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Study of Fatty Liver Syndrome Frequency in Dairy Cattle by Assessment of TG, APO-A and APO-B Serum Values in Tabriz

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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 TG, APO-A and APO-B serum values. The results showed that TG has a negative correlation with APO-A and APO-B. Thus with elevating of TG serum values, APO-A and APO-B contrary diminished.

Key words: Fatty liver, dairy cattle, TG, APO-A, APO-B, Iran

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 is 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 1st 4 weeks after parturition (Grummer, 1993) when >50% of cows show different degrees of Triacylglycerol (TAG) accumulation in their livers (Jorritsma *et al*., 2001).

One of the reasons is that daily nutrition of cow is not sufficient and it can not 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 is 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

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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 >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 the 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 is 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 150 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 based on Table 1 were divided into 2 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 TG levels in serum by Randox kit and auto analyzer were measured. In this study, levels of APO-A and APO-B 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.

Table 1: Classification of cattle based on uterine position

Groups	Uterine condition
+1	>1 month after their last delivery
−1	<1 month after their last delivery

RESULTS AND DISCUSSION

TG serum value average: Based on Table 2 and ANOVA test and t-test results revealed that there is a significant difference between 2 groups and this variation in group −1 was more significant than +1 ($p<0.001$).

APO-A serum value average: Based on Table 3 and ANOVA test and t-test results revealed that there is a significant difference between two groups and this variation in group +1 was more significant than −1 ($p<0.001$).

APO-B serum value average: Based on Table 4 and ANOVA test and t-test results revealed that there is a significant difference between two groups and this variation in group −1 was more significant ($p<0.001$).

Relationship between TG and APO-A: Based on Table 5 and Pearson's correlation index revealed that there is a significant and direct correlation between TG and APO-A serum values so that correlation index was r = 0.807. This index indicates a negative effect of TG on APO-A serum values. Thus with elevating of TG serum values, the APO-A values was decreased.

Relationship between TG and APO-B: Based on Table 6 and Pearson's correlation index revealed that there is a significant and direct correlation between TG and APO-B

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

Groups	No.	Mean (mg mL^{-1})	F	p-value	t-test	df
−1	67	7.01±1.35	14.76	0.000	15.21	109.42
+1	83	4.09±0.88	-	-	-	-

Table 3: Mean serum APO-A in Holstein dairy cows based on pregnancy status

Groups	No.	Mean (mg mL^{-1})	F	p-value	t-test	df
−1	67	1.14±0.28	0.301	0.58	11.74	148
+1	83	1.64±0.23	-	-	-	-

Table 4: Mean serum APO-B in Holstein dairy cows based on pregnancy status

Groups	No.	Mean (mg mL^{-1})	F	p-value	t-test	df
−1	67	0.83±0.28	0.301	0.58	11.74	148
+1	83	1.33±0.23	-	-	-	-

Table 5: Correlation index between TG and APO-A

Variables	APO-A (mg mL^{-1})
TG	R = 0.807
	p = 0.000
	N = 150

Table 6: Correlation index between NEFA and total Bilirobin serum values

Variables	APO-B (mg mL^{-1})
TG	R = 0.807
	p = 0.000
	N = 150

serum values so that correlation index was r = 0.807. This index indicates a negative effect of TG on APO-B serum values. Thus with elevating of TG serum values, the APO-B values was decreased.

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). Reid (1980) divided livers in 4 levels depending on severity of fat accumulation in it; normal, slight, average and severe. Now-a-days, 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, 2000; Geelen and Wensing, 2006). In a normal situation and positive energy balance, NEFA value is about 200 meq L^{-1} in blood. This value increases since 3 weeks is parturition and reaches to 300 meq L^{-1} in the last week. In the last days before parturition, it reaches to 800-200 mcq L^{-1}. After parturition these acids should wane immediately and if it remains >700 meq L^{-1} after 7 days, represents negative energy balance and probability of fatty liver incidence.

About 3 weeks after parturition, the amount of these acids should return to normal level (200 meq L^{-1}) (Drackley, 2000). Also, the results of this study have conformity with Grummer (1993) results that showed three is most lipid aggregation in liver in 1st 4 weeks after parturition.

There was a research in Netherlands about 71 dairy cattle before parturition that showed 5% of liver is occupied with TAG (Johannsen *et al*., 1993). Also in a slaughterhouse research in Tehran, aggregation of TAG >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 >5% of liver cells and amount of NEFA was >900 meq L^{-1} being nonspecific and some other reasons.

