

Phenotyping milk fatty acid composition in dairy goats to study variations in rumen fermentation patterns and to predict the occurrence of acidosis

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Take home message Individual milk fatty acid composition is a good biomarker in dairy goats to detect status of rumen fermentation patterns. According to this purpose, it can be used to phenotype dairy goats susceptibility to acidosis.

Introduction Main factors of variation of milk fatty acid (FA) composition are linked to diet composition and physiological status. This trial aimed to study the between animal variation when they were moved from a low concentrate diet to a high one and test if milk FA profile could be a good biomarker of SARA (sub-acute rumen acidosis).

Materials & methods Eight rumen cannulated dairy goats adapted to a low concentrate diet (20 %) were switched to a higher concentrate diet (50 %). Samples of milk were taken individually on the morning for 2 days before the change (Days 1 and 2), the 4 days following the change (Days 3 to 6) and once weekly for 3 weeks (Days 7 to 9). Therefore, the day effect would represent the effect of the diet (i.e. before, during and after diet transition). 91 fatty acids (FA) were detected by gas chromatography. Rumen fluid was sampled simultaneously before the morning feed (T0) and 1, 2, 4 and 6 hours afterwards and analysed for pH and volatile fatty acid (VFA) composition. A principal component analysis (PCA) was used to describe the relationships among milk FA % which were pooled in groups according to their saturation degree and C chain length. Rumen fermentation data were considered as supplementary variates in this PCA.

Results & discussion Score plots of the observations (mean values for goats and mean values for days) on the first two components (48 % of variance explained) showed that there were significant goat and day effects, but almost independent effects: goat axis (between-animals variation) was perpendicular to day axis (between days variation, Figure 1).

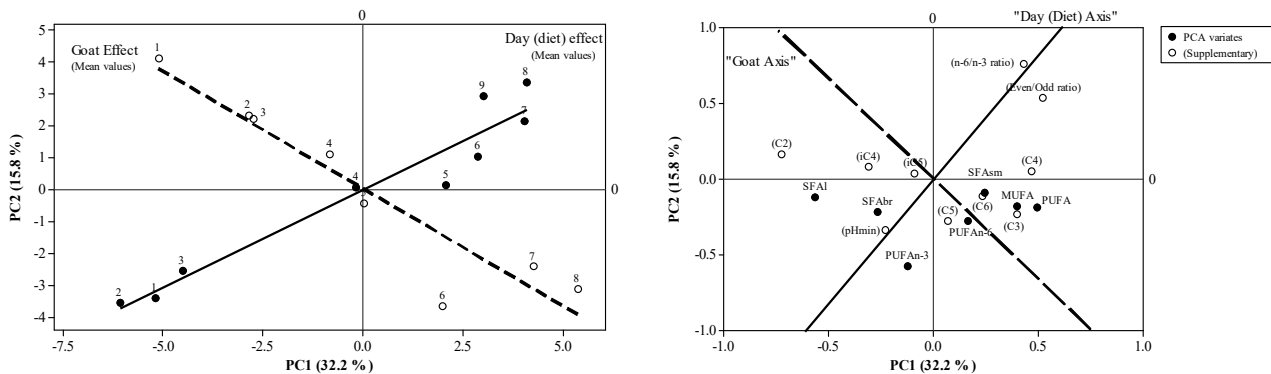


Figure 2 Score plots of the variates on the first 2 components of the PCA.

Score plots of the variates showed that the goat effect can be linked to an opposition between short saturated (SFAs), mono (MUFA) and polyunsaturated (PUFA) FA, on one hand, and long (SFAl) and branched SFA (SFABr), on the other hand (Figure 2). Modification of FA profile after the dietary change began very rapidly. A steady state status was observed around one week after it. Concentration of odd FA decreased, while the even/odd ratio of SFA and the n-6/n-3 ratio increased with the high concentrate diet. Score plots of the supplementary rumen variates showed that differences between goats were mainly linked to rumen fermentation patterns. Rumen pH was opposed to even/odd and n-6/n-3 ratios. On the PC1, % of C2, iC4 and iC5 are opposed to % C3 and % C4 which corresponds to a more acidogenic profile. This also suggests that VFA profile was stronger affected than pH, probably due to differences in microbiota. Goats in the bottom right quadrant (6 to 8) seemed more susceptible to acidosis than goats in the up left quadrant (1 to 3). Thus, fatty acid composition of goat milk is linked to rumen fermentation patterns as previously reported in cows (Fievez *et al.*, 2012), with an important between-animal variation that can explain why some authors find a marked between-trial effect (Bhagwat *et al.*, 2012). Phenotyping animals on this trait could outline specific rumen fermentation patterns.

Conclusion This study suggests that milk FA composition detected by gas chromatography may be a biomarker of changes in rumen fermentation and subsequent SARA, and so phenotyping goats on that trait might be of practical interest.

