EFFECT OF DIET ON THE CHEMICAL AND THERMAL PROPERTIES OF BEEF FAT

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S-IVA.30

SUMMARY

The effect of the diet on the fatty acid composition and thermal behaviour of fat was studied in subcutaneous fat from 20 Aberdeen Angus steers under two diets based on grass alone or grass supplemented with grain. Diet affected significantly the fatty acid composition and the cooling and melting profiles of the subcutaneous fats.

Introduction

The quality of beef fat is important from the nutritional and technological point of view. The diet can affect its fatty acid composition and its thermal behaviour and it is important to know these effects. Differential scanning calorimetry (DSC) provides a direct measurement of the ΔH accompanying the physical and chemical changes studied and is now widely used in food research (Biliarderis, 1983). The purpose of the present paper was to determine the effects of the diet on fatty acid composition and in the thermal behaviour of subcutaneous fat from steers under 2 diet, grass alone or grass supplemented with corn grain.

Materials and methods

Samples of subcutaneous fat (approximately 200 g each) from the 10 to 13th ribs were finely chopped. Aliquot samples were used for the following analysis:
1. Total lipid determination by extraction of the dry samples with boiling hexane during 16 h.
2. Fatty acid composition. An aliquot sample was extracted with the Folch et al. (1957) method and the chloroform extract used for the determination of fatty acid composition using GLC of the methyl esters (García et al., 1986).
3. Determination of melting and cooling curves using a differential scanning calorimeter (DSC) Perkin-Elmer DSC-2C. The temperature was calibrated with indium and naphthalene as standards. Weighed samples of fat (5-6 mg) were placed in aluminium sample pans. The curves were obtained according to the following procedures:
A: The melted fat was kept 48 h at room temperature, cooled at -35°C and heating curves were recorded from -35 to 65°C at a heating rate of 5°C/min.
B: The sample was kept 5 min at 65°C, cooled from 65 to -35°C at 320°C/min and melted from -35 to 65°C at 5°C/min.
C: The sample was kept 5 min at 65°C and then cooled from 65 to -35°C at 5°C/min.
D: The sample was kept 5 min at 65°C, cooled from 65 to -35°C at 5°C/min and melted after 5 min from -35 to 65°C at 5/min.
E: The sample was kept 5 min at 65°C, cooled from 65 to -35°C at 5/min and melted after 1 h from -35 to 65°C.
The statistical analysis was carried out using GLM procedure of the SAS program (SAS Institute, 1987).

Results and discussion

The total lipid content in the subcutaneous fat was affected by the diet (80% vs 87 % in grass or grain diet respectively). The fatty acid composition of the subcutaneous fat from the two treatments is presented in Table 1. The differences were significant ($P<0.05$) for 17:0, 18:0, 18:1 and 18:3. Subcutaneous fat from grass fed steers had more 17:0, 18:0 and 18:3 but less 18:1 than the fat from grain fed steers. This results are in agreement with those of several researchers (Marmer et al.,1984) and show the effect of the diet in the fatty acid composition. A typical melting (A) and cooling (C) curves for subcutaneous fat from the grass or grain diet are shown in Figures 1 and 2. The two fats presented very different cooling and melting curves. The melting curves from grass subcutaneous fat showed a larger high temperature peak (25-45°C) compared with the grain subcutaneous fat. The melting point was also different (41.4±1.21°C CV% 2.8 vs 35.5± 2.8°C CV% 7.8 for grass and grain fats respectively). No significant differences in the melting curves for each type of fat using the procedures B, D or E were detected but the melting curve profiles from fat samples from 5 min to 4 hs of tempering at room temperature were different in both types of fats.

Conclusions

Diet affects the fatty acid composition and the thermal behaviour of subcutaneous steer fat. Differential scanning calorimetry could be used as a routine analysis for controlling beef subcutaneous fat quality.

References

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Table 1: Intramuscular fat (%) in the different meats
Table 2: Cholesterol content in the different meats (mg/100g)
Figure 1: Melting curves from subcutaneous fat from grass or grain fed steers according to procedure A.
Figure 2: Cooling curves from subcuteneous fat from grass or grain fed steers according to procedure C.