KRMIVA

INFLUENCE OF DIETARY VITAMIN E SUPPLEMENTATION ON CARCASS AND MEAT CHARACTERISTICS IN CATTLE

UTJECAJ DODAVANJA VITAMINA E U HRANIDBI GOVEDA NA ZNAČAJKE POLOVICA I MESA

Žgur, S., K. Salobir

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SUMMARY

Brown bulls (20 animals) were divided into four groups, five animals in each. The control group received maize and grass silage ad libidum and concentrates. Experimental groups received the same ration, only that concentrates were supplemented with alpha tocopheryl acetate to provide additional 3000 mg tocopheryl acetate per animal and day for 4 weeks (E4), 6 weeks (E6) and 8 weeks (E8) before slaughter. 24 hours after slaughter pH and meat colour were recorded on the cross section of longissimus muscle between the 7^{th} and 8^{th} rib and then right carcass halves were dissected into lean, fat, tendon and bone. The average live weight at slaughter was 582 kg at 602 days of age. The average daily gain in last 8 weeks before slaughter was 981 g/day. Dietary supplementation with vitamin E did not influence daily gain, dressing percentage, carcass conformation, fat cover, tissue percentage of carcasses, pH values and meat colour, but extended colour display life for one day.

INTRODUCTION

Vitamin E is a natural antioxidant, that plays an important role against free-radical injury. So Vitamin E deficiency coupled with selenium deficiency causes nutritional miopathy (McDowal, 1989). Its deficiency causes disturbance in hearth and muscle growth (Forenbacher et al., 1975), fertility and immunity (McDowal, 1989, Granz et al., 1990). Green plants contain relatively large amounts of vitamin E, so that ruminants seldom suffer vitamin E deficiency. Hill et al., 1990 found that vitamin E supplementation improved daily gain, food conversion and reduced occurrence of liver abscesses in finishing steers. Arnold et al., 1992 reported that vitamin E supplementation did not influence growth and carcass characteristics, and tended to lower dressing percentage. The surplus of vitamin E accumulates in different tissues and serves as a reserve. The concentration of vitamin E in muscle tissue can increase by 1.5 to 5 folds, depending on the quantity of vitamin E fed and the duration of supplementation (Arnold et al., 1993; Hidiroglou et al., 1988; Mitsumoto et al., 1993). Meat colour greatly depends on the quantity of myoglobin and its chemical form. Vitamin E influences deoxyimyoglobin stability and meat colour. A bright cherry red colour is extended due to prevention of oxidation of deoxymyoglobin to metmyoglobin (Arnold et al., 1992, 1993; Chan et al., 1995; Faustman et al., 1989a, 1989b; Mitsumoto et al., 1993; Schaefer et al., 1995; Sherbeck et al., 1995).

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Doc. dr. Silvester Žgur, Prof. dr. Karl Salobir, University of Ljubljana, Biotechical faculty, Zootehnical department, 1230 Domžale, Slovenia.

The aim of this work was to investigate the influence of vitamin E supplementation on growth, carcass and meat characteristics of brown bulls.

MATERIALS AND METHODS

Brown bulls (20 animals) were divided into four groups five animals in each. The control group received maize and grass silage ad libidum and concentrates. Experimental groups received the same ration, only that concentrates were supplemented with alpha tocopheryl acetate to provide additional 3000 mg tocopheryl acetate per animal and day for 4 weeks (E4), 6 weeks (E6) and 8 weeks (E8) before slaughter. Bulls were slaughtered in a commercial slaughterhouse. 24 hours after slaughter pH and meat colour were recorded on the cross section of longissimus muscle between the 7^{th} and 8^{th} rib and then right carcass halves were dissected into lean, fat, tendon and bone. Colour stability was followed on longissimus (3X4X1 cm) which were over-wrapped with oxygen-permeable fresh meat film and stored at temperature of 4°C. The colour was measured with Minolta CR 300 as tristimulus the colour coordinates (L, a*, b*) on three different places. Three bulls exhibited higher pH than 5.8 and were excluded from colour stability analysis.

Data on growth, carcass characteristics and meat traits taken 24 after slaughter were analysed by analysis of variance using the ANOVA procedure of SAS (1989). The Scheffe multiple-range test was used to determine the differences between means of experimental groups. The Changing of a* values during ageing was analysed by analysis of variance using the GLM procedure of SAS (1989). Differences between groups were tested with linear contrasts for significance.

RESULTS AND DISCUSSION

In Table 1 we can see that the age and live weight at the beginning and at the end of the experiment were similar. Bulls that were fed on supplementation of vitamin E (E4, E6 and E8) had higher daily gains than bulls in the control group (E0), but the differences were not statistically significant. Arnold et al., 1992 did not find any differences in growth of cattle supplemented with 300 IU for 266 days, 1140 IU for 67 days or 1200 IU vitamin E for 38 days, while Hill et al., 1990 reported higher daily gain for steers that received diet supplemented with 95 IE vitamin E per kg diet for 126 or 133days.

