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Survey fatty liver syndrome in cattle in Kermanshah province

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ABSTRACT

Fatty liver is one of the major metabolic disorders that in early lactation stage, almost in half of dairy cows that were calved several times, causing a mild or extreme to be involved. The aim of the present study was to assess the prevalence of fatty liver syndrome, with the evaluation of levels of serum NEFA, Glucose, triglycerides, and albumin in the dairy cows of Kermanshah region. Dairy cows sampled in four groups based on pregnancy status of 1-8 months pregnant, 8-9 months pregnant, giving birth less than a month ago and they were divided into more than one month before their delivery. Levels of serum NEFA, Glucose, triglycerides, and serum albumin were determined spectrophotometrically. The results of the study showed highly significant differences among the groups in terms of NEFA there and most of them are in cows that less than one month gone of their birth. Also, triglyceride and glucose levels were significantly different between pregnant cows and not pregnant ones, but according to our results the levels of the amount of albumin there was no significant difference between the four groups under the study.

Keywords: Dairy cow, Serum, Fatty liver, Kermanshah

INTRODUCTION

Fatty liver syndrome (Hepatic lipidosis) or fat cow syndrome is a major metabolic disorder in many dairy cattle's in early period of lactation (8) and it's combined with decrease in health and reproduction rate of livestock (10, 14). Fatty liver syndrome was documented in forties (decade 1940) but there were few researches about it until mid-seventies. In early 70 and 80 decades, this syndrome was reported around calving widely and it was recorded in many countries (8). When this disorder is severe, milk production and appetite of cow, both are decreased. So effective prevention of fatty liver can save millions of dollars every year and prevent from decrease in milk production (6).

Incidence of Fatty liver in dairy cattle is mainly in first four weeks after calving (12), when more than 50% of cows show different degrees of Triacylglycerol (TAG) accumulation in their livers (14, 15). One of the reasons is that daily nutrition of cow is not sufficient and it can't meet increasing need of energy in cattle that is producing milk. In this condition, none Esterified fatty acid (NEFA) is released from adipose tissue, often more than it's needed, and extra amount is transferred to liver, especially in fat cows (17).

Fatty liver occurs when liver harvesting of lipids is more than their Oxidation and secretion by the liver and it is with high plasma concentrations of NEFA that is resulted from high adipose tissue (6, 12). Extra fat is stored in liver as TAG and results in decrease of metabolic function of liver (6). Liver is classified to three types, according to fat level: normal liver, liver with average fat and liver with very high fat (6, 12). The latter type is categorized to Non-encephalopathic fatty liver (2) and hepatic encephalopathy (6, 12).

Unbalanced or insufficient nutrition, overweight and high concentration of estrogen are involved in etiology of fatty liver (10). The disorder can be accompanied with high rate of dystocia, infectious and inflammatory disease, long interval between parturitions and reduction of milk and longevity average (10). For as much as even slight fatty liver is dual with decrease in health and reproduction status of cow, prevention of its occurrence with supplying enough food and creating an isolated place at preparation period for parturition can reduce decline rate of producing milk and it would be the most efficient therapeutic procedure among the other methods (26).

However this prevention is not enough for fat cows or the ones that are not feed well, the cows that have problem during parturition or had twins, the cows that have metabolic or infectious disease and the ones that have developed severe energy imbalance because of producing high amount of milk immediately after parturition (26). Assuming existence of about 9 million dairy cattle all over the America, annual charges of fatty liver in this country is estimated more than 60 million dollars (2). If there are more studies about molecular changes and relationship between the disease and immunity function, better remedies and more efficient ways to prevent fatty liver can be presented (28).

In Iran, because of industrial methods that speed for nurture and maintenance of dairy cattle, and because of producing more milk, more nutrition is considered; occurrence of this syndrome is most likely. According to these conditions, providing exact diagnose of this syndrome and estimate it's incidence rate and finally how to prevent it in our country is a necessity and this case made us do the first study about this disease in Kermanshah, Iran. It's possible that origin of many diseases happening around parturition could be fatty liver incidence in this region's dairy cattle.

