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RELATIONSHIP BETWEEN SERUM TOTAL CHOLESTEROL LEVELS BEFORE CALVING AND OCCURRENCE RATE OF DISEASES AFTER CALVING IN HOLSTEIN HEIFERS AND COWS

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The relationship between serum total cholesterol levels 20 days before calving and disease occurrence rate in relation to milk producing capacity after calving was investigated. In cases where peak daily milk yield were below 30kg, the disease occurrence rate in cows with total cholesterol levels between 120–170mg/dl and those with levels below 120mg/dl were 22.6% and 63.9%, respectively. The disease occurrence rate in cows with total cholesterol levels less than 120mg/dl was significantly higher ($P<0.01$). Similar observation was made in cows with peak daily milk yield of over 30kg. In this group moreover, cows with total cholesterol levels of more than 170mg/dl have significantly lower disease occurrence rate as compared to those with total cholesterol levels less than 120mg/dl ($P<0.01$). From these results, the prophylactic diagnosis using total cholesterol level and peak milk yield was found useful as an indicator to predict the occurrence of diseases after calving on farms with average milking yield between 5,000kg to 6,500kg/year.

Key words: cattle, total cholesterol level, disease occurrence rate, calving.

INTRODUCTION

With the increase of milk yield, the occurrence of diseases in dairy cows tend to increase. In Japan, the average milk yield/head have increased from 4,464kg in 1975 to 5,054kg in 1981. Concurrently the occurrence of diseases such as fat cow

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syndrome[4] or parturition syndrome[5] have increased from 18.3% in 1975 to 33.0% in 1981 and persisted till now[2]. Great emphasis should be placed on prophylaxis so as to reduce their rate of incidence. SOMMER[5] reported that by measuring the level of GOT and total cholesterol (T-CHO), the occurrence of diseases after calving could be predicted. He found that 50–80% of cows with increased GOT or reduced T-CHO levels fall ill postpartum as compared to 10–20% of animals with normal levels. Similar results were obtained by other researchers[3,7,10]. However, the useful application of this method in predicting the occurrence of diseases has been questioned by researchers in New Zealand[8] and Japan[9].

In this paper, the relationship between T-CHO levels before calving and disease occurrence rate after calving in relation to milk producing capacity after calving was investigated.

MATERIALS AND METHODS

This survey was done on 53 farms in Hokkaido, Japan from July, 1982 to July, 1983. These farms were divided into 2 groups according to milk yield. In group 1, 271 Holstein heifers and cows in 46 farms with an average milk yield between, 5,000kg to 6,500kg per year were used. In group 2, 85 Holstein heifers and cows in 7 farms with an average milk yield over 7,000kg per year. In both group, they were managed intensively in stanchion type barn. They were fed corn or grass silage, hay and concentrates. The cows were divided into 3 groups according to serum T-CHO level; a) below 120mg/dl, b) between 120mg/dl and 170mg/dl, and c) over 170mg/dl. Occurrence of diseases which are included in the parturition syndrome was recorded from 7 days before calving to 60 days after calving. Milk yield of each individual cows was measured once a month and the peak production was recorded. Blood sample was collected from the coccygeal vein. Days of sampling were grouped into 3 sampling time; a) 20–49 days, b) 50–69 days, and c) over 70 days before calving. Serum was separated and analysed for T-CHO using a spectro-photometric enzyme method (International Reagents Corp.).

RESULTS

In group 1, 15 kinds of diseases were observed between 7 days before calving and 60 days after calving. Ovarian disorders (21.9%), diseases of the udder (18.1%), downer cow syndrome (13.1%), digestive disorders (12.5%), and diseases of claw and limb (10.0%) were most prevalent (table 1). The relationship between serum T-CHO levels and disease occurrence rate in group 1 is shown in table 2. Fifty-five percent of 271 cows suffered from disorders of one or more kinds. Disease occurrence rate of cows with serum T-CHO levels below 120mg/dl, between 120mg/dl and 170mg/dl

TABLE 1 *Kind of diseases occurred in cows within 60 days after calving in group 1*

KIND OF DISEASE	NO. OF DISEASE (%)
Diseases of the ovary	35 (21.9)
Diseases of the udder	29 (18.1)
Downer cow syndrome	21 (13.1)
Digestive disorders	20 (12.5)
Diseases of claw & limb	16 (10.0)
Retained placenta	11 (6.9)
Diseases of the uterus	5 (3.1)
Dystocia	4 (2.5)
Still birth, premature birth	4 (2.5)
Ketosis	4 (2.5)
Puerperal fever	3 (1.9)
Respiratory disorders	2 (1.3)
Uterine torsion	2 (1.3)
Vaginal prolapse	2 (1.3)
Piroplasmosis	2 (1.3)
Total	160 (100%)

TABLE 2 *Relationship between serum total cholesterol levels of dry cows and occurrence of disease within 60 days after calving in group 1*

T-CHO (mg/dl)	<120	120–170	>170
Percentage of occurrence	69.4%[a] (100/144)	38.0%[b] (38/100)	40.7%[b] (11/27)

No. of cows diseased / No. of cows studied =149/271 (55.0%)
ab: $p<0.01$ (λ^2- test)

and over 170mg/dl were 69.4%, 38.0% and 40.7%, respectively. Disease occurrence rate of cows was significantly higher in those cows with serum T-CHO level less than 120mg/dl ($P<0.01$). The relationship among T-CHO levels, peak milk yield and disease occurrence rate in group 1 is shown in table 3. In the case where the peak milk yield is below 30kg/day, the disease occurrence rate (22.6%) of cows with T-CHO level between 120mg/dl and 170mg/dl was significantly lower than that of cows with T-CHO below 120mg/dl ($P<0.01$). When the peak milk yield was 30kg and over, the disease occurrence rate (73.5%) of cows with T-CHO below 120mg/dl was significantly higher than 44.9% of cows with T-CHO between 120mg/dl and 170mg/dl and 27.8% of cows with T-CHO over 170mg/dl ($P<0.01$). The relationship between T-CHO levels at different days before calving in dry cows with peak milk yield of 30kg

