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Effects of the dose and the administration form of rosemary essential oils on carcass characteristics of lambs

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Abstract. The aim of this experiment was to study the effects of the dose and the administration form of rosemary (*Rosmarinus officinalis* L.) essential oils on lambs' carcass characteristics and meat composition. Thirty two Barbarine lambs were allotted to 4 homogeneous groups and fed oat-hay *ad libitum* with 500 g of concentrate. Rosemary essential oils (REO) were orally administrated at a dose of 0.3 and 0.6 ml/day to lambs in O-R1 and O-R2 groups, respectively. Rosemary essential oils were mixed with the concentrate at an equivalent dose of 0.3 ml /day for the Mix-R1 group, while the control group (C) did not receive REO. The administration of REO affected hot carcass weight and, consequently, commercial dressing percentage ($P < 0.05$) being higher for the Mix-R1 group (48 %). The administration of REO slightly ameliorated testicles weight (111 vs. 105 g for REO and C groups, respectively; $P?$). The administration of 0.3 ml /day of rosemary essential oils may have an important effect on carcass characteristics and meat composition.

Keywords. Rosemary – Lambs – Carcass – Meat.

Effets de la dose et de la forme d'administration d'huiles essentielles de romarin sur les caractéristiques des carcasses d'agneaux

Résumé. La finalité de cette expérimentation était d'étudier les effets de la dose et de la forme d'administration d'huiles essentielles de romarin (*Rosmarinus officinalis* L.) sur les caractéristiques des carcasses d'agneaux et la composition de la viande. Trente-deux ovins de race Barbarine ont été répartis en lots formant 4 groupes homogènes alimentés de foin d'avoine à volonté avec 500 g de concentré. Les huiles essentielles de romarin (REO) étaient administrées oralement à une dose de 0,3 et 0,6 ml/jour aux agneaux des groupes O-R1 et O-R2, respectivement. Les huiles essentielles de romarin étaient mélangées avec le concentré à une dose équivalente à 0,3 ml/jour pour le groupe Mix-R1, tandis que le groupe témoin (C) ne recevait pas de REO. L'administration de REO affectait le poids à chaud de la carcasse et, par conséquent, le pourcentage de rendement commercial de la carcasse ($P < 0.05$) était plus élevé pour le groupe Mix-R1 (48 %). L'administration de REO améliorait légèrement le poids testiculaire (111 vs. 105 g pour les groupes REO et C, respectivement; $P?$). L'administration de 0,3 ml/jour de REO pourrait avoir un important effet sur les caractéristiques de la carcasse et la composition de la viande.

Mots-clés. Romarin – Agneaux – Carcasse – Viande.

I – Introduction

Front consumer's increasing demand for healthy and ecological meat products makes the investigation about the possibility of manipulating meat quality through dietary strategies needed. Plant secondary compounds can exert antioxidant activity due to the content of phenolic diterpenes (Aruoma *et al.*, 1996). Previous studies demonstrated that rosemary essential oils (REO) can be used as a dietary supplement to improve meat quality and oxidative stability (Nieto *et al.*, 2010; O'Grady *et al.*, 2006; Smeti *et al.*, 2013), although information about the adequate form and dose of REO and their effects on meat composition and carcass characteristics are scarce. On this basis, we were interested in evaluating whether the dose rates and administration form of rosemary (*Rosmarinus officinalis* L.) essential oils could affect lambs' carcass characteristics and meat quality.

II – Material and methods

1. Animals and diets

The experiment was carried out in the National Institute of Agricultural Research of Tunisia (INRAT) and lasted 100 days. The experiment started with a total of 32 Barbarine lambs (32 + 3 kg of BW). Animals were ranked by weight and allotted to 4 homogeneous groups, and received oat-hay *ad libitum* supplemented with 500 g of concentrate. The REO was orally administered at a dose of 0.3 and 0.6 ml/day to lambs in O-R1 and O-R2 groups, respectively. It was mixed with the concentrate at an equivalent dose of 0.3 ml /day for the Mix-R1 group, while the control group (C) did not receive REO. When reaching 39 + 3 kg of weight, animals were slaughtered after an overnight period without feed but free access to water.

