The use of Blood Metabolite Concentrations as Indicators of the Metabolic and Productive Status in Dairy Cows

by

Manuela Gőtschi

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In the Faculty of Natural, Agricultural and Information Sciences

Department of Animal and Wildlife Sciences
University of Pretoria
Pretoria
South Africa

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DECLARATION

I DECLARE THAT THIS THESIS FOR THE DEGREE OF MSc (Agric) Production Physiology AT THE UNIVERSITY OF PRETORIA HAS NOT BEEN SUBMITTED FOR A DEGREE AT ANY OTHER UNIVERSITY

Signature: Götschi

Date: 19/5/2000

Manuela Götschi

ABSTRACT

Twenty-nine dairy cows from three different farms were used in a study to investigate the value of using blood metabolites in determining the metabolic, productive and nutritional status of freshened cows. Blood samples were collected on a weekly basis until nine weeks postpartum. Blood glucose, blood cholesterol, blood total protein and blood urea concentrations were determined spectrophotometrically.

A second trial was conducted with thirty Holstein cows. Their whole blood glucose and cholesterol concentrations were sampled every second week and analyzed immediately with the help of a hand-held glucometer. Fifteen cows were put onto transponders and their feed intake measured.

In these studies it was found that glucose concentration decreased to a certain extent after parturition. With the onset of lactation the increased demand for glucose for the synthesis of lactose is partially responsible for the decrease in glucose concentration as well as the re-organization of the reproductive organs from pregnancy to being able to reconceive. It was also found that during this time there was an increase in the cholesterol concentration. This can be partly attributed to the increase in the mobilization of body reserves and also increased thyroid activity. The mean glucose concentration had an effect on the number of times a cow had to be inseminated before she conceived, with those requiring three inseminations having significantly lower glucose concentrations than those animals only requiring one or two inseminations. The lower glucose concentrations led to an increased interval between calving and reconception, which has an economic impact on a dairy enterprise.

It was concluded that, although the use of blood metabolites to determine an animals metabolic and productive status can be a useful tool, the use of the hand-held glucometer for such determinations is of little value due to the many factors affecting both glucose concentration and cholesterol concentration. The hand-held glucometer can however be used to determine an animal's mean glucose concentration so as to help in keeping it above a certain concentration and in this way keep the period between parturition and reconception to a minimum.

ABSTRAK

Nege en twintig melk koeie van drie verskillende plase is in hierdie studie gebruik om die waarde van bloedmetaboliete vas te stel vir die bepaling van die koei se metaboliese, produktiewe en voedings status. Bloedmonsters is vanaf kalwing, weekliks geneem vir nege weke. Die bloed glukose, bloedcholesterol, bloed totale protein en bloed ureum konsentrasies is gemeet met die hulp van n' stektrofotometer.

n' Tweede eksperiment was gedoen op dertig Holstein koeie. Die heel bloedglukose en heel bloedcholesterol was elke tweede week gemeet met 'n draagbare glukometer. Hulle bloed was getoets vanaf kalwing tot rekonsepsie. Vyftien van die koeie het transponders aangehad sodat hulle daaglikse voer inname gemeet kan word.

In hierdie studies was dit gevind dat bloedglukose konsentrasie gelydelik afgeneem het na kalwing. Met die begin van laktasie het die behoefte van glukose verhoog vir die sintese van laktose. Dit tesame met die herorganisasie van die reproduktiewe stelsel, wat ook glukose benodig, is gedeeltelik verantwoordelik vir die daling in bloedglukose vlakke. Dit was ook gevind dat gedurende hierdie tydperk daar ook n' verhooging in bloedcholesterol vlakke was. Dit kan gedeeltelik toegeskryf word aan n' verhoging in die mobilisering van ligaams reserwes as ook n' verhoging in skildklier aktiwiteit. Die gemiddelde bloedglukose konsentrasie het ook n' invloed gehad op die hoeveelheid kere n' koeie geinsemineer is voordat sy gevat het. Die koeie wat drie keer geinsemineer was het 'n betekenisvolle laer glukose konsentrasie gehad as die wat net een of twee inseminasies nodig gehad het om te vat. Laer glukose konsentrasies het gely tot n' langer tydperk tussen kalwing en herkonsepsie en dit het 'n ekonomiese uitwerking op n' melkboerdery.

Die gevolgtrekking wat van hierdie studie gemaak kan word is dat, alhoewel bloed metaboliete 'n waardevolle bydrae kan lewer tot die bepaling van 'n dier se metaboliese en produktiewe status, die gebruik van die hand glukometer van min waarde is in die bepaling van hierdie faktor omdat soveel ander faktore bloed glukose en bloed cholesterol konsentrasies beinvloed. Die hand glukometer kan tog 'n waardevolle bydrae maak in die bepaling van 'n dier se bloed glukose konsentrasie sodat die konsentrasie bo 'n sekere vlak gehou kan om sodoende die tydperk tussen kalwing en herkonsepsie tot 'n minimum te beperk.