HEALTHY BEEF – THE EFFECT OF DIET ON THE FATTY ACID COMPOSITION OF BEEF FROM HUNGARIAN GREY AND HOLSTEIN-FRIESIAN YOUNG BULLS

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Introduction

According to current human dietary principles a reduction in the fat content of the diet and the modification of fatty acid composition of meat is recommended. The meat with "healthy" fatty acid composition contains a lower amount of saturated fatty acids; its maintenance of the myristic and palmitic acid content is low, the ratio of PUFA/SFA is higher than 0.45, the ratio of *n*-6/*n*-3 PUFA is lower than 5:1 and the fat contains a high amount of the conjugated linoleic acid (CLA) (Scollan *et al.*, 2001, Nuernberg *et al.*, 2005). It was demonstrated in cattle, that feeding concentrates enriched in *n*-3 fatty acids, increased the content of long chain *n*-3 PUFA in beef muscle (Nuernberg *et al.*, 2005). On the other hand, in several studies differences in fatty acid composition among cattle breeds under same feeding regimes were established (Nuernberg *et al.*, 1998). Consumers are not only concerned about meat quality and its healthiness, but also about its origin and how animals are reared. In the EU many local breeds are kept under traditional conditions and their meat is labelled for a quality guarantee. This gives the Hungarian old animal breeds (especially Hungarian Grey,) a greater opportunity. Knowledge of the meat quality of traditional animal breeds is needed for the effective product output. It is an important research target to examine and evaluate the nutritional value of meat for human health.

The aim of our fattening trial was to analyse the effect of extensive vs. intensive nutrition on beef quality and fatty acid composition from human nutritional point of view using Hungarian Grey (HG) cattle bulls in comparison to Holstein-Friesian (HF) bulls.

Materials and Methods

HG and HF growing-finishing bulls were fed rations consisting of either grass, grass silage and concentrate or maize silage and concentrate with and without linseed supplementation according to a 2 x 2 factorial experimental design in four groups. Ten animals were assigned per group into the above treatments. In the extensive and intensive groups days on feed lasted for 221 and 201, respectively. There were no significant differences among groups in the initial live weight. The nutrient content of different feedstuffs can be seen in Table *1*. Concentrates for extensive groups were supplemented 20 % linseed meal containing 44.77 % linolenic acid fed in the last month of growing-finishing period. Average final weights were actually identical in all groups (512.4±58.4 kg). The animals were slaughtered and the left half carcasses were dissected according to DLG method. After a 24hr chilling *longissimus* (LD) samples were taken from the left carcasses. The fatty acid composition of samples was determined according to method described by Nuernberg *et al.*, (2002). Data processing was performed using SAS program package.

Table 1: Chemical composition of feed.

%	intensive			extensive		
	Maize silage	Hay	Concentrate	Grass silage	Grass	Concentrate with linseed
Dry matter	36.4	91.4	88.0	23.3	23.6	90.8
Crude protein	3.2	7.0	16.4	2.3	2.8	18.0
Crude fat	0.9	1.7	2.0	0.9	0.6	4.3
Crude fibre	7.0	35.9	13.0	8.8	6.6	9.4

Results and Discussion

Higher final weights were recorded for the intensively fed bulls at the end of fattening (i:555.00±35.62 kg, e:469.75±44.03 kg), with differences between breeds not significant (HG:506.35±67.01 kg, HF:518.40±49.66 kg).

The extensive feeding resulted as less fat deposition and more lean into their carcass, on the other hand the HG bulls had more lean meat content in both feeding groups, than the HF (HG:69.41+2.26 %, HF:66.62+2.44 %, P<0.001).

Table 2 summarises the main fatty acids of LD. Rumen biohydrogenation in cattle limits the amount of long chain PUFA which can be transferred into ruminant muscle. As a result of this, the PUFA/SFA ratio for beef is typically very low. Findings reveal that in the case of the extensive fed HG the ratio of SFA/UFA of *longissimus* could be more favourably altered, than in case of the HF bulls. On the other hand the HG deposited more SFA in muscle tissues opposite to HF bulls. The process of biohydrogenisation also results in the production of CLA intermediates. It is recognised that CLA has numerous positive effects on the human health. The CLA content of *longissimus* muscle was influenced by breed as well as by feeding. The CLA percentage of *longissimus* muscle in HG bulls was higher, than that of HF considering any groups. On the other hand, with extensive feeding CLA content in muscle can be two times higher.