MATERIALS AND METHODS

One hundred crossover dairy cattle which were apparently healthy and aged 3 to 5 years old were surveyed. Cows were divided into four groups as follows:

Group 1: not pregnant cows that less than one month has passed their calving (-1), group 2: not pregnant cows that more than a month ago they calved (+1), group3: cows under 8-month pregnant (-8), group 4: cows above 8-month-pregnant (+8).

Then from each of the four groups of cows serum samples were obtained. Samples have been frozen and were stored in a freezer until the process of taking samples complete. After that in serum samples amount of NEFA levels, Albumin, Glucose and Triglycerides were measured by kits of Randox Company and with the spectrophotometery method.

Data Analysis

The data of the study was evaluated with using SPSS software version 18.0. For comparing of each data between four groups of study ANOVA test and Duncan post hoc test was performed. To determine the relationship between NEFA levels with each set of data statistical analysis was performed using Pearson's correlation.

RESULTS

Our results indicated that NEFA amounts increase around parturition, and then it is decrease, also it was showed that until one month after calving it was very high and was different statistically from other periods. Also results of study indicated that the Glucose was increase before calving and decrease immediately after it, and it was different statistically between before and after calving ($p<0.01$). Triglyceride levels before calving increase and until 1 month after calving it reach to highest and then it was decreased in our study. Also our research results showed that there was not any significant difference between groups in Albumin amounts ($p>0.05$).

Table1: Mean ± Standard Error of NEFA, Glucose, Triglyceride and Albumin in different groups

Group	NEFA (µEq/lit)	Glc (mg/dl)	TG (mg/dl)	Alb (mg/dl)
1	703.10±26.31^{d*}	27.75±2.83^{a}	106.35±7.18^{b}	3.18±0.32
2	214.25±22.83^{b}	37.40±3.19^{a}	94.55±7.94^{b}	3.30±0.24
3	112.15±18.63^{a}	66.35±6.78^{b}	68.05±4.80^{a}	3.39±0.19
4	396.15±24.83^{c}	68.50±6.68^{b}	75.50±6.29^{a}	3.68±0.23
P value	0.001	0.001	0.001	0.541

