

Reliability of visible reflectance spectroscopy in discriminating between pasture and stall-fed lambs from thin and fat-tailed sheep breeds in dry and hot environment

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Considering the additional market value of pasture meat, many authentication methods were developed to discriminate it from meat produced in conventional systems. The visible reflectance spectroscopy technique has proved its efficiency under European conditions and breeds. The present study tested the reliability of this method to discriminate between pasture-fed (P) and stall-fed (S) lambs under North African conditions and investigated the effect of feeding system (FS) (P v. S) and breed (Barbarine; Queue Fine de l'Ouest; and Noire de Thibar) on weight and colour of perirenal, subcutaneous and caudal fat. A total of 18 P and 18 S lambs were used with 6 P and 6 S lambs for each breed. The colour and the reflectance spectrum of different fat tissues were measured. The FS affected weights of all fat tissues and all colour parameters of perirenal and subcutaneous fat ($P \leq 0.01$); it almost affected redness and yellowness of caudal fat ($P \leq 0.05$; $P \leq 0.01$). In all adipose tissues, lightness was higher and both redness and yellowness were lower for S lambs than P lambs. The breed affected weight, lightness and redness of perirenal fat and weight and redness of subcutaneous fat with significant interaction with FS for subcutaneous fat data. To discriminate P lambs from S lambs, the reflectance spectrum of perirenal, subcutaneous and caudal fat at wavelengths between 450 and 510 nm (Method 1, M1) or at wavelengths between 400 and 700 nm using partial least squares discriminative analysis as a classification method (Method 2, M2) were used. M2 yielded to a higher proportion of correctly classified lambs compared with M1 ($P = 0.001$). The proportion of correctly classified lambs using M2 was 76.4, 75.0 and 80.0% for perirenal, subcutaneous and caudal fat for P lambs and 83.3, 76.4 and 100.0% for S lambs. Despite lower reliability in comparisons to European researches, this study confirmed the efficiency of visible reflectance spectroscopy technique applied on perirenal fat in feeding systems authentication under North African conditions and spotted the caudal fat as a new support for better classification of fat-tailed breeds.

Keywords: fat colour, feeding, authentication, traceability, sheep

Implications

The present study of reporting data about the colour of different fat tissues of North African meat breeds under stall- and pasture-feeding systems aims to apply methods developed in European temperate areas to authenticate lamb meat from grassland-based systems under North African conditions. This work has confirmed the importance of perirenal fat colour in feeding systems discrimination, spotted the caudal fat as a better classification tool and propose further researches to bear out this finding on a larger number of fat-tailed

lambs. These initial results may increase the meat market value by knowing its feeding origin.

Introduction

Since the Bovine Spongiform Encephalopathy crisis, research interest in the reconstruction of animal diet from the meat has increased. Several factors have contributed to this interest: (i) the consumer demand for guarantee about the animal diet and (ii) the convection that the animal diet strongly influences the meat quality (Rousset-Akrim *et al.*, 1997; Hajji *et al.*, 2016). Several studies have reported differences between lambs raised indoor with concentrates and those

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