Effects of phytoterapic diet supplementation on carcass traits and meat quality of *Blonde d'Aquitaine* bulls

Tassone S., Fortina R., Cornale P., Battaglini L.M. and Barbera S.

Dipartimento di Scienze Zootecniche, Università degli Studi di Torino, Italy

Abstract— **An herbal complex consisting of *Melissa officinalis* L. and *Hypericum perforatum* L. was studied to investigate its effects on carcass characteristics and meat quality of *Blonde d'Aquitaine* bulls. 20 finishing bulls (average LW=556.5±11.80 kg), were equally divided, into 2 groups and fed 60 days a finishing diet without or with 50 g head^{-1} day^{-1} of the phytoterapic mixture. No statistical differences were observed on carcass traits. Both groups showed low pH_{45} values, indicating a proper management before slaughtering; values were lower in treated group (6.24 *vs* 6.39, P=0.07). The meat maintained a good quality without sensory traits alteration. The only improving effect of phytoterapic was on margaric acid, lower in treated group (0.61% *vs* 1.13%, P=0.04). Although the phytoterapic mixture did not interfere negatively on meat quality, no significant improvement on beef carcass traits were observed; therefore, under the same conditions of the trial, the use of this mixture would not seem justified.**

Keywords— **phytoterapic, carcass traits, beef quality**

I. INTRODUCTION

In the last years, the demand for meat products free from chemical residues, as well as the public concern over the routine use of feed antibiotics and growth promoters in livestock production has increased [1]. Nowadays, there is a great interest in using plants and plant extracts as alternative to antibiotics, to manipulate rumen fermentation, and to improve feed efficiency [2] [3] and meat characteristics [4][5].

This interest has further increased with the introduction of recent legislation [6] within the European Union, that prohibits the use of growth-promoting antibiotics in animal feeds, as responsible of transmissible resistance factors that may compromise the therapeutic use of antibiotic in humans [7].

A wide variety of beneficial secondary compounds are produced by plants [8], but at the same time some are toxic to animals or could have undesired effects [9]. The practical use of plant extracts as feed additives for ruminants is limited; quality and quantity of the active compound are extremely variable and difficult to standardise. Vegetative stage, part of the plant used, environmental conditions and cultivar influence secondary metabolites production. Some of the bioactive compounds are antioxidant, but their property can be lost during storage [9]. The dosage depends on the whole chemical composition of the plant preparation, since there can be additive, synergetic, and antagonistic effects among bioactive compounds in a complex mixture of secondary metabolites [10][11].

Even if some herbs have been extensively studied [12], little information is available concerning secondary effect of plant extracts on meat quality. Some phytoterapic products are known and used for their immediate and direct effect, but their influence on animal products is rarely under control. In this study we investigated the indirect effects of essential oils contained in and herbal complex including *Melissa officinalis* L. and *Hypericum perforatum* L.. *Melissa officinalis* essential oil contains eugenol, which mills bacteria and has been shown to calm muscles and numb tissues. It also contains tannins that contribute to antiviral effects [13], as well as terpenes, that add soothing effects. *Melissa officinalis* extract was identified as a potent inhibitor of GABA transaminasi due to the rosmarinic acid, which explains the anxiolytic effects. It was also found to have exceptionally high antioxidant activity [14].

Hypericum contains different polyphenols flavonoids, phenolic acids, naphtodianthrones, and phloroglucinols. It is widely used as herbal treatment against depression, but also as an anti-flammatory, astringent and antiseptic.

A commercial product (Taurus®) containing a mixture of these components is widely used in finishing beef to relax animals, to improve nutrients absorption, and to reduce ulcers and colics.

Aim of this study was to evaluate the indirect effects of this commercial product on carcass and meat characteristics of beef.

