin concentrations. The performance of inexperienced lambs were similar ($P > 0.05$) to the experienced lambs when adapted to diets for at least 24 days. Acacia tannins had no carry-over effect.

Keywords: *Acacia cyanophylla* tannins; Early experience; Adaptation; Intake; Digestion; Growth; Sheep

1. Introduction

Fibrous feedstuffs, mainly cereal straws and stubbles and some grass hays (e.g. oaten, barley, etc.) are the main roughages given to sheep in dry environments in Tunisia. In addition, the integration of fodder shrubs (e.g. *Acacia cyanophylla*, cactus pads, etc.) into the feeding calendars for ruminants has become a familiar practice in arid and semi-arid zones. However, most of these feed sources have a low nutritive value because they are low in available nutrients, especially energy and nitrogen. Therefore, supplementation is necessary. While the low nutritive value of numerous feedstuffs is often ascribed to the low content of digestible nutrients (soluble carbohydrates, nitrogen, etc.) or to the high content of indigestible components like lignin, contemporary research has demonstrated that some secondary compounds (tannins, oxalates, saponins, etc.) present in a wide range of forage species hamper the utilisation of carbohydrates, nitrogen and several minerals by rumen microflora and may also cause direct intoxication of animals (D'Mello, 2000). Decreased performance of sheep and goats, consuming diets rich in these anti-nutritional factors has been reported by many authors (Silanikove et al., 1996; Degen et al., 1998; Decandia et al., 2000). The potential use of tanniniferous shrubs in livestock feeding was thoroughly investigated and some recent reviews have discussed the negative and positive effects of tannins on ruminant nutrition and performance (Makkar, 2003a; Min et al., 2003). Ruminants exposed to tannins-rich diets for a long time seem to develop different adaptation mechanisms to overcome deleterious effects of these secondary compounds. Several animal species (e.g. rats, mice and deer) adapt to high tannin diets by producing unique salivary proline-rich proteins. However, sheep and goats do not possess this ability (McArthur et al., 1995). A specific rumen bacterium (*Streptococcus caprinus*), able to grow in the presence of high levels of condensed and hydrolysable tannins, was isolated in goats by Brooker et al.