EFFECTS OF A RESTRICTED GROWING DIET AND/OR A FAT SUPPLEMENTED FATTENING DIET ON FATTY ACID COMPOSITION IN CARCASSES OF BULLS

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SUMMARY

Twelve Belgian Blue bulls were used in a 2 x 2 factorial design to evaluate the effects of food restriction during growth and/or fat supplementation during the fattening period on fatty acid composition in the carcasses. Both treatments increased the fat content and the unsaturated fatty acid proportion in the carcasses, the extent of the changes being different according to the fat location.

INTRODUCTION

The incidence of coronary heart disease in populations correlates closely with both the mean serum cholesterol level and the mean proportion of energy derived from saturated fats (Rose, 1980). It is therefore interesting to increase the unsaturated fatty acid proportion in carcasses of fattening bulls. Such carcasses can be produced by different ways such as the choice of the breed (Clinquart et al, 1992) or the supplementation of the diet by fat (Clinquart et al, 1991a). Changes in fatty acid composition could be expected with a food restriction during the growing period. The present experiment was designed to examine the effects on fatty acid composition and fat content in the carcasses of protein and energy restriction during growth associated or not with a fat supplement during the fattening period.

MATERIAL AND METHODS

Twelve Belgian Blue bulls were used in a 2 x 2 factorial design. They were from the dual purpose type. Their initial live weight was close to 230 kg. During a 202 days growing period they were offered eiher a diet made of 80% concentrate and 20% hay or a restricted diet made of 20% concentrate, 20% hay and 60% straw. The average daily gains produced with these two diets were respectively 1.13 and 0.34 kg/d. The animals were then divided in two groups during the fattening period. The first group was given a control fattening diet based on sugar beet pulp and the second group was offered a fattening diet supplemented with 15% extruded soya bean. Both diets were offered *ad libitum*. The fattening period lasted for 82d for 194d and the average daily gain was 1.44 and 1.46 kg/d according to the previous growing diet. The gains were 1.50 and 1.40 kg/d in the control fattening diet and in the fat supplemented diet respectively. The 7-8-9 ribs were removed at slaughter and a sample of perirenal fat was also obtained. The ribs were dissected in order to separate muscle, fat and bones and to estimate the carcass composition. Longissimus Dorsi samples and intermuscular fat around this muscle were obtained during the dissection. The fat content of the muscle samples was measured by the Soxhlet technique. Intramuscular fat was obtained by extraction from the Longissimus Dorsi. Fatty acid composition of intramuscular, intermuscular and perirenal fats was determined by gas chromatography.

RESULTS AND DISCUSSION

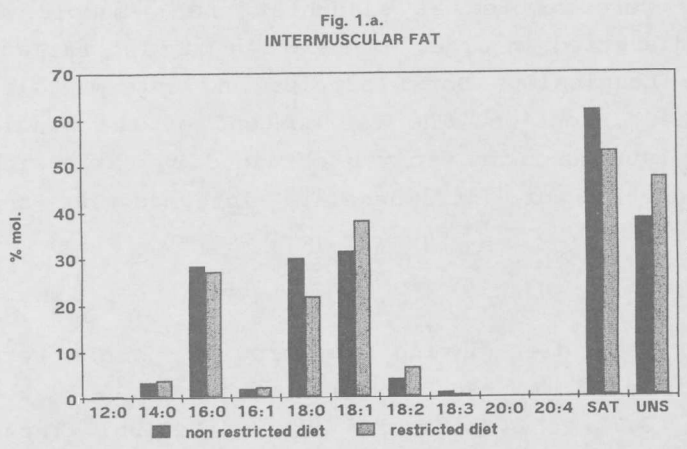
The carcasses of the bulls offered the restricted diet during the growing period were characterized by a higher fat proportion (31.1% vs 26.4%, $P \leq 0.05$). There was also a higher ether extract content in the Longissimus Dorsi (8.7% vs 6.8% in dry matter, $P \leq 0.05$). These two ether extract contents could be considered as acceptable since the Belgian Blue breed produces a lean meat as compared with Holstein bulls at 17.2% (Clinquart et al, 1992) or