**Different alphabets in same column indicated there is a significant difference between groups.*

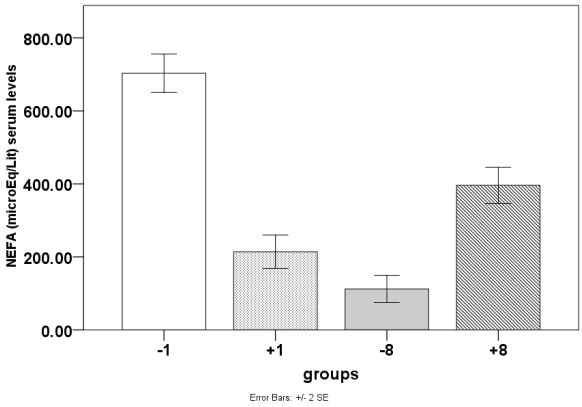

Figure1: Serum levels of NEFA (mEq/l) in different groups

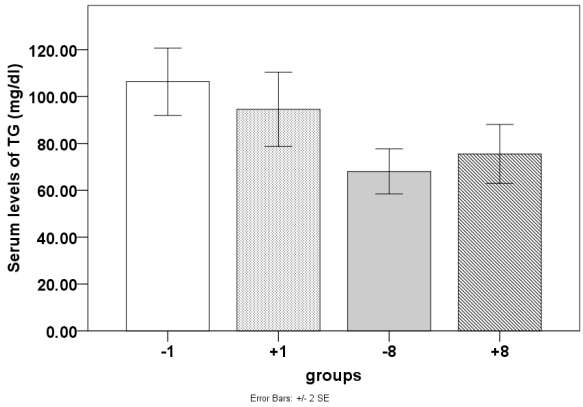

Figure3: Serum levels of TG (mg/dl) in different groups

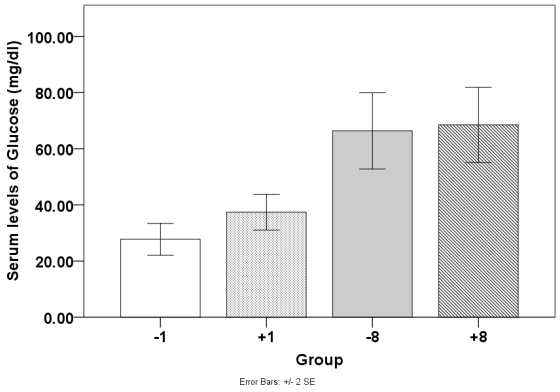

Figure2: Serum levels of Glucose (mg/dl) in different groups

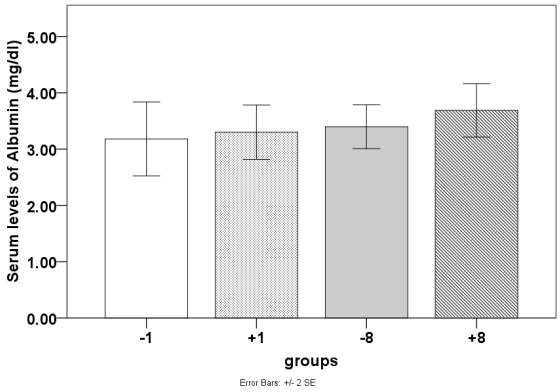

Figure4: Serum levels of Albumin (mg/dl) in different groups

DISCUSSION AND CONCLUSION

Fatty liver syndrome was documented in the 1940s but by the mid 1970s, little research was done about it (3). In the 1970s and in early 1980s this syndrome in dairy cows around the time of calving widely reported and this event was recorded in many countries (8).

Fatty liver is the most probable when the blood NEFA density is high that Often come to more than 1,000 mEq per L in calving. In first esterfication NEFA turn to TG that in ruminants due to insufficient oxidation of NEFA, Large amounts of ketone bodies, acetoacetate and BHBA are produced. From reasons of diseases we can refer to sudden changes in diet, Stress, Disease before calving, emaciated cows and obesity. Bacic et al., concluded that niacin could reduce blood ketone bodies and also propylene glycol orally is effective for reducing NEFA (1). For having information about fatty liver syndrome can use blood biochemical parameters or take samples of liver cells (27).
Today is generally believed that a high percentage of multi-parous cows with around parturition will hit from liver mild or severe fatty liver (6, 13). Approximately during the delivery amount of non-esterified fatty acids in the blood in almost all cows will increase and pour into liver (6). The increase in non-esterified fatty acids before delivery can lead to diseases such as ketosis, LDA, Metritis and fatty liver after delivery (9). If one cow is in positive energy balance amount of non-esterified fatty acids in the blood is about 200 mEq per liter. From 3 weeks before the

delivery these acids in the blood gradually increase and come to 300 mEq per liter in the last week of parturition from 2 to 3 days before the delivery amount of these acids increase dramatically as if the day before delivery they come to 800-1200 mEq per liter. These acids should be decreased immediately after delivery, so if 7 days after delivery they were higher than 700 mEq per liter, it is indication of a negative energy balance and occurrence of fatty liver is likely. These acids should return to normal form in 3 week after delivery. In the current study based on analysis of variance (ANOVA) there is a significant increase in serum NEFA in postpartum cows compared to the other groups.

In the study by Rezaei saber and colleagues (2007) was conducted in Ahvaz slaughterhouse the highest levels of NEFA (Non-esterified fatty acids) in cows that less than one month passed from their calving, in this study any significant correlation between direct serum bilirubin and increasing amount of serum NEFA were not reported, but quite significant correlation between the increasing amount of fat of serum and increasing of liver enzymes and increasing of total bilirubin specially in postpartum cows were reported (21). In mentioned study in the first month after delivery amount of non-esterified fatty acids were higher than 1000 mEq per liter (21).

