

ORIGINAL ARTICLE

**METABOLIC PROFILE OF FOOT AND MOUTH DISEASE
STRESSED SHEEP IN SEMI ARID REGION**

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The present study was designed to evaluate serum biochemical parameters in twenty local bred sheep infected with Foot-and-Mouth disease virus (FMDV) serotype O. Ten healthy sheep were used as controls. Peripheral blood was collected from both diseased and control group and serum was separated which was further used to estimate the concentration of glucose, total protein, albumin, urea, calcium, phosphorus, cholesterol and activity of AST, ALT and ALP. It was found that there was a significant increase in glucose, AST and phosphorus in FMD affected sheep ($p < 0.01$). Total protein, albumin, calcium, cholesterol and urea level were significantly lower ($p < 0.05$) in FMD group compared to those in the control group. The biochemical alteration indicates the development of pancreatic dysfunction in Foot and Mouth disease affected sheep with FMDV serotype O.

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Foot-and-mouth disease (FMD) is an OIE listed and one of the most feared viral diseases of the livestock. The disease is highly contagious in cloven-footed animals, most prevalent in cattle and buffaloes followed by sheep and goats, whereas pigs acts as amplifiers. The FMD virus (FMDV) belongs to genus Aphthovirus of the family Picornaviridae and is classified into seven antigenically distinct serotypes i.e. O, A, C, SAT1, SAT2 SAT3, and

Asia1; and innumerable subtypes. In domestic animals it causes economic losses by decreasing the production, cost of treatment etc. Lameness is usually the first indication of FMD in sheep and goats. An affected animal develops fever, is reluctant to walk, vesicles develop in the interdigital cleft, on the heel bulb and on the coronary band. Vesicles also form in the mouth (on dental pad, hard palate, lips and gums) but they rupture easily.

(Kitching & Hughes, 2002). Some strains of the virus cause necrosis of heart muscle and may result in death before lesions develop in more common and visible locations such as the mouth or foot (Rodostitis, 1994). Most of the work being carried out on FMD is concerned with the cattle. However, there is lack of published reports related to small ruminants. The level of certain metabolites in blood may indicate various types of stress, resulting in an animal or a herd under a given management system possibly becoming susceptible to certain diseases (Payne 1973). The aim of the present study was to determine the possible alteration in biochemical parameters in naturally infected sheep with FMD.

MATERIALS AND METHODS

Experimental animals

Two groups of sheep were used, one group comprises of 20 naturally infected sheep with FMD virus and other group with 10 healthy sheep was kept as control. The animals were of local breed and both groups comprises of both Ram and Ewe. The animals were kept under free-range system with optimum maintenance requirement. Their feed consisted of a concentrate mixture provided for their optimal maintenance and Jowar (Sorgum) Kadbi or Green (Lucern or Maize) accordingly to the availability of fodder.

Collection of blood and separation of serum

Peripheral blood was collected by puncturing the jugular vein with the least stress to the animal under aseptic condition directly into sterile tubes. The serum was separated out on the same day by centrifuging at 2000 rpm for 15 min. The serum samples were stored at -20°C till further use.

Virus isolation:

FMD virus was isolated from the tongue epithelial samples taken in 50% buffered glycerol and was triturated and centrifuged at centrifuged at 3000 rpm for 15 min. The supernatant was collected and filtered through 0.22µm membrane filter and was inoculated in Baby hamster kidney cell line, BHK-21 CT (Clone Tubingen) grown in MEM (GIBCO) for the presence of cytopathic effect. Further, Serotyping was done by sandwich ELISA using reference FMDV reference serotypes (vaccine strains) O, A and Asia1 procured from Central Laboratory of the Project Directorate on FMD, IVRI, Mukteswar-Kumaon, Uttarakhand, India.

Biochemical tests:

Blood glucose, total protein, albumin, urea, calcium, phosphorus, cholesterol levels and activity of AST, ALT and ALP of both experimental and controlled group was analyzed on IDEXX VetTest automated chemistry analyzer.

Statistical Analysis:

Statistical analysis was carried out by using an unpaired “t” test (Panse & Sukhatme, 1965).

RESULTS

The mean values of the parameters studied are presented in the table- 1. FMD affected sheep had significantly increased concentration of glucose and phosphorus, the activity of AST was significantly higher. Further the concentration of total protein, albumin, urea, cholesterol and calcium was significantly lower. The activity of ALT, ALP and GGT was non significantly higher in FMD affected animals in comparison to control group.