2. Measurements and analysis

Body weight at slaughter (SBW) was recorded. Skin, feet, head, red cut-down (liver, kidneys, spleen, and heart), all fractions of the digestive tract, and the hot carcass (HCW) were weighed. Samples of *Longissimus dorsi* were dried (50 °C), ground (1 mm screen), and stored for subsequent analyses. Dry matter was determined by drying at 80 °C until constant weight. Mineral content was determined by ashing at 600 °C for 8 h. Nitrogen was determined by Kjeldahl method (Crude protein = N×6.25). Meat ether extract was determined by Soxhlet extraction.

3. Statistical analysis

A one-way ANOVA (PROCGLM of SAS (2002)) was used to test the effect of REO incorporation on meat chemical composition, and carcass. The following model was used: $Y = \mu + Di + e$; Y: variable; μ : mean; Di: Diet effect; e: standard residual error. The level of significance was set at 0.05. The following contrasts were used: Contrast 1: Effects of rosemary incorporation form [Mix-R1 group vs. O-R1 + O-R2 groups]; Contrast 2: Effects of rosemary dose [O-R1 vs. O-R2 group]; Contrast 3: Effects of rosemary presence [C vs. O-R1 + O-R2 + Mix-R1 groups].

III – Results and discussion

1. Meat chemical composition

Feeding lambs with REO did not affect ($P > 0.05$) the moisture, protein, ash and fat content of Barbarine lambs' meat (Table 1). These results are in agreement with recent studies of Smeti *et al.* (2013 a) who did not find significant effects of the REO on the meat chemical composition of lambs from the same breed. Similarly, no significant changes in the chemical characteristics of the muscles (moisture, protein, fat, ash) were found between dietary treatments when lambs of different groups were slaughtered at similar BW (Atti and Mahouachi, 2009), which was the case for the current study.

Table 1. Chemical composition of meat

Group	C	Mix-R1	O-R1	O-R2	S.E.M	P	Cst 1	Cst 2	Cst 3
Moisture (g/kg)	73.3	73.9	74.9	74.6	0.97	NS	NS	NS	NS
Protein (g/kg dry matter-DM)	77.7	77.3	77.2	78.1	2.68	NS	NS	NS	NS
Ash (g/kg DM)	4.4	4.4	4.5	4.6	0.01	NS	NS	NS	NS
Fat (g/kg DM)	17.9	18.2	18.3	17.3	2.68	NS	NS	NS	NS

C: control ; Mix-R1 : 0.3 ml/d REO (rosemary essential oils) administered mixed with concentrate ; O-R1: 0.3 ml/d REO administered orally ; and O-R2: 0.6 ml/d REO administered orally. S.E.M: standard error of the mean; NS, $P > 0.05$; Cst 1: Mix-R1 vs. O-R1 + O-R2; Cst 2: O-R1 vs. O-R2; Cst 3: C vs. O-R1 + O-R2 + Mix-R1.

2. Slaughter parameters and non- carcass components

Rosemary administration affected HCW and CDP (commercial dressing percentage) (Table 2: $P < 0.05$). Both values were higher for the Mix-R1 group (19.4 kg and 48 %, respectively). These differences could be related to the numerical difference in SBW (Atti and Khaldi, 1988; Atti *et al.*, 2003), which was higher for lambs from the Mix-R1 group (40.2 kg).

However, no significant differences between groups were recorded for the weight of the different red cut-down (Table 2).

Table 2. Effects of rosemary administration on lambs' slaughter parameters and non-carcass components

	C	Mix-R1	O-R1	O-R2	S.E.M	P	Cst 1	Cst 2	Cst 3
SBW (kg)	39.3	40.2	38.7	39.1	1.20	NS	NS	NS	NS
HCW (kg)	17.8	19.4	17.2	17.4	0.55	*	0.45	NS	**
CDP (%)	45.5	48.2	44.3	44.5	0.76	**	NS	NS	***
Red cut-down (g)	1248	1284	1279	1272	40.3	NS	NS	NS	NS
Testicles (g)	105	108	118	106	9.2	NS	NS	NS	NS

S.E.M: standard error of the mean; NS, $P > 0.05$; *, $P < 0.05$; ** < 0.01 ; Cst 1: Mix-R1 vs. O-R1+O-R2; Cst 2: O-R1 vs. O-R2; Cst 3: C vs. O-R1 + O-R2 + Mix-R1; SBW, slaughter body weight; HWC, hot carcass weight; CDP, commercial dressing percentage.

IV – Conclusion

The administration of 0.3 ml /day of rosemary essential oils may have an important interest on carcass parameters of Barbarine lambs.

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