The Possible Relationship Between Feeding, Fertility, and Blood Parameters of Milking Cows

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Blood parameters from 1000 Israeli-Holstein breed milking cows in 30 kibbutz dairy herds, were studied during a period of 3 years and the relationship to feeding and fertlity was studied. The cows were raised and kept under similar management and A.I. regimes. Herds with high OCR (Overall conception rate) of 48.3 ± 1.3 were considered good ones, while farms with low OCR (30.0 ± 1.3) were considered poor ones. High producing cows were cows that gave 28 kg (and over) milk/day while low producing cows were those that gave 27 (and less) kg milk/day, this at a period of up to 90 days postpartum.

Feed composition had a significant effect (p 0.001) on OCR. In the high OCR herds, cows were fed concentrates and roughage at a ratio of 69:31, while in the low OCR herds the ratio was 80:20, based on dry matter. There was also a good correlation (p 0.001) between OCR and the blood parameter Δ Pi (a difference obtained by subtracting the level of the whole blood inorganic-P from the serum inorganic-P). In cows from herds with high OCR Δ Pi was 0.75 ± 0.06 (n=107), while in herds with low OCR this value was 1.33 ± 0.05 (n = 106). There was no significant difference between feeding or OCR and the blood parameters urea, total proteins, albumine, glucose, total-lipids, cholesterol inorganic and organic-P, calcium and magnesium.

Introduction

The problem of herd infertility is one of great economical importance. Milk cows of the same breed, kept under similar husbandry conditions and artificial insemination vary in their fertility rate. The question is whether this phenomenon is related to nutrition and whether these differences could be detected and defined by blood tests so that changes could be made to improve fertility. The topic of detecting the problematic herds and cows was investigated extensively and many blood constituents were suggested as good parameters (1, 6, 8, 10, 11, 12, 13, 14, 18). The results and conclusions recommended by the different investigators are different.

This could be due to variations on the husbandry conditions and nutrition of the cows. Some results describing the relationship between feeding and fertility have been reported (4, 5, 6, 7, 8, 9, 15, 17). The following report describes the results of study relating to fertility, nutrition and levels of blood parameters.

Materials and Methods

Israeli Fiesian cows in commercial kibbutz herds weighing approximately 650 kg at maturity and producing an average of over 8000 dg milk/305 days at 3 milkings/day were used. The herds were under similar management and artificial insemination (A.I.) The herds were divided into 2 groups according to the overall conception rate (OCR), defined as total yearly number of insemination pregnancies, divided by the total yearly number of inseminations x 100.

Feed samples - from each farm were taken and analyzed for the content of calcium, phosphorus (P), digestible proteins and dry matter. Calculations were done on the dry matter basis.

Blood was taken from at least 10 cows from each farm. Only cows yielding at least 28 kg milk/day were taken. The blood was taken from the jugular vein and serum was obtained. Total proteins, albumin, globulin, total lipids, cholesterol, glucose, total organic and inorganic P, urea, calcium and magnesium were determined according to methods previously described by Bogin et al. (2). Total P, inorganic and organic-P were determined both in serum and whole blood by methods descriped by Bogin et al. (3). Glucose was determined in whole blood. The value delta Pi (Δ Pi) was calculated by subtracting whole blood-Pi from serum Pi. Data analysis was done according to SAS user's guide (16).

Results

Table 1 describes data on the cow and OCR. As seen there are highly significant differences (p 0.001) between the two

groups when OCR is calculated on either 1 month of blood sampling, 3 months (including month prior and after blood sampling) or yearly basis and also on the inseminations to conception. There was no difference between the groups on open days, rest days, calvings, milk and fat yields.

Table 2 gives total and composition of feed given to the two groups of herds. As seen there are significant differences in feed composition between the two groups. Tables 3 and 4 describe the levels of various blood constituents. There were highly significant differences (p 0.001) in the calculated ratio of total lipids to glucose and in the values of blood Pi and Δ Pi. There were small or no differences in the levels of most other blood constituents.

Discussion

As seen, feed composition has an adverse effect on both fertility and some of the blood parameters. Higher levels of concentrated feed related directly to OCR. It is not clear which of the feed constituents is responsible for this effect, either by exerting a direct effect on the metabolism or being less available to the animal. Two out of the various blood parameters studied showed a highly significant relationship to nutrition and fertility. The energetic parameter total lipids to glucose ratio and the phosphates - blood Pi and Δ Pi. While neither glucose nor lipids were very much different in the two groups, the calculated ratio of the two was highly significantly different (p 0.001), resulting from somewhat lower blood glucose and higher total lipids. This parameter which is based on 2 metabolically related blood constituents, is a better one than each one alone, is more accurate and has a smaller standard deviation. The results of this study show that cows from herds with low OCR have a higher ratio which may indicate on possible energy shortage. The other blood parameter Δ Pi, which is also a calculated value is based on two other parameters, Pi in serum and whole blood. Since the level of pi in the red blood cells is small and the volume of the erythrocytes is about 35%, Pi in whole blood is smaller and thus the value Δ Pi which is obtained by subtracting the value of Pi in whole blood from that in serum is a positive value. The scale of this parameter is more sensitive than blood Pi in the serum or blood. While the difference of Pi in the blood from the two groups was 18%, on the scale of the parameter Δ Pi it was 77%.

Measurements of whole blood Pi is preferred to measurements of serum since it allows the determination of Pi in the freshly drawn blood which changes which take place during the prolonged process of serum preparation at room temperature. Thus the value Δ Pi indicates some differences in phosphate compounds in the erythrocytes. It seems that since total P of whole blood in cows from the 2 groups is similar and since blood-Po is higher while Pi is smaller, that there are larger quantities of some organic phosphates in some cows from herds with high OCR. Whether is represents a metabolic situation in the cow requires a further investigation which is presently being done in our laboratory.

References

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