From Drackely views increasing of non-esterified fatty acids higher than 1000 mEq per liter were considered as severe fatty liver (6). The findings of Grummer (1993) also showed that in the first 4 weeks after delivery the highest accumulation of fat in the blood can be observed that it is consistent (6).

Fatty infiltration in liver on gluconeogenesis by hepatocytes has no effect (24, 25). But TG accumulation in hepatocytes decrease cell capacity for urea synthesis and ammonia can reduce the power of hepatocytes in glucose synthesis from propionate (18). So the TG accumulation in hepatocytes of cows effects on glucose synthesis indirectly.

Also in this study as shown in Table 1 can be observed the lowest serum glucose levels is in postpartum cows that they also had the highest NEFA in serum. Pearson correlation results also showed that there is a significant and inverse correlation between NEFA of serums and glucose ($p<0.01$).

With pregnancy progress will increase the amount of glucose that is one of the reasons of hypoglycemia that refers to hypoglycemia pregnancy which could occur (23).

Rukkwamsk et al., (1999) also conducted studies on the effect of fatty liver on hepatic gluconeogenesis of liver and found that Fatty liver has bad effect on hepatic gluconeogenesis (22). As in one week prior to delivery high liver glycogen and 1 week after delivery liver glycogen decreases also in liver phosphoenol pyruvate carboxykinase enzyme in 1 week before and 0.5 and 2 weeks after delivery decreases and 1, 6 fructose D-phosphatase enzyme tended to decrease and 1, 6 glucose D-phosphatase enzyme tended to increase after delivery. So Gluconeogenesis is not desired in the liver that in the result of it the continuing of the process of lipolysis and fatty liver occur (22).
In the studies by Djokovic et al., (2007) were performed turn out that in cows with ketosis glucose and gluconeogenesis levels decrease and also decreasing in insulin appears that this is apparently decreasing in ability of endocrine pancreatic B cells in releasing of insulin (5).

The results of present study also showed that the amount of glucose was decreased in cows that their NEFA was significantly increased ($p<0.01$).

Related to serum albumin, previously researchers have shown that in fatty liver can be notably reduce it has been shown that a serum albumin density become lower not long after delivery and then gradually rises during the first month of lactation (20). It has shown that between one by one cows from aspect of serum albumin there is differences as if in some of cows during delivery serum albumin decreased and in other group it was stay the same. Hypoalbuminemia is one of the prevailing and chronic liver diseases and that occurs when liver function is reduced to 80% (7).

The lowest level of serum albumin in complete liver failure occurs not in cows with fatty liver (19), there is evidence that total protein synthesis and blood albumin is not affected by the accumulation of TAG in Hepatocytes in cows (24, 25).According to the present study results table 1 there was no significant difference between the studied groups according to pregnancy status from the aspect of serum albumin rate ($p>0.05$).

According to Table 1 significant correlation between serum NEFA and albumin in animals which were understudy was not observed (P> 0.05).

Bremmer et al., (2000) demonstrated that in greedy cows the NEFA accumulation in serum include palmitic, oleic, and linoleic and Stearic acid. In TG accumulation in the liver includes palmitic, oleic and linoleic acid found that stearic acid is consumed in oxidation of liver (4). Also Grohn et al., (1983) found that in cows with ketosis a positive correlation between the penetration of fat and accumulation of ketone bodies and have a negative correlation with glucose accumulation. Also there was a positive correlation between the penetration of fat and liver enzymes and found that OCT and SDH enzymes can be used to identify cows with ketosis and fatty liver. From other ways of identifying liver we can pointed to: 1- BHBA accumulation, 2– biopsy of liver (11).

Lubojacka and colleagues in a study that they were conducted (2005) discovered that cows with fatty liver in 2 weeks after delivery had increases in serum BHBA, NEFA, LDH, cholesterol, triglycerides, bilirubin, accumulation and decrease in protein accumulation and urea (16).

In the present study and according to Table 1 on cows of Kermanshah region that was found the highest serum levels of triglycerides in postpartum cows is observed and between pregnant and non-pregnant animals, from the aspect of levels of triglycerides there was significant difference (P <0.01).

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