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ORIGINAL ARTICLE

Study of Fatty Liver Syndrome Frequency in Dairy Cattle by Evaluating NEFA, APO-A, Ammoniac, Tsh and Total Bilirobin Serum Values in Tabriz

[1]Amirparviz Rezaeisaber, [2]Mehrdad Nazeri

[1]Department of clinical science, Tabriz branch, Islamic Azad University, Tabriz, Iran.
[2]Young Researchers Club, Tabriz Branch, Islamic Azad University, Tabriz, Iran

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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, APO-A, Ammoniac, TSH and Total Bilirobin serum values. The results showed that NEFA has a positive relationship with ammoniac and total Bilirobin serum values and reverse relationship with APO-A and TSH. Thus, with elevating of NEFA serum values, ammoniac and total Bilirobin also increased and TSH and APO-A contrary diminished.

Key words: fatty liver, dairy cattle, NEFA, BHBA, Urea, Total Protein, cholesterol.

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 [3,6] and it's combined with decrease in health and reproduction rate of livestock [9,14]. 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 parturition widely and it was recorded in many countries [3,6]. 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 [4]. Incidence of Fatty liver in dairy cattle is mainly in first four weeks after parturition [10], when more than 50% of cows show different degrees of Triacylglycerol (TAG) accumulation in their livers [13,14]. 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 [15]. 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 [4,10]. Extra fat is stored in liver as TAG and results in decrease of metabolic function of liver [4]. Liver is classified to three types, according to fat level: normal liver, liver with average fat and liver with very high fat [4,10]. The latter type is categorized to Non-encephalopathic fatty liver [1] and hepatic encephalopathy [4,10]. Unbalanced or insufficient nutrition, overweight and high concentration of estrogen are involved in etiology of fatty liver [9]. 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 [9]. Forasmuch as even slight fatty liver is dual with decrease in health and

Corresponding Author

Amirparviz Rezaeisaber, Department of clinical science, Tabriz branch, Islamic Azad University, Tabriz, Iran.
E-mail: aprs_1352@yahoo.com Am_rezaei@iaut.ac.ir
Tel: +98 914 411 7297

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 [18]. 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 [18]. 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 [1]. 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 [19]. 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.

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 400 Holstein cows were done. In this inspection, age, body condition score and Pregnancy status of animals was investigated [7]. In next stage, according achieved results; Cows based on Table 1 were divided into four groups. 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 APO-A, ammoniac, TSH and total Bilirobin 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:

NEFA Serum Value Average:

Based on table 2 and ANOVA test results, NEFA serum value average in group +8 was 825.60±105.23, in group +1 was 628.40±65.9, in group -8 was 728.64±35.66 and in group -1 was 1125.58±123.60 that has significant difference ($P<0.001$) with normal value (86.18).

Ammoniac Serum Value Average:

Based on table 3 and ANOVA test results, Ammoniac serum value average in group +8 was 59.60±4.99, in group +1 was 43.53±3.73, in group -8 was 51.05±2.92and in group -1 was 69.66±4.43 that has significant difference ($P<0.001$) with normal value (108.21).

TSH Serum Value Average:

Based on table 4 and ANOVA test results, TSH serum value average in group +8 was 2.73±0.03, in group +1 was 2.91±0.19, in group -8 was 2.75±0.06 and in group -1 was 2.54±0.14 that has significant difference ($P<0.001$) with normal value (17.65).

Total Bilirobin Serum Value Average:

Based on table 5 and ANOVA test results, Total Bilirobin serum value average in group +8 was 0.97±0.108, in group +1 was 0.56±0.17, in group -8 was 0.78±0.06 and in group -1 was 1.24±0.12 that has significant difference ($P<0.001$) with normal value (69.206).

APO-A Serum Value Average:

Based on table 5 and ANOVA test results, APO-A serum value average in group +8 was 0.94±0.22, in group +1 was 1.45±0.22, in group -8 was 1.27±0.15 and in group -1 was 0.77±0.09 that has significant difference ($P<0.001$) with normal value (36.54).

Relationship Between NEFA and Ammoniac:

Based on table 6 and pearson's Correlation index revealed that between NEFA and ammoniac serum values there is a significant and direct correlation so that correlation index was $r=0.87$. This index indicates a positive effect of NEFA on ammoniac serum values. Thus, with elevating of NEFA serum values the ammoniac values also increase.