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PHENOTYPING MILK FATTY ACID COMPOSITION IN DAIRY GOATS TO STUDY VARIATIONS IN RUMEN FERMENTATION PATTERNS AND TO PREDICT THE OCCURRENCE OF ACIDOSIS

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Take home Message

Individual milk fatty acid composition is a good biomarker in dairy goats to detect status of rumen fermentation patterns. According to this purpose, it can be used to phenotype dairy goats susceptibility to sub-acute rumen acidosis (SARA).

Introduction

Milk fatty acid (FA) composition is linked to diet composition. This trial aimed to study the between animal variation when they were moved from a low concentrate diet (20 %) to a high one (50 %) and test if milk FA profile could be a good biomarker of SARA (sub-acute rumen acidosis).

Material and Methods

Milk was sampled on 8 cannulated goats, for 2 days before the shifting from the low- to the high-concentrate diet (D1 & D2), 4 days after (D3 to D6) and once weekly (D7 to D9) and analysed for 91 fatty acids (FA) detected by Gas Chromatography.

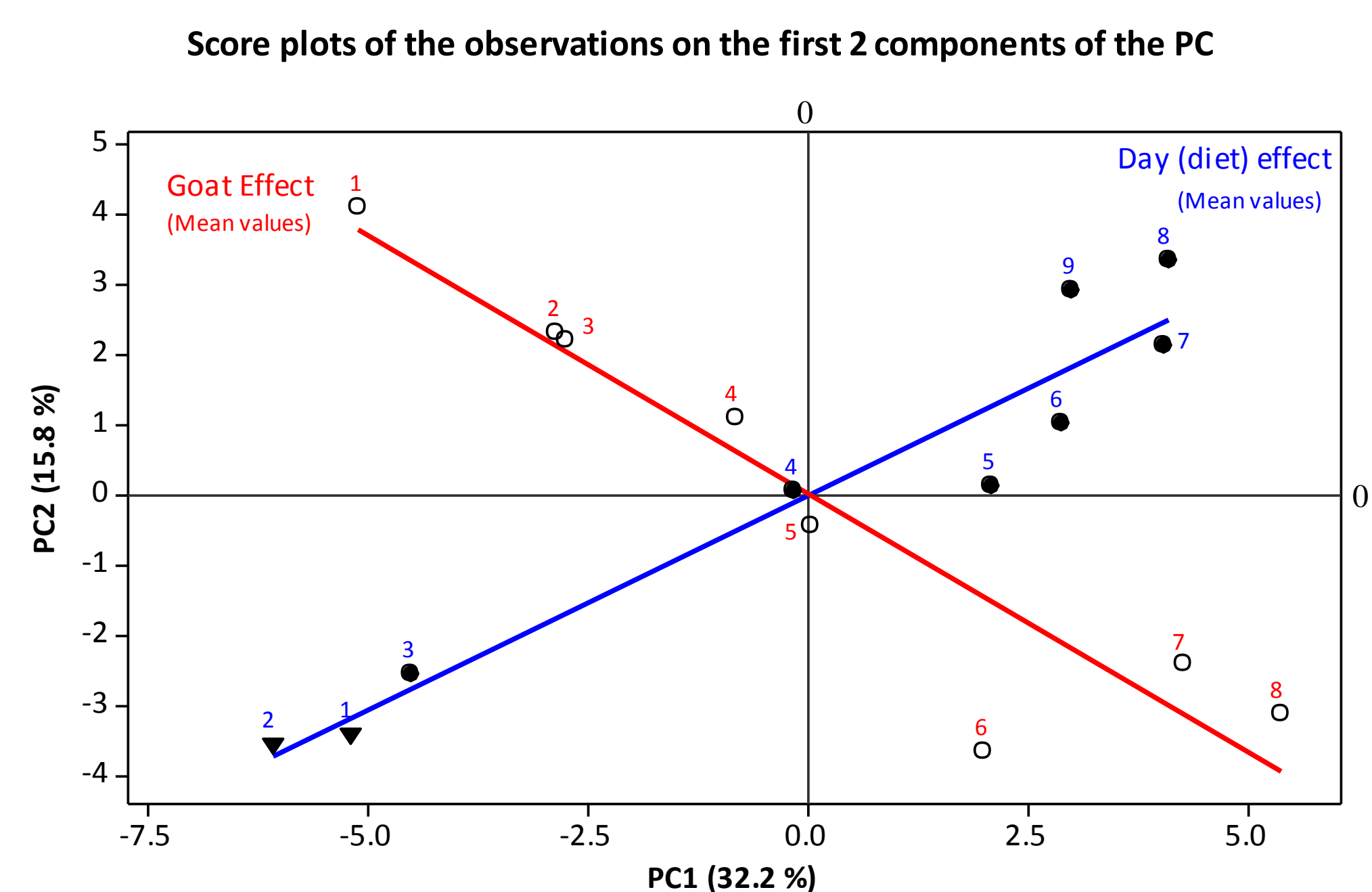
Rumen fluid was sampled simultaneously before the morning feed (T0) and 1, 2, 4 and 6 h after and analysed for pH and Volatile Fatty Acids (VFA).