Table 1: Age and live weight at the beginning and at the end of the trial and daily gains of Brown bulls
Tablica 1. Dob i živa vaga na početku i na kraju pokusa te dnevni prirast bikova Brown

	$\bar{x}$ ± SD			
	Control Kontrola	Vitamin E treatment Postupak s vitaminom E		
	E0	E4	E6	E8
Age at the beginning of the trial, days Starost na početku pokusa, dana	527 ±39	546 ±46	502 ±30	561 ±27
Live weight at the beginning of the trial, kg Živa vaga na početku pokusa, kg	526,0 ±20,5	503,8 ±25,2	507,4 ±28,6	522,8 ±18,4
Age at the end of the trial, days Starost na kraju pokusa, dana	595 ±39	614 ±46	570 ±30	629 ±27
Live weight at the end of the trial, kg Živa vaga na kraju pokusa, kg	585,2 ±35,4	581,2 ±29,5	574,4 ±27,2	586,2 ±23,3
Daily gain, g/day Dnevni prirast, g/dan	870 ±336	1138 ±140	985 ±96	932 ±335

Carcass characteristics are displayed in Table 2. Bulls fed on vitamin E supplementation attained higher dressing percentage at the same live weight. The highest dressing percentage had E8 bulls followed by E6, E4 and E0 bulls. The differences between groups were not statistically significant for carcass conformation and fatness as well. Vitamin E supplementation did not influence the longissimus muscle area and tissue percentage in the carcasses either.

Table 2. Effect of vitamin E supplementation on carcass characteristics
Tablica 2. Djelovanja dodavanja vitamina E na značajke polovica

	$\bar{x}$ ± SD			
	Control Kontrola	Vitamin E treatment Postupak s vitaminom E		
	E0	E4	E6	E8
Dressing percentage, % Postotak randmana	55,1 ±1,5	55,3 ±2,4	56,3 ±1,6	56,7 ±0,8
Carcass weight, kg Težina trupla, kg	322,8 ±25,6	321,0 ±7,4	323,4 ±18,9	332,2 ±14,5
EUROP conformation* EUROP konformacija	2,6 ±0,9	2,8 ±0,4	2,8 ±0,4	3,0 ±0
EUROP fatness EUROP prekrivenost	2,6 ±0,5	2,6 ±0,5	3,0 ±0,0	3,0 ±0,0
Longissimus muscle area, cm^2 Površina longissimus mišića, cm^2	60,4 ±6,2	60,0 ±3,8	63,1 ±4,5	60,6 ±11,1
Lean, % Mršavo meso, %	68,9 ±2,8	67,5 ±3,3	66,8 ±3,2	68,6 ±2,2
Fat, % Masno tkivo, %	11,9 ±2,7	14,6 ±3,9	15,3 ±2,6	12,9 ±1,5
Tendon, % Tetiva, %	1,7 ±0,3	1,8 ±0,2	1,8 ±0,2	1,7 ±0,3
Bone, % Kost, %	17,3 ±1,2	16,1 ±0,9	16,1 ±1,4	16,6 ±1,2

* E=5, U=4, R=3, O=2, P=1

The greatest effect of vitamin E supplementation was expected on meat traits, specially on meat colour and its stability. In Table 3 meat traits measured 24 hours after slaughter are presented. There were no statistically significant differences between different groups. Arnold et al., 1992 and Mitsumoto et al., 1991, 1993 found no differences in meat colour soon after slaughter.

In Figure 1 changing of meat colour in during ageing is presented. CIE a* value for E0 bulls decreased slowly until day 13 after slaughter and then fell abruptly. In other three groups CIE a* values decreased slower, and in groups E4 and E8 did not fall abruptly until days 14. The differences between E0 and E4 were significant ($p<0.05$) from 5 to 14 days and between E0 and E8 from 5 to 15 days. The differences between E0 and E6 were significant ($p<0.05$) only on day 8 and 9. On day 16 there were no significant differences between different groups. Liu et al., 1996 found a quadratic regression between vitamin E content and colour stability. Higher vitamin E content meant also longer colour stability in muscle *longissimus lumborum*.

Table 3: Effect of vitamin E supplementation on meat traits

Tablica 3. Učinak dodavanja vitamina E na svojstva mesa

	$\bar{x}$ ± SD			
	Control Kontrola	Vitamin E treatment Postupak s vitaminom E		
	E0	E4	E6	E8
pH 24	5,38 ±0,06	5,32 ±0,07	5,60 ±0,37	5,64 ±0,62
CIE L*	36,09 ±1,65	39,19 ±2,14	34,36 ±3,10	34,46 ±2,93
A*	22,92 ±2,91	24,24 ±2,73	22,92 ±3,99	22,50 ±6,10
B*	11,40 ±1,70	12,88 ±1,69	10,75 ±2,96	10,37 ±3,61

