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Fatty Liver Syndrome In Dairy Cattle: Relationship Between Nefa And Tg Serum Values In This Syndrome

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Abstract: Fatty liver syndrome (Hepatic lipidosis) or fat cow syndrome is a major metabolic disorder in many dairy cattle's in early period of lactation. The aim of this study was to evaluating fatty liver syndrome in dairy cattle in Tabriz by measurement of NEFA and TG serum values. The results showed that NEFA has a direct relationship with TG. Thus, with elevating of NEFA serum values, TG also increased.

Key words: fatty liver, dairy cattle, NEFA, TG, Tabriz.

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 (Bruss, 1993; Eddy, 1992) and it's combined with decrease in health and reproduction rate of livestock (Goff and Horst, 1997; Jorritsma, *et al*., 2001). 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 parturition widely and it was recorded in many countries (Bruss, 1993; Eddy, 1992). 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 (Drackley, 1999). Incidence of Fatty liver in dairy cattle is mainly in first four weeks after parturition (Grummer, 1993), when more than 50% of cows show different degrees of Triacylglycerol (TAG) accumulation in their livers (Jorritsma, *et al*., 2000; Jorritsma, *et al*., 2001). 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 (Mcnamara, 2000). 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 (Drackley, 1999; Grummer, 1993). Extra fat is stored in liver as TAG and results in decrease of metabolic function of liver (Drackley, 1999). Liver is classified to three types, according to fat level: normal liver, liver with average fat and liver with very high fat (Drackley, 1999; Grummer, 1993). The latter type is categorized to Non-encephalopathic fatty liver (Bobe, *et al*., 2004) and hepatic encephalopathy (Drackley, 1999; Grummer, 1993). Unbalanced or insufficient nutrition, overweight and high concentration of estrogen are involved in etiology of fatty liver (Goff and Horst, 1997). 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 (Goff and Horst, 1997). Forasmuch 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 (Wensing, *et al*., 1997). 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 (Wensing, *et al*., 1997). 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 (Bobe, *et al*., 2004). 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 (Zerbe, *et al*., 2000). In our country, 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 Tabriz. It's possible that origin of many diseases happening around parturition could be fatty liver incidence in this region's dairy cattle.

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MATERIALS AND METHODS

This research is descriptive – analytical. In this quest, during frequently visits from dairy cattle farms of Tabriz, according to statistics of dairy cattle in Tabriz area, the inspection of 122 Holstein cows were done. In this inspection, age, body condition score and Pregnancy status of animals was investigated (Edmonson, *et al*., 1989). In next stage, according achieved results; Cows were divided into 3 groups based on their liver TG percentage. Simultaneous inspection of animals, attempting to obtain blood samples of 10 ml of jugular vein was done by venoject. Blood samples taken near the ice and sent to the laboratory and after serum preparation were freezing inside the micro tube. At the time of testing, sera were defrosted and NEFA levels in serum by Randox kit and Auto analyzer were measured. In this study, levels of TG in serum by Pars test kits and by spectrophotometric method was measured. In this study to analyzing and comparison of data were used of ANOVA test and to evaluate the relationship between the variables together, correlation test was used.

RESULTS AND DISCUSSION

NEFA serum value average:

Based on table 1 and ANOVA test results, NEFA serum value average in normal group was 615.06±126.28, in mild group was 696.61±64.49 and in moderate group was 839.10±46.96, that based on F= 28.58 with significance levels of 0.000 is significant. ($p<0.001$)

Table 1: Mean serum NEFA in Holstein dairy cows based on liver TG percentage

groups	NO.	mean	Mean square between groups	Mean square within groups	F	P
Normal	31	615.06±126.28				
Mild	81	696.61±64.49				
moderate	10	839.10±46.96	199605.96	6983.76	28.58	0.000
total	122	687.57±100.83				

TG serum value average:

Based on table 2 and ANOVA test results, NEFA serum value average in normal group was 0.65±0.22, in mild group was 2.41±0.45 and in moderate group was 8.64±0.64, that based on F= 1313.92 with significance levels of 0.000 is significant. ($p<0.001$)

Table 2: Mean serum TG in Holstein dairy cows based on liver TG percentage

groups	NO.	mean	Mean square between groups	Mean square within groups	F	P
Normal	31	0.65±0.22				
Mild	81	2.41±0.45				
moderate	10	8.64±0.64	241.54	0.184	1313.92	0.000
total	122	2.47±2.04				

Relationship between NEFA and TG:

Based on table 3 and Pearson's Correlation index revealed that between NEFA and TG serum values there is a significant and direct correlation so that correlation index was r=0.586. This index indicates a positive effect of NEFA on TG serum values. Thus, with elevating of NEFA serum values the TG values also increase.

Table 3: correlation index between NEFA and TG serum values

variables	TG
NEFA	R= 0.586 P= 0.000 N= 122

Discussion:

For awareness of fatty liver syndrome, blood biochemical parameters can be used or we can measure TAG and total fat of hepatic cell. Some researchers inspect fatty liver based on TAB or hepatic fat percent (Wensing, *et al*., 1997; Raid, 1980) divided livers in 4 levels depending on severity of fat accumulation in it: Normal, slight, average and severe (Reid, 1980). Nowadays general opinion is that a high percent of mature cows show signs of slight or severe fatty liver around parturition (Drackley, 1999; Grummer, 1995). Almost near parturition NEFA increases in blood and moves to liver, and can cause ketosis, abomasums displacement, metritis and fatty liver after parturition (Drackley, 1999; Drackley, 2000; Geelen and Wensing, 2006). In a normal situation and positive energy balance, NEFA value is about 200 meq/lit in blood. This value increases since 3 weeks is parturition and reaches to 300 meq/lit in the last week. In the last days before parturition, it reaches to 800 -

1200mcq/lit. After parturition these acids should wane immediately and if it remains more than 700meq/lit after 7 days, represents negative energy balance and probability of fatty liver incidence. 3 weeks after parturition the amount of these acids should return to normal level (200meq/lit) (Drackley, 2000). Also the results of this study have conformity with Grummer results that showed three is most lipid aggregation in liver in first 4 weeks after parturition (Grummer, 1993). There was a research in Netherlands about 71 dairy cattle before parturition that showed 5 percent of liver is occupied with TAG (Johannsen, *et al*., 1993). Also in a slaughterhouse research in Tehran, aggregation of TAG more than 10% in liver in last month of pregnancy was reported. These researchers had not measured NEFA values. In this study, TAG aggregation in liver in last month of pregnancy had occupied more than 5% of liver cells and amount of NEFA was more than 900meq/lit being nonspecific and some other reasons. Slight and Mild forms of fatty liver con destroy hepatocytes and disturb liver function without making any changes in activity of hepatic specific enzymes found in serum. Measurement of liver enzymes in serum is useful for evaluating fatty liver disease but with certain restrictions such as is being nonspecific. Mild and moderate forms of fatty liver with damaged hepatocytes can cause liver and no specific changes in liver enzymes in serum, liver dysfunction to establish (Bogin, *et al*., 1988; Rukkwamsuk, 1999).

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