Research on nutrient distribution in fat tissue of growing Fleckvieh bulls fed diets with varying energy concentrations

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The performance of Fleckvieh (German Simmental) fattening bulls has been improved by selective breeding during past decades. This might have affected carcass tissue composition as well as chemical body composition and as a consequence energy and nutrient requirements of animals during fattening might have changed. In order to reevaluate the deposition of energy and nutrients and the chemical and body tissue composition of growing Fleckvieh bulls of modern type, a feeding and slaughter experiment was conducted. This abstract presents data on nutrient content of bulls slaughtered in different weight categories after feeding diets with different energy concentrations.

Methods

72 Fleckvieh bulls (age: 42 d, body weight (BW) 80 kg) were fed with restricted amounts of milk replacer (120 g/l) with a maximum of 6 l/d and a total mixed ration (TMR) based on concentrates (55.7 %), hay (30.0 %) and molasses (14.3 %) over a period of 6 weeks until weaning at an average BW of 121 kg. Subsequently, the animals were fed a TMR based on maize silage (average 63.6 %), concentrates (30.8 %), hay (3.7 %) and molasses (1.9 %) for ad libitum intake. The TMR for the period after weaning (8 weeks) was adjusted weekly and supplemented with brewer's yeast, 110 g per calf and day. The fattening period began at an average BW of 225 kg. Bulls were randomly allocated to a normal and a high energy treatment group with 11.6 and 12.4 MJ ME/kg DM, respectively. Individual feed intake was recorded daily and BW was determined in four-week intervals. The bulls were slaughtered in five final live weight groups with 120 (n=8), 200 (n=10), 400 (n=18), 600 (n=18), and 780 kg (n=18). During slaughtering and carcass processing, the empty body weight was determined as final live weight minus the contents of urinary bladder and gastrointestinal tract and the fat tissue fractions suet, visceral fat and carcass fat were manually dissected. The fat tissues were chemically analyzed for crude fat, crude protein, crude ash and water contents and the nutrient contents of the total fat tissue were calculated from the nutrient contents of the individual fat tissues. Statistical analysis was performed using Proc Mixed of SAS (Version 9.4). Results are shown in ranges and standard error and were compared by the PDIFF option with values of $p<0.05$ regarded as significant.

Results

During calf rearing, the NE and HE feed intake groups were fed the same calf ration. Hence, the daily feed, nutrient and energy intake did not vary between the animal groups (Tab. 1, weight range 120-200kg). In consequence of feeding varying energy concentrations for the fattening period, the HE treatment bulls showed in all stages of the finishing period a higher daily DM, sugar, starch and energy intake than the NE animal group while the NE fed bulls showed a higher aNDFom intake. These results are based on the varying amounts of maize silage and concentrates in the NE and HE TMR.

Tab. 1: Daily feed, nutrient and energy intake of bulls in normal and high energy treatment groups in different weight ranges

Weight range/ feeding groups	**n**	**DM** kg	**CP** g	**aNDFom** g	**Sugar + Starch** g	**ME** MJ
120-200kg	64	4.4	647	1465	1475	51.4
120-400kg						
Normal energy	27	6.33[a]	911[a]	2067[a]	2162[a]	74.0[a]
High energy	27	6.67[b]	961[b]	1813[b]	2888[b]	81.8[b]
SE		0.03	4.39	8.23	14.78	0.39
120-600kg						
Normal energy	18	7.21[a]	1041[a]	2360[a]	2417[a]	84.1[a]
High energy	18	7.61[b]	1099[b]	2014[b]	3335[b]	93.7[b]
SE		0.03	4.49	8.56	13.88	0.39
120-780kg						
Normal energy	9	7.67[a]	1105[a]	2511[a]	2556[a]	89.3[a]
High energy	9	8.27[b]	1199[b]	2153[b]	3656[b]	102.2[b]
SE		0.03	4.49	8.57	13.63	0.38

The body fat tissue proportion increased significantly during growth ($p<0.05$; Tab. 2) and correspond widely to data of Augustini et al. (1992). The crude fat content in fat tissue ranged from 39.0-78.6 % from the lowest to the highest weight group and thus increased by 39.6 percentage units, while the water and crude protein content decreased by 33.6 and 5.6 percentage units, respectively ($p<0.05$). The increase of crude fat percentage at the expense of water and crude protein in the fat tissue of growing bulls is in agreement with data of Schulz et al. (1974), Berg & Butterfield (1976) and Otto et al. (1994) and illustrates progressive maturing of the animals. Besides crude fat, fat tissue also contains a high amount of water and crude protein rich connective tissue as is obvious in early stages of fat tissue development. However, the present data showed no significant effect of dietary energy concentration on the nutrient composition of body fat tissue.

Tab. 2: Average percentages of fat tissue and nutrient composition of fat tissue of bulls in different weight groups

	Weight groups				
	120kg	**200kg**	**400kg**	**600kg**	**780kg**
Empty body fat					
Normal energy	3.7^{Aa}	6.8^{Bb}	9.9^{C}	13.7^{D}	18.7^{E}
High energy			10.3^{c}	14.6^{d}	18.4^{e}
Water					
Normal energy	49.3^{Aa}	30.1^{Bb}	20.3^{C}	17.9^{CD}	15.7^{D}
High energy			20.8^{c}	16.9^{d}	15.6^{d}
Crude protein					
Normal energy	11.2^{Aa}	7.3^{Bb}	7.0^{B}	5.7^{B}	6.0^{B}
High energy			7.0^{b}	6.3^{bc}	5.1^{c}
Crude fat					
Normal energy	39.0^{Aa}	62.3^{Bb}	72.4^{C}	76.2^{D}	78.1^{D}
High energy			72.0^{c}	76.5^{d}	79.1^{d}
Crude ash					
Normal energy	0.6^{Aa}	0.4^{Bb}	0.2^{C}	0.2^{C}	0.2^{C}
High energy			0.3^{c}	0.2^{cd}	0.2^{d}

^{A,B} Comparing weight groups within NE treatment group
^{a,b} Comparing weight groups within HE treatment group

Conclusion

The amount of body fat increased during growth and fat tissue proportions of bulls in different weight groups corresponded widely to literature data from past decades. Variations in dietary energy concentrations showed no significant effect on the nutrient composition of body fat tissue. The experiment confirms that current Fleckvieh bulls can be fattened intensively to high finals weights as 780 kg without gaining excessive amounts of fat.

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