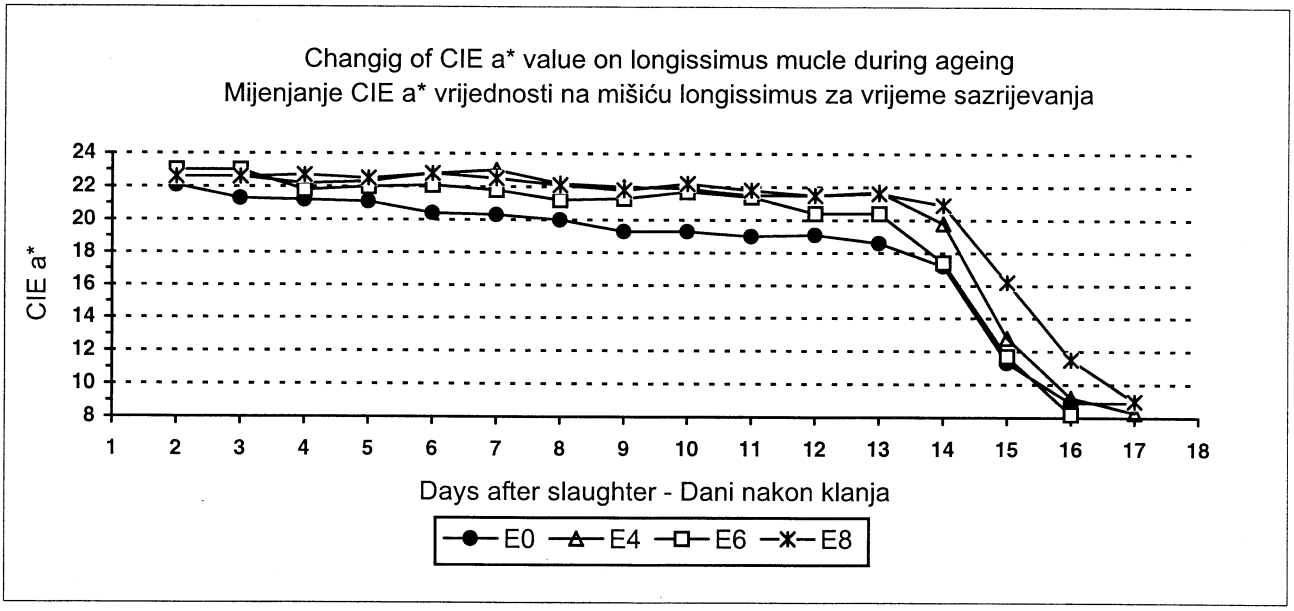
Arnold et al., 1992 reported that 300 IU Vitamin-E per day 266 days, 1140 IU/day 67 days or 1200 IU/day 38 days extended colour stability in *muscle longissimus lumborum* of steers by 2.5 to 4.8 days and in *gluteus medius* by 1.6 to 3.8 days. Extended colour display life was also reported by other authors (Arnold et al., 1992, 1993; Chan et al. 1995; Faustman et al., 1989a, 1989b; Mitsumoto et al., 1993; Schaefer et al., 1995; Sherbeck et al., 1995). In our experiment vitamin E supplementation extended colour stability. The undesirable brown colour developed one day later in E4 and E8 groups.

CONCLUSIONS

Vitamin E supplementation had no effects on growth, carcass characteristics and meat traits measured 24 hours after slaughter, but extended colour display life by one day.

Figure 1: Means for CIE a* value on longissimus muscle during ageing

Slika 1. Promjene CIE a* vrijednosti na mišiću longissimus dorsi u vrijeme sazrijevanja



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SAŽETAK

Smeđi bikovi (20 životinja) bili su podijeljeni u četiri skupine po pet životinja. Kontrolna je skupina dobivala silažu kukuruza i trave ad libitum te koncentrate. Pokusne skupine dobivale su iste obroke samo je koncentratima dodavan alfa tokoferil acetat da bi se osiguralo dodatnih 3000 mg tokoferil acetata po životinji i danu, tijekom 4 tjedna (E 4), 6 tjedana (E6) i 8 tjedana (E8) prije klanja. Dvadeset i četiri sata nakon klanja zabilježeni su pH i boja mesa na presjeku misića longissimusa između 7. i 8. rebra, a zatim su desne polovice secirane u mršavo meso, masno tkivo, tetive i kost. Prosječna živa vaga kod klanja bila je 582 kg sa 602. dana starosti. Prosječni dnevni prirast u zadnjih 8 tjedana prije klanja bio je 981 g/dan. Dodatak vitamina E u hranu nije djelovao na dnevni prirast, postotak randmana, konformaciju trupa, sloj masnog tkiva, postotak tkiva u polovicama, vrijednost pH i FOP, te boju mesa, ali je produžio postojanost boje za jedan dan.

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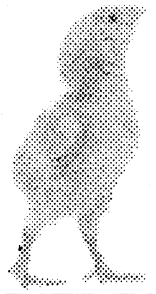

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