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THE ROLE OF GRASS FEEDING IN IMPROVING OXIDATIVE STABILITY AND INCREASING VITAMIN B_{12} CONTENT OF BEEF AND VEAL

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Abstract

The objective of this study was to investigate the influence of grass feeding of cattle on the decontamination capacity against free radical (DCAFR) and vitamin B_{12} content of beef and veal. The meat samples from intensively (26 cattle, final weight 485±9 kg, concentrate feeding) and ecologically (25 heifers, final weight 472±32 kg, and 28 calves, final weight 260±24 kg, pasture grazing) managed cattle groups were investigated. The DCAFR was colorimetric assessed by examining damage to 1.4 benzoquinone. Vitamin B_{12} was analyzed by high performance liquid chromatography. Data indicate that the oxidative stability of meat samples from ecological management were significant ($p< 0.05$) higher (1.39 µg/ ml sec) compared to samples from intensive management (1.09 µg/ ml sec). Meat from pasture grazed animals proves to be an especially good source of vitamin B_{12}, which was present in the high amount in beef (3.24 µg/100g) and veal (3.32 µg/100g). This paper

establishes the importance of grass feeding at the levels of the relevant essential nutrients supplied by meat.

Keywords: Beef, veal, vitamin B_{12}, free radical, decontamination capacity

Introduction

In recent years awareness of the importance of food quality in human health has increased. The optimum of nutritional micro-environment (i.e. vitamins, minerals, trace elements, fatty and amino acids, enzymes, hormones, etc.) of every cell in the body is vital to achieve or restore optimal health; deficiencies in this environment cause the body to be more susceptible to disease and degeneration. Food safety, environmental quality, human health, and animal well-being are directly impacted by the ways farmers raise and grow food in modern agricultural systems.

Pasture is the source of most of the nutrients consumed by grazing livestock. This study was done to investigate the influence of cattle grass feeding on the qualitative characteristic of beef and veal meat in order to describe its nutritional values. The decontamination capacity of meat against free radical (DCAFR), as well as vitamin B_{12} contents was estimated.

Material and Methods

The samples of beef and veal (M. long. dorsi.) from two different cattle groups were investigated. The first group (G1, 26 heifers) was housed in an open shed on concrete slatted floors, allowing a space of 2.4 m^2 per animal. The cattle were raised on a total of 20 kg milk replacer per calf, a commercial calf starter, and some hay. The calves were 223±12 d old and had an average weight 276±11 kg at the start of the experiment. The diet consisted of

11.4MJ/kg DM of metabolizable energy and 13.4% of crude protein. The other cattle group (G2, 25 heifers and 28 calves) was managed according to the standards of ecological animal husbandry (Biopark e V standards). The heifers of G2 grazed on pasture until October and fed hay during the winter period. The calves of G2 were reared on mother milk and grazed with mothers. The slaughter data of cattle groups are presented in Table 1.

The DCAFR was colorimetric assessed by examining damage to 1.4 benzoquinone (pbc). The formation of hydroquinone (λ = 500 nm) was accompanied by an increase in the absorption of the solution. The difference in absorbance values in 60 sec. represented total antioxidants activity of investigated samples. The DCAFR was calculated using the extinction coefficient of 280.8 and expressed as µg/ ml sec.

Vitamin B_{12} was analyzed by high performance liquid chromatography (Professor Hellriegel Institut e. V., Bernburg).

Results

The administration of redox-indicator pbc and subsequent reaction with antioxidants resulted in the formation of chromogen hydroquinone with absorbance maxima 500 nm. The absorbance of the investigated samples increases with increased reductive capabilities of meat that point out the oxidative stability of meat.

Oxidative stability of the meat samples in G2 was significant ($P < 0.05$) higher (1.39 µg/ ml sec) compared to G1 (1.09 µg/ ml sec).

Vitamin B_{12} content of beef and veal samples from ecological livestock is shown in Table 2. Meat from grass grazed animals proves to be an especially good source of vitamin B_{12}, which was present in the high amount in beef and veal.

Discussion

Consumer perception is considered as the starting point for this paper since perception of health-related attributes constitutes an important dimension of the acceptability of food. Better perception possibly results in a better acceptability, a more favorable attitude, preference and increased consumption of the concerned product.

The recent study (Matthes et al, 1999, Pastushenko et al, 2000) demonstrated, that the fatty acid composition of concentrate-based and grass based diets are quite different and lead to different fatty acid compositions in tissue. Meat derived from pasture grazed ruminants is particularly valuable food in terms of PUFA supply to the diet and the balance between the n-6/n-3 PUFA. Its high concentrations of α-linolenic acid (C18: 3 n=3), eicosapentaenoic acid (C20: 5 n=3), docosahexaenoic acid (C22: 6 n=3) and conjugated linoleic acid (C18: 2 conj), low n-6/n-3 PUFA proportion as well as high PUFA/SFA proportion are especially notable as part of a healthy diet.

PUFA are the most important nutritional components in meat susceptible to oxidation. Sufficient oxidative stability makes it possible not only to avoid the negative effects of reactive oxygen species, but also affect the health of consumers favorably. Our study demonstrated, that protective mechanisms against reactive oxygen metabolites were significantly influenced by animal husbandry management and showed the positive impact of grass feeding.

The housing condition and dietary composition of bioactive substances probably reflect the immediate qualitative status of meat. Outdoor-housed animals from ecological farming have less negative stress influences than animals, housed in the barn. The stress of indoor-housed animals can probably contribute to the increasing of catecholamines issue. Catecholamines are normally enzymatic oxidized by monoamine oxidase resulting in the formation of hydrogen peroxide. Stress mediators can also reduce transition metals so that they can participate in Fenton or Haber-Weiss style reactions generating the reactive hydroxyl radical from hydrogen peroxide (Blake 1995). Oxidation manifests as a conversion of red muscle pigment myoglobin to brown metmyoglobin and the development of rancid odors and flavors from the degradation of the polyunsaturated fatty acids in the tissue membranes.

Numerous studies have shown the positive effect of dietary low molecular weight antioxidants on the oxidative stability of meat and meat products (Wood et al., 1997; Guidera et al., 1997). Harmonic composition and natural activity of grass antioxidants contribute the high antioxidant property of meat from the ecological livestock.

Vitamin B_{12} is needed for normal nerve cell activity, DNA replication, carbohydrate metabolism, myelin formation and controls homocystein levels, thus also modulating antioxidative-prooxidative balance. The present study demonstrates higher Vitamin B_{12} content in beef and veal from ecological production compared with those of standard values from Belitz et al. (1992) (1.3 μg/100g). Cobalt is required for the synthesis of Vitamin B_{12} in ruminants. The findings of this study are in agreement with those of Stangl et al (2000), which indicated a reduced Vitamin B_{12} status accompanied with cobalt deficiency of silage –based diet.

In conclusion, grass feeding increased the antioxidant status and vitamin B_{12} content of beef and veal.

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Table 1 - The slaughter data of cattle groups.

Slaughter data	G1	G2 (Heifers)	G2 (Calves)
Final weight, kg	485±9	472±32	260±24
Carcass weight, kg	263±6	260±18	147±15
Dressing, %	57.1±0. 44	56.7±1. 6	56.0±2. 0

Table 2 - Vitamin B_{12} content of ecological veal and beef

		Vitamin B_{12}, µg/100g	
	n	LSQ	SD
Veal	28	3.32	0.38
Beef	25	3.24	0.36