II. MATERIALS AND METHODS

A. Animals and diets

Twenty Blonde d'Aquitaine bulls (average live weight: 556.5±11.80 kg; age 467±66.6: days) were randomly assigned to two homogeneous groups (control: C; experimental: E). During 60 days *ante mortem,* animals of the C group were fed *ad libitum* a basal diet (BD) (CP 14.6%; SolP 24.1% of CP; DIP 43.5% of CP; NDF 35.3%; EE 3%). The E group diet was supplemented with 50 g $head^{-1}$ day^{-1} of Taurus® herbal complex.

B. Carcass traits

Slaughtering occurred in wintertime following standard handling procedures. Hot carcass weight (HCW) was registered. Temperature and pH of *longissimus thoracis* muscle between the 12^{th} and 13^{th} rib were measured at 45 minutes (T_{45}, pH_{45}), using a Crison 52-32 pHmeter. Measurements of pH and temperature were repeated on meat samples after 3 days (pH_3, T_3).

Carcasses were graded and fatness scored using the European Grading System.

C. Meat characteristics

Meat samples of M. *longissimus thoracis et lumborum* (between T9 and L1) were removed from the right side of the carcass 48 hours post-mortem and chilled at 4°C for 7 days. After storage, meat samples were analysed. Colour was measured using a Minolta Chromameter Reflectance II CR200/08 and the CIE L*a*b* color space coordinates were recorded [15]. Chroma and Hue were calculated ($Chroma=\sqrt{a^{*2}+ b^{*2}}$; $Hue=arctg\ b^*/a^*$). Shear force was measured on oven cooked samples (internal temperature: 70°C) using an Instron 1011 with a Warner Bratzler (WBSF) [16]. Drip Loss (DL) was measured as weight loss of raw meat after 48 hours at 4°C [17]. The Cooking Loss (CL) was expressed as ratio (%) between the cooked meat and the raw meat weight. Meat Cooking Shrinkage (MCS) was calculated as difference between the raw and cooked areas of the meat sample, expressed as percentage of the raw area [18]. MCS protocol allows measuring water loss caused by cooking (CLmcs) [18]. Meat samples were analysed for their fatty acid profile (Shimadzu GC 17-A with a J&W DB-WAX capillary column, 60 m, 0.53 mm i.d., FID on FAMEs samples) [19]. Sensory analysis was carried out on 2 cm-thick steaks cooked in oven at 165°C until the internal temperature reached 70°C. A panel of six people trained according to ISO 8586-1, scored the meat samples on a 8-points scale (1, minimum; 8 maximum) for the following parameters: appearance of raw steak, tenderness and juiciness, overall acceptability of steak.

Due to the significant difference in the initial age (IA) of animals between groups C and E, a one-way analysis of covariance (with IA as covariate and E group as independent variable) was performed. According to the results, the data were analysed using a simple one-way analysis of variance design with the two diets as a fixed factor (SAS 9.02).

III. RESULTS AND DISCUSSION

No statistical differences were observed on carcass traits (Table 1). Hot carcass weight, conformation and fatness score (5 and 2 for both groups, respectively) were not affected by the supplementation. Both groups showed low pH_{45} values, indicating a proper management before slaughtering. Lower values observed in the E group (6.24 *vs* 6.39; P=0.07) could be due to the relaxing effect of the herbal mixture.

No significant effect of phytoterapic was observed on meat characteristics (Table 1).

Colour values responded to the actual consumers demand, as confirmed by the panel test (appearance score: 6.1). No indirect influence of diet supplementation on meat colour was observed. Antioxidant activity of *Melissa officinalis* L. seems to have no effect on haemoglobin oxidation and on the activation of mechanisms that modify pigment

distribution in animal tissue, as previously observed in other dietary herbal supplementation studies [20].

Shear force values did not reflect antistress properties of herbal complex. Shear force is significantly related to temperament [21], implying that calmer animals had lower WBSF values. The pH_{45} of E group was not sufficiently low to influence shear force.

Taurus® had no effect on proteolysis mechanisms and no effect on the resulting muscle cell shrinkage and mobilization of water to the extracellular space. For this reason no differences were found in water holding capacity and meat cooking shrinkage. Values of drip and cooking losses, meat cooking shrinkage and CL by MCS were in the normal range for beef [22].