Hereford steers at 28.5% (Dryden and Marchello, 1970). This effect was associated wi longer fattening period (194d vs 82d) and a higher food intake during the fattening pe (2.23 vs 1.81 kg/100 kg body weight). By contrast Wright and Russel (1991) did not obse such effects but in their experiment food intakes were similar in both groups. The ove effects on fatty acid composition of the restricted diet during the growth period were increase of the unsaturated fatty acid proportion. The extent of the changes were differ according to the fat location. For the intermuscular fat (Fig. 1.a.) there was a reduction stearic acid content (21.7 vs 29.7%, P≤0.01) and an increase of oleic acid (38.0 vs 31. P≤0.01) and linoleic acid (6.4 vs 3.9%, P≥0.05) resulting in an increased unsaturated fa acid proportion (47.2 vs 38.3%, P≤0.01). Similar trends were observed in intramuscular (48.7 vs 46.6% unsaturated fatty acids) (Fig. 1.b.) but these were non significant except oleic acid (37.8 vs 35.6%, P≤0.05). By contrast the fatty acid composition of perirenal was not affected (Fig 1.c.). These effects on intermuscular and intramuscular fats could be explained by a older age in the restricted group (194 vs 82d fattening period) since et al (1970) observed only small changes in the fatty acid composition of bovine mus lipids during growth, the greatest difference being a relative decrease of polyunsatura fatty acids.

The inclusion of soya bean in the fattening diet did not significantly increase the proportion in the carcasses (29.6% vs 27.9%) and the ether extract content in the Longissi Dorsi (7.9% vs 7.6% in dry matter). The changes of the fatty acid composition in supplemented group were quite similar to those observed with the restricted diet offe during the growing period. The unsaturated fatty acid proportion was increased intermuscular fat (44.5% vs 40.9%, P≤0.05) (Fig 2.a.) due to a non significant reduction stearic acid (24.5% vs 27.1%) and a non significant increase in oleic (36.0% vs 33.3%) linoleic acid contents (5.5% vs 4.8%). The effects of the two treatments were cumulative the unsaturated fatty acid proportion since the difference between the two extreme groups greater than 12% units (50.0% vs 37.5% in the restricted group with soya bean and in control group respectively). Similar but not significant changes were observed intramuscular (Fig. 2.b.) and perirenal (Fig. 2.c.) fats. In a previous experiment with soya oil in a similar diet (Clinquart et al, 1991b), the unsaturated fatty acid proport was increased in intermuscular and perirenal fats by changes in oleic and palmitic acids not in linoleic acid. The degree of saturation was not affected in intramuscular fat.

Fig. 1.- Fatty acid composition of intermuscular (1.a.), intramuscular (1.b.) and perirenal (1.c.) fats as influenced by the diet during the growing period

Fig. 2.- Fatty acid composition of intermuscular (2.a.), intramuscular (2.b.) and perirenal (2.c.) fats as influenced by fat supplementation during the fattening period