In nutritional guidelines there are separate recommendations for *n*-6 and *n*-3 classes of PUFA. There are beneficial effects of *n*-3 PUFA in the prevention of cardiovascular disease and cancer in contrast to opposite effects indicated for *n*-6 PUFA. The amount of *n*-3 and *n*-6 fatty acids was significantly higher in extensive fed groups. In the *n*-6 fatty acid content of beef, there was a significant difference between breeds. HG had in both feeding groups a lower value, consequently their ratio of *n*-6/*n*-3 fatty acid is more advantageous for human nutrition.

Table 2: Fatty acid composition of *longissimus* muscle.

Fatty acids (%)	intensive				extensive				Significance P<0.05
	HF		HG		HF		HG		
	mean	SE	mean	SE	mean	SE	mean	SE	
C16:0	25.94	0.49	28.40	0.49	21.13	0.49	21.41	0.49	D,B,B*D
C16:1	2.52	0.13	2.82	0.13	1.46	0.13	1.57	0.13	D
C18:0	15.64	0.50	15.96	0.50	19.09	0.50	17.67	0.50	D
C18:1*trans*-11	1.88	0.27	0.89	0.27	4.46	0.27	4.78	0.27	D ,B*D
C18:1*cis*-9	32.86	0.82	35.21	0.82	25.88	0.82	25.97	0.82	D
C18:1*cis*-11	1.34	0.04	1.21	0.04	1.40	0.04	1.31	0.04	D ,B
C18:2*trans*	0.22	0.02	0.17	0.02	0.37	0.02	0.24	0.02	D ,B
C18:2 *n*-6	8.20	0.65	5.44	0.65	10.36	0.65	10.79	0.65	D,B*D
C18:3 *n*-3	0.75	0.18	0.61	0.18	2.73	0.18	3.21	0.18	D
*c*9,*t*11 CLA	0.27	0.03	0.36	0.03	0.58	0.03	0.81	0.03	D, B, B*D
C20:3 *n*-6	0.50	0.05	0.28	0.05	0.67	0.05	0.59	0.05	D,B
C20:4 *n*-6	2.36	0.26	1.18	0.26	3.55	0.26	2.87	0.26	D,B
C20:5 *n*-3	0.11	0.04	0.14	0.04	0.37	0.04	0.63	0.04	D,B,B*D
C22:4 *n*-6	0.30	0.03	0.13	0.03	0.41	0.03	0.22	0.03	D,B
C22:5 *n*-3	0.28	0.05	0.25	0.05	0.61	0.05	0.75	0.05	D
C22:6 *n*-3	0.04	0.01	0.05	0.01	0.10	0.01	0.13	0.01	D
SFA	45.80	0.68	49.20	0.68	44.58	0.68	43.80	0.68	D,B*D
UFA	54.20	0.68	50.80	0.68	55.42	0.68	56.20	0.68	D,B*D
PUFA	13.36	1.21	8.83	1.21	20.29	1.21	20.76	1.21	D,B*D
n-3 fatty acids	1.30	0.28	1.13	0.28	4.14	0.28	5.05	0.28	D
n-6 fatty acids	11.26	0.94	7.05	0.94	14.80	0.94	14.44	0.94	D,B,B*D
n-6/*n*-3 ratio	9.27	0.34	6.24	0.34	3.61	0.34	2.86	0.34	D,B,B*D

D- diet, B - breed

Conclusions

The fatty acid composition of intramuscular fat of beef can be modified favourably by feeding grass and concentrate supplementation which is rich in *n*-3 fatty acids, however the beef of HG has a more beneficial impact on human health (CLA content, *n*-6/*n*-3 ratio), compared with HF bulls.

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