Fatty acid profiles of the samples are shown in Table 2. Obtained results indicate that Taurus® had no effect on meat fatty acid composition, except for margaric acid (C17:0) that was lower in E group (0.61% vs 1.13%, P=0.04).

Results from instrumental analysis were confirmed by sensory analysis, as shown in Figure 1.

Table 2 Meat fatty acid composition (%)

	C	E	MSE	P-value
C14:0	2.28	2.30	0.176	NS
C14:1	0.50	0.45	0.080	NS
C15:0	0.60	0.51	0.029	NS
C15:1	1.12	1.07	0.204	NS
C16:0	27.41	26.70	1.294	NS
C16:1	2.78	2.67	0.183	NS
C17:0	1.13	0.61	0.176	0.037
C17:1	0.70	0.71	0.037	NS
C18:0	20.61	22.28	4.881	NS
C18:1	32.67	32.42	10.602	NS
C18:2n6	9.33	9.36	14.493	NS
C18:3n3	0.10	0.09	0.000	NS
CLA10*t*12*c*	0.32	0.38	0.012	NS
CLA9*c*11*t*	0.44	0.45	0.020	NS
∑CLA	0.76	0.83	0.054	NS
n3/n6	0.01	0.01	0.000	NS
∑SFA	52.03	52.40	9.701	NS
∑MUFA	37.77	37.33	12.179	NS
∑PUFA	10.19	10.28	14.140	NS
SFA/UFA	1.10	1.10	0.019	NS

Table 1 Meat characteristics

	C	E	MSE	P-value
HCW, k	421.3	423.9	1029.18	NS
pH_{45}	6.39	6.24	0.033	0.072
T_{45},°C	39.0	38.7	0.26	NS
pH_3	5.50	5.51	0.004	NS
T_3, °C	3.65	4.48	0.766	0.048
L*	44.82	46.63	34.906	NS
a*	23.62	23.08	3.272	NS
b*	7.98	7.52	4.011	NS
Chroma	24.96	24.37	3.778	NS
Hue	0.32	0.31	0.006	NS
WBSF, N	62.4	58.5	131.93	NS
DL ,%	2.44	3.25	3.294	NS
CL, %	21.32	20.47	24.882	NS
MCS, %	19.82	18.88	11.217	NS
CLmcs, %	25.42	25.66	16.086	NS

IV. CONCLUSIONS

The results of this trial suggest that the Taurus® herbal complex containing Melissa officinalis L. and Hypericum perforatum L. fed to improve nutrients absorption and animals relax of finishing bulls does not negatively interfere on meat quality.

However, we did not find any significant improvement on carcass traits. Therefore, the use of this mixture under the trial conditions is not justified

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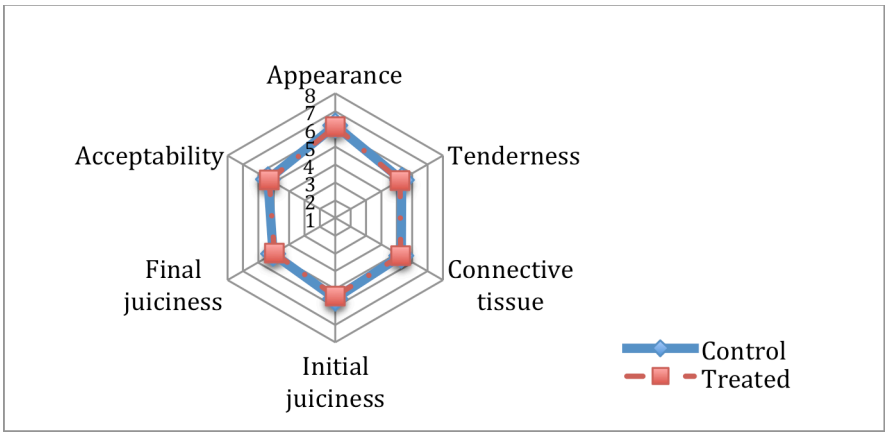

Fig. 1 Panel test

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