A principal component analysis (PCA) was used to describe relationships among FA which were pooled in groups according to their saturation degree and C chain length. Rumen fermentation data were considered as supplementary variates in the PCA.

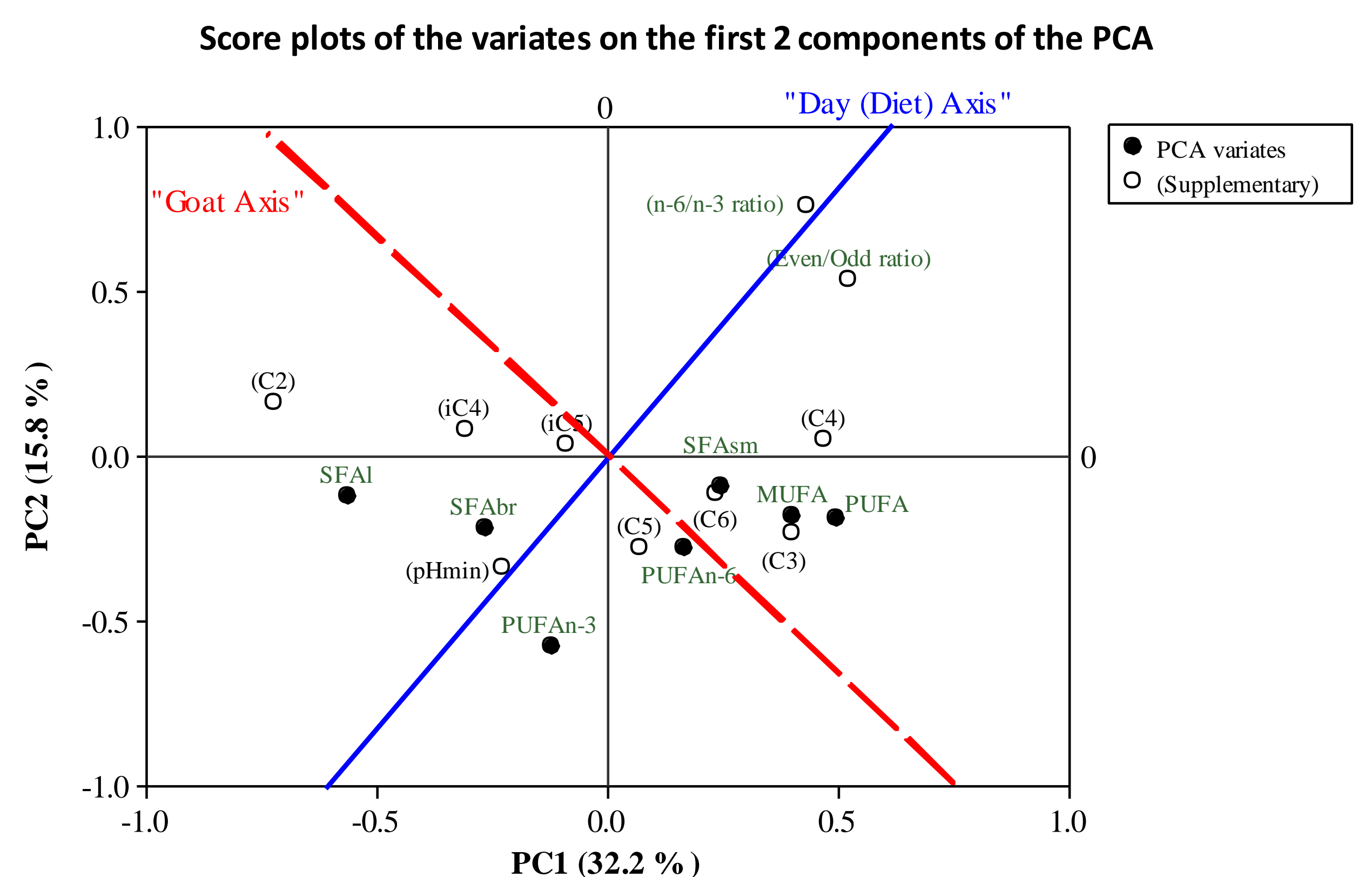
Acknowledgements: This research was partially supported by grants from Idele in the project CASDAR rfi Acid 1310.

Results & Discussion

Score plots of the observations showed significant goat and day effects



The goat effect is linked to the type of FA which were modified very quickly after diet change due to modifications in rumen fermentation pattern.



Phenotyping animals on this trait could outline specific rumen fermentation patterns.