Milk fat composition measured by MIR Spectroscopy as an indicator of ketosis status in dairy cows
A preliminary study

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INTRODUCTION

Ketosis: definition

Energy balance << 0

+

Glycogen (liver) not available to cover energy requirements

Adipose tissue mobilisation (β-oxidation)

⬇

Fatty acids (C18:0, C18:1) => liver => ketone bodies (aceto-acetate, β-OH)

⬇

When long/high starvation => ketosis

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INTRODUCTION

Ketosis : definition

- Ketosis occurs at the beginning of lactation (0-6 weeks)

- Two levels of ketosis:
  - Subclinical ketosis
  - Clinical ketosis
    - Type 1 ketosis
    - Type 2 ketosis (hepatic steatosis)

- Health consequences : fertility, mastitis,...

- Ketosis diagnosis mainly based on blood and milk parameters (ketone bodies)

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OBJECTIVE

> The recent development of FA composition measurement by Mid-InfraRed Spectroscopy (MIRS) may help in diagnosing ketosis, as it is well known FA profile is linked to ketosis metabolic status.

> Our objective was to assess if FA composition measured by MIRS may help in diagnosing ketosis in dairy cows.

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MATERIAL & METHODS

6 dairy farms

Visual diagnosis by 2 vets

Glycemia & β-OH
(Optium Xceed® test / blood sample)

16 healthy cows (HC) and 11 ketotic cows (KC)

Milk
Fat, protein and urea contents, somatic cell count, FA profile (by MIRS)

Blood
NEFA, acetate, propionate, minerals, insuline, serum-amyloid A, haptoglobin, thyroxin

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MATERIAL & METHODS

> Effects of metabolic status on blood and milk parameters
>> ANOVA (proc glm) : 2 factors => farm & metabolic status

> Test of FA profile as an help in diagnosing ketosis
>> Decision trees

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RESULTS

Animal performance

	Healthy cows	Ketotic cows
n=	16	11
DIM	70	31
Milk yield, kg/d	34.5	33.0
Fat content, g/kg	43.8	56.5
Protein Content, g/kg	29.1	29.2
Fat/protein	1.52	1.96
Urea content, mg/kg	358	279

❯ Results in accordance with literature
❯ Confirm diagnosis

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RESULTS

Blood parameters

	Healthy cows	Ketotic cows
n=	16	11
Glycemia, g/l	0.45	0.30
β-OH, mmol/L	0.88	3.15
NEFA, mmol/L	0.33	0.61
Urea, mmol/L	7.69	5.94
Thyroxin, nmol/L	47.8	32.3

Results in accordance with literature (Michaux, 2008; Veenhuisen, 1991)

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RESULTS

Milk FA profile

% FA	Healthy cows	Ketotic cows
n=	16	11
C16:0	29.7	22.9
C18:1	28.3	34.7
MUFA	29.4	37.2
PUFA	5.70	5.54
C18:0	13.7	16.4
AGMI+C18:0-C16:0	13.4	30.7

RESULTS

Decision tree

Total = 27 cows
n = 16 healthy
n = 11 ketotic

C16:0 ≥ 24.34 %   C16:0 < 24.34 %

Total = 15 cows
n = 14 healthy
n = 1 ketotic

Total = 12 cows
n = 2 healthy
n = 10 ketotic

Fat/Protein ≥ 1.31   Fat/Protein < 1.31

Total = 10 cows
n = 0 healthy
n = 10 ketotic

Total = 2 cows
n = 2 healthy
n = 0 ketotic

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CONCLUSION

› Milk FA profile by MIRS can help in diagnosing ketosis

⇒ Routine FA analysis can give a risk factor of ketosis

› Small database used => further studies needed to validate these indicators

› Ketosis detection at the beginning of lactation
  › Rapid treatment
  › Adaptation of ketosis prevention in farms

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Thank you for your attention.