Metabolic Profile Tests in High Yielding Normal Cows and in Cows Suffering From Abomasal Displacement*

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Introduction

High yielding dairy cows very often develop metabolic disturbances as ketonaemia and fatty liver. These abnormalities are frequently accompanied by or complicated by other syndromes, such as hypocalcaemia, abomasal dislocation and infectious processes as mastitis and metritis.

Ketonaemia and its etiology

As far as the etiology of ketonaemia is concerned, initially an energy deficiency was put forward. But the pathogenesis of the syndrome seems more complicated and several parameters may play a role in the development of the syndrome. In slide number 1, an attempt is made to combine several factors which may be of importance.

Diagnosis of ketonaemia and fatty liver: Results and interpretation

Determination of ketone bodies in blood and urine is often used as a method for diagnosing metabolic disturbances. However, it has been proved that a postprandial ketonaemia and ketonuria can appear, without any pathological significance, in both non-lactating and high yielding dairy cows. It was the aim of the present investigation to correlate blood parameters to the metabolic profile of the liver as estimated by the quantitative determination of triglycerides (TG) and glycogen in liver biopsies of control cows and cows with metabolic disturbances.

The liver of clinically normal lactating cows contains less than 20 mg TG and more than 20 mg glycogen per gram of wet tissue.

From Table 1 it can be seen that in high yielding cows from a farm with metabolic problems, only those animals with both fatty liver and glycogen depletion showed ketonaemia and hypoglycaemia. When the glycogen level was normal, keotonaemia and glycaemia stayed within normal limits, even though these cows had a fatty liver.

Table 1 Blood parameters from high yielding cows on a farm with problems of metabolic disturbances.

Number of animals n=42	3OHBA mmol/l	glucose mmol/l
Fatty liver : n=20		
- normal glycogen n= 8	0,76 ± 0,36	3,54 ± 0,58
- glycogen depletion n=12	2,13 ± 1,17**	2,59 ± 0,47**
Not fatty liver : n=22		
- normal glycogen n=14	0,71 ± 0,18	3,41 ± 0,23
- glycogen depletion n= 8	0,61 ± 0,26	3,31 ± 0,29

** Significantly different from other groups ($p < 0.01$)

In problem herds, regular control of ketone bodies, eventually associated with liver biopsies, might be indicated to evaluate the energy state of the animals. Besides, determination of blood levels of some ions, expecially Ca and Mg, may be a guide to take special care of pre- and post-partum supplementation.

IVGT-tests in cows suffering from abomasal dislocation

In high yielding dairy cows, abomasal dislocation is a frequently occurring syndrome. Going back to slide 1, we can point out 3 factors which certainly play a main role in this syndrome, because they inhibit the emptying of the abomasum: hypocalcaemia, circulating endotoxins and insuline resistence. Using cows with a fistulated duodenum it was shown that insuline, endotoxins and hypocalcaemia induced a definite decrease in abomasal emptying. In cows suffering from LD, it was found that notwithstanding a frequently occurring ketonaemia, these cows showed high blood glucose levels.

Table 2 T1/2 of glucose after IVGTT in control animals and animals suffering from LD.

T1/2 : min	Control animals (n=40)	LD (n=387)
First hour	52,2 ± 9,3	66 ± 15**
Second hour	77,8 ± 13,1	103 ± 26**

** Significantly different from control animals ($p < 0{,}01$)

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Table 3 Insuline response after IVGTT in control animals and animals suffering from LD

Time after IVGTT	Control animals		LD
(min)	non-ketotic(33)	ketotic(7)	(38)
0	47 ± 19[a]	31 ± 5[b]	73 ± 31[c]
15	203 ± 98[a]	42 ± 20[b]	235 ± 62[a]
30	158 ± 108[a]	50 ± 17[b]	230 ± 70[c]
60	117 ± 80[a]	44 ± 10[b]	209 ± 62[c]
120	52 ± 18[a]	36 ± 10[b]	103 ± 52[c]
240	48 ± 22[a]	30 ± 13[b]	79 ± 23[c]

Values pointed by various letters are significantly different ($p < 0{,}01$)

IVGT-tests indicated that LD-cows reacted with high insuline levels, which apparently were not able to decrease the glycaemia. In contrast, in normal non-ketotic cows, the insuline response to the intravenous glucose resulted in a normal glucose clearance. In normal ketotic cows, the glucose clearance was also normal, even though they showed a minimal insuline response. Up till now, there is no explanation available for this.

From these results in LD-cows, the presence of an insuline resistance was put forward. The causes for this resistance are not very clear yet. Among other things, lipolysis and circulating ketone bodies are supposed to play a role. STH, that reaches a peak at the moment of the partus, is known to cause insuline resistance in ruminants, as well as a lipolytic effect.

Conclusion

In conclusion, we can say that in dairy herds health management, determination of ketone bodies and some ions is a useful aid to evaluate the energy and ionary state of the herd, so that intervention is possible where needed. As for the causes of insuline resistance which appears in cows suffering from LD, further investigation will be needed.

Summary

In high yielding dairy cows, the determination of the ketone bodies in blood and urine for evaluaton of the energy state, is not always a reliable method, though it can be helpful in diary herd health management. Determination of Ca and Mg may also be a guide for eventual supplementation in pre- and post-partum diet. Cows suffering from abomasal dislocation were found to be in a state of insuline resistance of which the causes need further investigation.

References

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