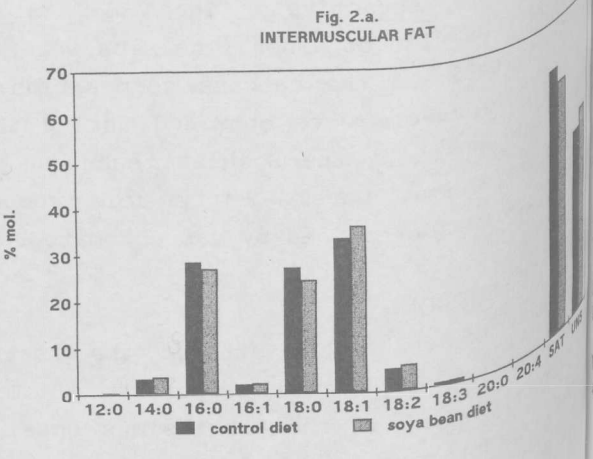


Fig.1.b.
INTRAMUSCULAR FAT

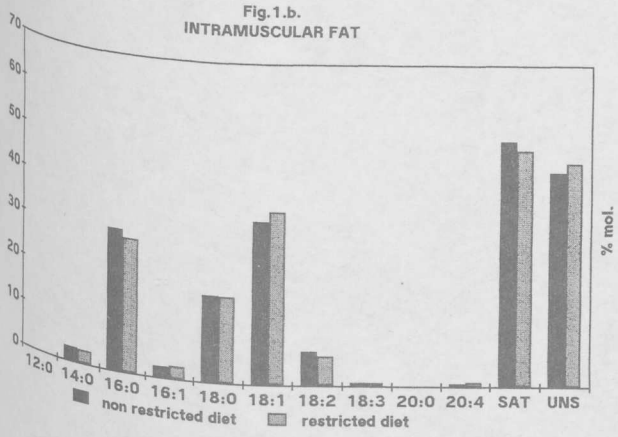


Fig. 2.b.
INTRAMUSCULAR FAT

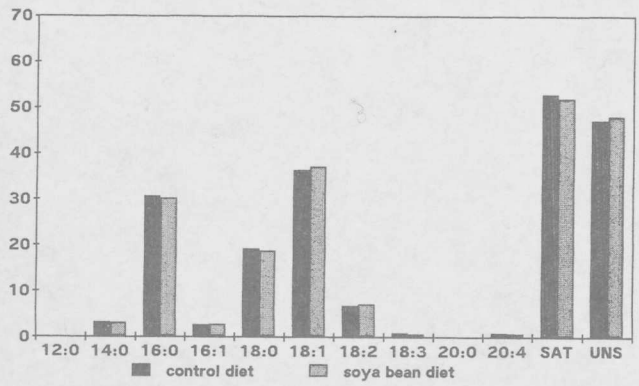


Fig. 1.c.
PERIRENAL FAT

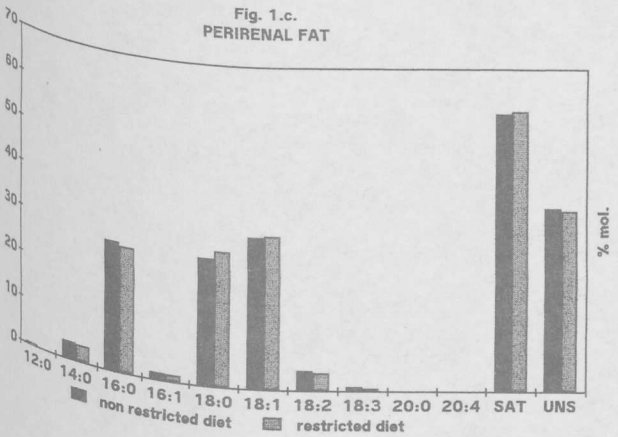
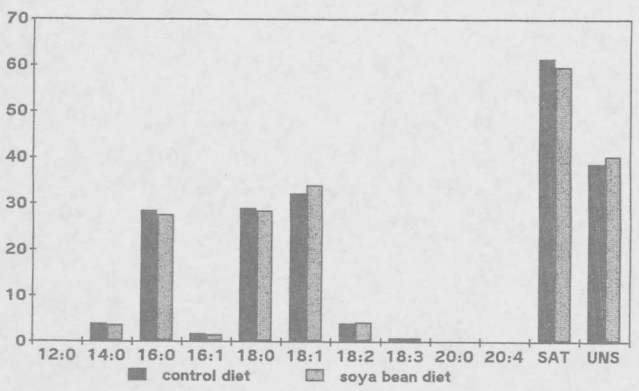


Fig. 2.c.
PERIRENAL FAT



ONCLUSION

rom the present experiment, it appeared that it was possible to manipulate the fatty acid omposition of the carcasses, with therefore a beneficial effect to the consumer. A estricted diet during the growing period and the supplementation with soya bean during the attening period produced similar effects on fatty acid composition. The unsaturated fatty cid proportion was increased in different extents according to the fat location. In the resent experiment food restriction during the growth period produced fatter carcasses robably due to a longer fattening period.

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