Table 1: Classification of cattle based on uterine position.

Non-pregnant cows	New born to under one month postpartum (-1)
	More than one month of their last calving (+1)
pregnant cows	Less than 8 month (-8)
	More than 8 month (+8)

Table 2: Mean serum NEFA in Holstein dairy cows based on pregnancy status.

groups	mean	Mean square between groups	Mean square within groups	F	P
+8	825.60±105.23	601413.04	6978.49	86.14	0.001
+1	628.40±65.9				
-8	728.64±35.66				
-1	1125.58±123.60				
total	806.96±201.55				

Table 3: Mean serum Ammoniac in Holstein dairy cows based on pregnancy status.

groups	mean	Mean square between groups	Mean square within groups	F	P
+8	59.60±4.99	1674.63	15.47	108.21	0.000
+1	43.53±3.73				
-8	51.05±2.92				
-1	69.66±4.43				
total	54.68±10.45				

Table 4: Mean serum TSH in Holstein dairy cows based on pregnancy status.

groups	mean	Mean square between groups	Mean square within groups	F	P
+8	2.73±0.03	0.29	0.01	17.65	0.000
+1	2.91±0.19				
-8	2.75±0.06				
-1	2.54±0.14				
total	2.74±0.17				

Table 5: Mean serum Total Bilirobin in Holstein dairy cows based on pregnancy status.

groups	mean	Mean square between groups	Mean square within groups	F	P
+8	0.97±0.108	1.08	0.016	69.206	0.000
+1	0.56±0.17				
-8	0.78±0.06				
-1	1.24±0.12				
total	0.86±0.27				

Table 5: Mean serum APO-A in Holstein dairy cows based on pregnancy status.

groups	mean	Mean square between groups	Mean square within groups	F	P
+8	0.94±0.22	1.24	0.03	36.54	0.000
+1	1.45±0.22				
-8	1.27±0.15				
-1	0.77±0.09				
total	1.15±0.32				

Relationship Between NEFA and Total Bilirobin:

Based on table 7 and pearson's Correlation index revealed that between NEFA and Total Bilirobin serum values there is a significant and direct correlation so that correlation index was r=0.82. This index indicates a positive effect of NEFA on Total Bilirobin serum values. Thus, with elevating of NEFA serum values the Total Bilirobin values also increase.

Relationship Between NEFA and TSH:

Based on table 8 and pearson's Correlation index revealed that between NEFA and TSH serum values there is a reverse correlation so that correlation index was r= -0.65. This index indicates a reverse effect of NEFA on TSH serum values. Thus, with elevating of NEFA serum values the TSH values decreased.

Relationship Between NEFA and APO-A:

Based on table 8 and pearson's Correlation index revealed that between NEFA and APO-A serum values there is a reverse correlation so that correlation index was r= -0.69. This index indicates a reverse effect of NEFA on APO-A serum values. Thus, with elevating of NEFA serum values the APO-A values diminished.

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 [18]. Raid [16] divided livers in 4 levels depending on severity of fat accumulation in it: Normal, slight, average and severe [16].

Table 6: Correlation index between NEFA and ammoniac serum values.

variables	NEFA
ammoniac	R= 0.87
	P= 0.000
	N= 54

Table 7: Correlation index between NEFA and Total Bilirobin serum values.

variables	NEFA
Total Bilirobin	R= 0.82
	P= 0.000
	N= 54

Table 8: Correlation index between NEFA and TSH serum values.

variables	NEFA
TSH	R= -0.65
	P= 0.000
	N= 54

Table 8: Correlation index between NEFA and APO-A serum values.

variables	NEFA
APO-A	R= -0.69
	P= 0.000
	N= 54

Nowadays general opinion is that a high percent of mature cows show signs of slight or severe fatty liver around parturition [4,11]. Almost near parturition NEFA increases in blood and moves to liver, and can cause ketosis, abomasums displacement, metritis and fatty liver after parturition [4,5,8]. 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) [5]. 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 [10]. There was a research in Netherlands about 71 dairy cattle before parturition that showed 5 percent of liver is occupied with TAG [12]. 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 [2,17].

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