TABLE 3 *Relationship of serum total cholesterol levels of dry cows, peak milk yield and occurrence of disease within 60 days after calving in group 1*

MILK YIELD (kg) \ T-CHO (mg/dl)	<120	120–170	>170
30>	63.9%[a] (39/61)	22.6%[b] (7/31)	66.7% (6/9)
30≦	73.5%[c] (61/83)	44.9%[d] (31/69)	27.8%[e] (5/18)

ab, cd, ce : $p<0.01$
bd : $p<0.05$

TABLE 4 *Relationship between serum total cholesterol levels at different days before calving in dry cows (30kg and above peak milk yield) and occurrence of disease within 60 days after calving in group 1*

DAYS* \ T-CHO (mg/dl)	<120	120–170	>170
20–49	69.8% (37/53)	60.7% (17/28)	66.7% (2/3)
50–69	85.7%[a] (24/28)	38.2%[b] (13/34)	16.7%[c] (2/12)
70 ≦	0.0% (0/2)	14.3% (1/7)	33.3% (1/3)

*: Days before calving
ab, ac : $p<0.01$

and over and disease occurrence rate in group 1 is shown in table 4. When T-CHO was measured between 20 days and 49 days before calving, the disease occurrence rate was not significantly different among 3 groups. Between 50 days and 69 days before calving, the disease occurrence rate (85.7%) of cows with T-CHO below 120mg/dl was significantly higher than 38.2% of cows between 120mg/dl and 170mg/dl, and 16.7% of cows with T-CHO over 170mg/dl ($P<0.01$). The relationship between T-CHO levels at different days before calving in dry cows with peak milk yield below 30kg and disease occurrence rate in group 1 is shown in table 5. When the peak milk yield was below 30kg, the disease occurrence rate of cows with T-CHO between 120mg/dl and 170mg/dl was significantly lower than that of cows with T-CHO below 120mg/dl between 20 days and 49 days, and between 50 days and 69 days ($P<0.05$). The relationship between T-CHO levels and disease occurrence rate in group 2 is shown in table 6. The disease occurrence rate was not different among the groups.

TABLE 5 *Relationship between serum total cholesterol levels at different days before calving in dry cows (below 30kg peak milk yield) and occurrence of disease within 60 days after calving in group 1*

T-CHO (mg/dl) / DAYS*	<120	120–170	>170
20–49	61.1%[a] (22/36)	23.1%[b] (3/13)	66.7% (2/3)
50–69	69.6%[c] (16/23)	28.6%[d] (4/14)	66.7% (2/3)
70≦	50.0% (1/2)	0.0% (0/4)	66.7% (2/3)

*: Days before calving
ab, cd: $p<0.05$

TABLE 6 *Relationship between serum total cholesterol levels of dry cows and occurrence of disease within 60 days after calving in group 2*

MILK YIELD / T-CHO (mg/dl)	<120	120–170	>170
7,000kg≦	66.1% (37/56)	64.0% (16/25)	25.0% (1/4)

DISCUSSION

The normal range of T-CHO of cows 6–8 weeks before calving estimated by SOMMER[6] was between 90mg/dl and 150mg/dl. However, our results showed that the normal range was between 120mg/dl and 170mg/dl. In the case of cows with peak daily milk of more than 30kg, the upper levels of the normal range seem to be higher though we do not know the exact levels yet.

Other researchers[3,8,9,10] including SOMMER[5], did not take lactation capacity after calving into consideration. It is supposed that lactation capacity is an important factor in predicting disease problems after calving by means of T-CHO which is thought to indicate the metabolic condition of animals. The factors affecting the occurrence of diseases after calving were supposed to be the animal's metabolic condition and energy balance before and after calving. The energy balance is dependent partly on lactation capacity after calving[1]. Initially, we tried to apply the parameter on dry cows in different farms without regards of milk yield but the accuracy was not good in some farms. When milk yield was taken as a parameter, the accuracy was similar with the results of SOMMER[5] and LOTTHAMMER et al[3]. Our concept that the factors affecting the occurrence of diseases were metabolic condition and energy balance before and after calving was substantiated by the fact that the occurrence rate of diseases of cows with T-CHO levels between 120mg/dl and 170mg/dl was higher in the group with peak daily milk yield of 30kg and over, compared to that in the group with milk yield below 30kg.

According to LOTTHAMMER et al[3] if the check-ups take place nearer the calving date, more animals at risk would be recovered. In regards with the days between blood collection and calving, the accuracy is different between peak milk yield of below and over 30kg. We do not know why the parameter was useless between 20 days and 49 days before calving when it is applied on the cows with peak milk yield of 30kg and over. Moreover, prediction by means of T-CHO was impossible in farms milking over an average of 7,000kg. For the individual preventive examination of cows managed in farms milking over an average of 7,000kg, other items besides T-CHO would be required, for example, Na,, P as recommended by SOMMER[6] or items indicating energy balance. In our experiment, GOT activity was also measured. Though the relationship between GOT activity before calving and occurrence rate of diseases after calving was investigated, the result did not conform to that of Sommer[6].

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