

Accretion rates of body tissues, nutrients, and energy in growing Fleckvieh bulls fed rations 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 the contents of body tissues, nutrients, and energy per kg empty body weight gain in Fleckvieh bulls fed rations with varying 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 (GIT) and the whole empty body was dissected to body tissue fractions as hide, blood, organs, empty GIT, body fat, muscle, tendon and bone. The individual tissues were analyzed for their nutrient contents (crude fat, crude protein, crude ash, water) and the nutrient contents of the animal's empty bodies was calculated according to the results. The energy content of the animal's empty bodies was calculated based on studies of Böhme & Gädeken (1980), which determined the energy contents of crude fat and crude protein in cattle with 39.0 kJ/g and 22.6 kJ/g, respectively.

To determine the composition of gain, third degree polynomial regression equations of the individual body tissues and nutrients were calculated. In a next step, Residuals of the fitted models were calculated to evaluate the goodness of fit of the model. A two-way analysis of variance with interaction (feed energy, weight group, feed energy x weight group) was performed with the calculated residuals to analyze if the model fits both feed energy groups. Since no significant effect of feed x weight interaction was observed, it was statistically justified to calculate combined regression equations of both feeding groups. The content of gain was calculated using the first derivatives of the regression equations and was scaled to 1000 g empty body weight gain (EBWG).

Results

Results on fattening and slaughter performance of growing Fleckvieh bulls were already published by Honig et al. (2020). In the following, results on the composition of gain of Fleckvieh bulls fed rations with different energy contents are presented. Table 1 illustrates the composition of gain of bulls within a 100-800 kg live weight range. In terms of tissue gain, growing bulls showed a decrease of blood, organ, GIT, and bone content per kg EBWG. In contrast, the content of fat tissue increased during growth. The tissues hide, muscle, and tendon showed a peak of tissue gain at 300 kg live weight of the animals and a decline in gain afterwards. Likewise, the nutrients protein and ash showed a peak of gain at 200 and 300 kg live weight, respectively, and a decrease in gain afterwards. Corresponding to fat tissue, crude fat content increased with increasing live weight of the animals, which also increased the energy content per kg EBWG in growing bulls.

Table 1: Calculated average body tissue, chemical composition, and energy contents per kg empty body weight gain of bulls at different live weights

Composition of gain (g/kg EBWG)	Live weight (kg)							
	100	200	300	400	500	600	700	800
Hide	112	119	120	117	109	96	77	52
Blood	54	50	46	42	36	30	23	14
Organs	71	64	58	54	50	47	44	42
GIT	70	51	37	27	19	15	13	13
Fat	62	98	136	177	222	272	330	396
Muscle	429	436	438	435	427	415	397	374
Tendon	42	44	44	43	42	39	36	31
Bone	161	138	120	105	94	86	80	77
Crude fat	89	133	174	214	254	294	335	379
Crude protein	204	206	204	198	190	177	161	140
Crude ash	44	47	48	47	46	42	38	32
Water	662	614	574	540	511	487	466	448
Energy	8.1	9.8	11.4	12.8	14.2	15.5	16.7	18.0

Conclusion

The requirements for nutrients and energy change during cattle growth and are based on the daily weight gain and composition of gain. Current Fleckvieh bulls show increased energy accretion rates in high weight groups, whereby an increase of the animal's energy requirements is expected. Furthermore, protein gain decreases during growth, so the protein content in the rations can be lowered as fattening proceeds. Thus, feed ingredients can be saved and unnecessary nutrient excretion can be avoided.

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References

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