CONCLUSION

This study shows that 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 *et al*., 1999).

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REFERENCES

Bobe, G., J.W. Young and D.C. Beitz, 2004. Pathology, etiology, prevention and treatment of fatty liver in dairy cows. J. Dairy Sci., 87: 3105-3124.

Bogin, E., Y. Avidan, M. Merom, S. Soback and G. Brenner, 1988. Biochemical changes associated with the fatty liver syndrome in cows. J. Comp. Pathol., 98: 337-347.

Bruss, M.L., 1993. Metabolic Fatty Liver of Ruminants. In: Advance in Veterinary Science and Comparative Medicine, Cornelius, C.E. (Ed.). Academic Press, San Diego, USA., pp: 421-422.

Drackley, J.K., 1999. Biology of dairy cows during the transition period: The final frontier, J. Dairy Sci., 82: 2259-2273.

Drackley, J.K., 2000. Use of NEFA as a tool to monitor energy balance in transition dairy cows. http://www.livestocktrail.uiuc.edu/dairynet/paperDisplay.cfm?ContentID=330.

Eddy, R.G., 1992. Fatty Liver Syndrome. In: Bovine Medicin, Andrews, A.H., R.W. Blowey, H. Boyd and R.G. Eddy (Eds.). Black well scientific publications, London, pp: 598-600.

Edmonson, A.J., I.J. Lean, L.D. Weaver, T. Farver and G. Webster, 1989. A body condition scoring chart for *Holstein* dairy cows. J. Dairy Sci., 72: 68-78.

Geelen, M.J. and T. Wensing, 2006. Studies on hepatic lipidosis and coinciding health and fertility problems of high-producing dairy cows using the Utrecht fatty liver model of dairy cows. Vet. Q., 28: 90-104.

Goff, J.P. and R.L. Horst, 1997. Physiological changes at parturition and their relationship to metabolic disorders. J. Dairy Sci., 80: 1260-1268.

Grummer, R.R., 1993. Etiology of lipid-related metabolic disorders in periparturient dairy cows. J. Dairy Sci., 76: 3882-3896.

Grummer, R.R., 1995. Impact of changes in organic nutrient metabolism on feeding the transition dairy cow. Anim. Sci., 73: 2820-2833.

Johannsen, U., S. Menger, R. Staufenbiel and N. Rossow, 1993. Investigations on morphology and function of the liver of high-yielding cows two weeks post partum. Dtsch. Tieraerztl. Wochenschr, 100: 177-181.

Jorritsma, R., H. Jorritsma, Y.H. Schukken and H.H. Wentink, 2000. Relationships between fatty liver and fertility and some periparturient diseases in commercial Dutch dairy herds. Theriogenology, 54: 1065-1074.

Jorritsma, R., H. Jorritsma, Y.H. Schukken, P.C. Bartlet, T. Wensing and G.H. Wentink,. 2001. Prevalence and indicators of post partum fatty infiltration of the liver in nine commercial dairy herds in The Netherlands. Livestock Prod. Sci., 68: 53-60.

Mcnamara, J.P., 2000. Integrating the Effect of Genotype and Nutrition on Utilization of Body Reserves During Lactation of Dairy Cattle. In: Ruminant Physiology: Digestion, Metabolism, Growth and Reproduction, Cronje, P.B. (Ed.). CABI Publishing, London, UK., ISBN: 9780851994635, Pages: 353-370.

Reid, I.M., 1980. Incidence and severity of fatty liver in dairy cows. Vet. Rec., 107: 281-284.

Rukkwamsuk, T., T.A. Kruip and T. Wensing, 1999. Relationship between over feeding conditioning in the dry peroid and the problems of high producing dairy cows during the post parturient period. Vet. Q., 21: 71-77.

Wensing, T., T.H. Kruip, M.J.H. Geelen, G.H. Wentink and A.M. van den Top, 1997. Postpartum fatty liver in high-producing dairy cows in practice and in animal studies. The connection with health, production and reproduction problems. Comp. Haematol. Int., 7: 167-171.

Zerbe, H., N. Schneider, W. Leibold, T. Wensing, T.A.M. Kruip and H.J. Schuberth, 2000. Altered functional and immunophenotypical properties of neutrophilic granulocytes in postpartum cows associated with fatty liver. Theriogenology, 54: 771-786.