Table 1 Comparison of various Serum biochemical parameters in the FMD affected sheep and Control groups

Parameter	FMD group	Control Group	P
Glucose (mmol/lit)	4.16±0.06	3.47±0.06	<0.01
Total protein (g/lit)	55.7±1.1	69.5±1.2	<0.01
Albumin (g/lit)	27.35±1.1	32.65±1.0	<0.01
Urea (mmol/lit)	4.24±0.1	4.61±0.14	<0.05
Cholesterol (mmol/lit)	1.60±0.09	1.85±0.05	<0.01
AST (IU/lit)	140.8±1.8	118.3±2.14	<0.01
ALT (IU/lit)	41.55±1.47	38.8±2.24	>0.05
ALP (IU/lit)	211.25±1.9	207.8±2.8	>0.05
GGT (IU/lit)	39.8±0.5	38.8±0.7	>0.05
Calcium (mmol/lit)	2.89±0.06	3.1±0.09	<0.01
Phosphorus (mmol/lit)	1.98±0.15	1.88±0.11	<0.05

DISCUSSION

Comparison of the mean values for blood glucose between the two groups showed a significant higher ($p < 0.01$) glucose level in FMD affected sheep. The researches has suggests that interleukin (IL)-1, IL-6 and tumor necrosis factor- α functions as mediators of the host inflammatory responses in innate immunity. The biological effects of these proinflammatory cytokines depend on the quantity of cytokine released. For example, at low concentration the principal function of IL-1 is as a mediator of local inflammation. In larger quantities, IL-1 enters the blood streams and exerts endocrine effects. This systemic IL-1 has the ability to cause fever, to induce the synthesis of acute phase protein by the liver, and to initiate metabolic wasting. There are 2 principal forms of IL-1, called IL-1 α and IL-1 β . Most of the IL-1 activity found in the circulation is IL-1 β (Abbas et.al. 1977). Stith & Templer (1994) have stated that a marked decreased in hepatic glycogen and a concomitant increase in plasma

glucose were observed following central injection of IL-1. Johnson (1997) stated that central IL-1 β has been shown to modulate the intermediary metabolism of carbohydrates in periphery. These effects could be attributed to the glycolytic action of glucocorticoids, which are notably elevated by central IL-1 (Berkenbosch 1987). Kaneko (1997) also reported that the increase in blood glucose concentration was in response to hypocalcemia because of interference with the secretion of insulin from the pancreas. Elevated blood glucose levels were reported by Sahal, 1994 in cows recovering from FMD. The significant decrease in total protein, albumin and serum urea observed in the study may be associated with lesions on the oral mucosa and interdental regions. It is known that protein requirement increase in the presence of any lesions on the body (Kaneko 1997). It is also known that protein consumption increase in animals with diabetes mellitus (Feldmann, 1987). Therefore hyperglycemia is another reason for the decrease in protein concentration observed in the study. Low

albumin and protein concentration may also be due to alteration in pancreatic β -cell function that might have developed during the clinical course of FMD as reported by Barboni, 1980.

The cholesterol level in FMD affected sheep was lower in present study. This could have been due to the cytokine induced alteration in energy metabolism, with lipids being released from adipose tissue. In this situation, a reduction in cholesterol rich very low density lipoprotein (VLDL) and low density lipoprotein (LDL) would be expected, with an increased ratio of VLDL and LDL to high density lipoprotein (HDL) (Kaneko 1997).

Thyroid hormone increases both the rate of cholesterol synthesis and the rate of its catabolism by the liver. In hypothyroidism condition, lipids and cholesterol catabolism are decreased to a lesser degree than the synthesis of the cholesterol. The effect of these changes, results in an increase in serum cholesterol (Kaneko 1997). In contrast to this, however, Lal 1981, found evidence indicative of hypothyroid activity in FMD affected cows; this author reported decreased protein bound iodine (PBI) values in FMD affected Thrparkar cows compared with the levels in healthy lactating cows. The low serum calcium level in the present study may be associated with inappetance and hypoproteinemia as reported by Kaneko, 1997. Therefore, in the study there was a significant decrease in serum protein level and severe anorexia in FMD sheep, which is the possible explanation for hypocalcemia observed. The higher phosphorus level in infected sheep might be due to rapid respiration, higher pulse rate, tissue oxidation and acidosis due to lack of excretion. Mullick 1949, reported high phosphorus and low calcium in FMD affected cattle than normal. The serum AST values significantly increase, whereas there was

nonsignificant increase in ALT, ALP, and GGT activity in FMD affected sheep. The transaminase activity intimately related with the protein catabolism and subsequent production of ketoacids. Georgie 1973 suggested that corticosteroid accelerates the transaminase reaction thereby augment the process of gluconeogenesis. Higher rectal temperature due to fever in infected animal induces stress condition which might have accelerated the transaminase activity. Elitok 1999 reported that the blood glucose and AST were higher in infected cattle than in control.

CONCLUSION

The biochemical alteration indicates the development of pancreatic dysfunction in Foot and Mouth disease affected sheep with FMDV serotype O.

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