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Haemato-biochemical alterations in helminths infected donkeys

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Present study was conducted to estimate the haemato-biochemical alterations during parasitic infection in donkey (Equus acinus) of Banaskantha district of Gujrat, India. Based on qualitative faecal sample examination, one hundred donkeys were categorized as Group-I and Group-II. Group-I animals were (+)ve for helminthic infection and designated as 'infected'; whereas, Group-II animals were (-)ve for helminthic infection and designated as 'uninfected'. Haematological profile revealed significant decrease in haemoglobin (Hb), total erythrocyte count (TEC) and packed cell volume (PCV) in infected animals as compared to uninfected. However, the rise in erythrocyte sedimentation rate (ESR) and eosinophil count in group-I was non significant. Whereas, there was no significant difference ($p<0.01$) in neutrophil, lymphocyte and monocyte count between the two groups. Biochemical profile indicated increase in the level of cholesterol, creatinine, acid phosphatase (ACP), alkaline phosphatase (AKP), aspertate amionotransferase (AST) and alanine aminotransferase (ALT) in infected animals. In contrast, biochemical analytes viz. glucose, total protein, albumin, globulin, calcium, phosphorus, magnesium and zinc were significantly decreased in infected animals as compared uninfected. Helminth infected animals also exhibited non-significantly lower level of iron, copper, total iron binding capacity (TIBC), triglyceride (TG) and blood urea nitrogen (BUN).The results suggest gross alteration in haemato-biochemical parameters and may form a basis of monitoring parasitic infection in donkey.

Key words: donkey, helminthic infection, haemato-biochemical profile

The donkey (Equus acinus), popularly known as a 'beast of burden' play an important role in socio-economic development by providing transportation in areas that are inaccessible to motorized vehicles or where modern means of transportation are absent. They are the cheapest and easiest means of transport for small, marginal and poor farmers in tropical countries like India (Pearson et al., 1999; Mwenya and Tandkeib, 2004). Although donkeys are often regarded as sturdy and resistant species, they are also vulnerable to an array of infectious and non infectious diseases including parasitic infections (Svendsen, 1997). A heavy internal parasitic burden adversely affects the health of the donkeys, particularly when they are undernourished and put to hard work (Mair, 1994; Krecek and Gouthrie, 1999). According to Lichtenfels (1975), equids are the host of more than 75 species of helminths. The most common helminths of equines are strongyles, tapeworms (Anoplocephala perfoliata), ascarid (Parascaris equorum), pin worm (Oxyuris equi) and the lung worm (Dictyocaulus arnfieldi) (Ayele and Dinaka, 2010; Mekibib et al., 2010). Among the helminths, strongyles are considered to be major cause of illness in donkeys (Svendsen, 1997, Hosseini et al., 2009, Shrikhande et al., 2009). Haemoparasitic diseases like trypanosomiasis and babesiosis in donkeys are attributed to reduction in their draught power efficiency (Svendsen, 1997).Parasitic infections are also known to cause considerable morbidity and mortality in donkeys (Chitra et al., 2010).

Although the importance of donkeys as pack animals is not debatable in developing countries like India, still they receive very little attention from research point of view. Laboratory data on haematological and biochemical parameters are of utmost importance to confirm presence or absence of a disease, to assess severity of a disease, and to estimate response of therapy (Faver, 1997). Further, results of haemato-biochemical analyses when combined with thorough physical examination and history form a basis for the veterinarians to arrive at a final diagnosis of a disease. Accordingly, the aim of the current study was to assess alterations in major haematological and biochemical parameters of donkeys infected naturally with helminths so as to assist the clinicians by providing reference values for an easy diagnosis of helminth infections in donkeys and determining effective therapy.

MATERIALS AND METHODS

Present study was conducted in Banaskantha district of Gujarat, India. One hundred donkeys were divided in two groups consisting of fifty animals each on the basis of qualitative faecal sample examination. Group-I animals with helmithic infection viz. Parascarius equorum, Strongylus sp. Strongyloides westeri and Oxyuris equi were categorized as 'infected'; whereas group-II animals free of helminths were designated as 'uninfected'. Blood samples were collected aseptically with the help of vacuette needle (20G) from jugular vein of each animal from both the groups. For the study, 9 ml of blood was drawn in each vacuette EDTA and vacuette serum clot activator (Greinerbio-one) for obtaining blood and serum, respectively for various haemato-biochemical analyses.

The haematological parameters viz. hemoglobin (Hb), total erythrocyte count (TEC), total leucocyte count (TLC), packed cell volume (PCV), erythrocyte sedimentation rate (ESR) and differential leucocyte count (DLC) were analyzed as per methods described by Jain (1986).

Various biochemical parameters like total protein, albumin, globulin, glucose, alkaline phosphatase (AKP), acid phosphatase (ACP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine, uric acid, cholesterol, triglyceride, calcium, phosphorus, magnesium, iron, total iron binding capacity (TIBC), zinc and copper were assayed using ready to use kit (Crest Biosystems, Goa, India).

The data were analyzed using student 't' test described by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The mean values of different haematological and biochemical parameters have been presented in table 1 and table 2, respectively.

In the present investigation, significantly lower level of Hb, TEC and PCV was observed in infected animals as compared to uninfected animals and there was no significant difference in neutrophil, lymphocyte and monocytes count between the two groups. These observations signify anaemic condition of the group-I animals. This might be due to infection of the donkeys with strongyles (Hosseini et al., 2009). These finding are in accordance with the earlier reports (Marques et al., 2000; Aquino et al., 2002; Herrera et al., 2002). Although dozens of helminths are known to affect equines, the strongyles are the most prevalent and the major cause of disease in donkeys (Shrikhande et al., 2009). Donkeys are more prone to be infected with large strongyle worms as they often graze in pastures. The large strongyles are voracious blood suckers and cause anemia, weakness, diarrhoea, and damage of the intestinal lining; whereas, immature worms (larvae) migrate to the branches of the intestinal (mesenteric) arteries where

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they cause damage, irritation and parasitic aneurysm. Dixon and Archer (1974) reported that persistent normocytic or macrocytic anemia without jaundice in equines indicates chronic haemorrhage and the most common cause of such anaemia is attributed to strongyloid nematodes. Further, the decreased level of Hb, TEC and PCV observed in the present study may also be due to reduced haemopoiesis as a result of poor metabolism and poor nutrition status since donkeys in India are mostly reared by poor farmers and hence remain undernourished (Soulsby, 1986). These observations coincide with that in sheep (Dargie, 1973) and other animals (Soulsby, 1986). Slight eosinophilia noticed in the helmith infected animals may be the result of constant irritation caused by the migration of the larvae through intestinal mucosa causing damage and inflammation along the way. Similar observation was also reported by Leder and Weller (2000). The infected group of animals also showed an increased ESR (93.64 ± 7.46 mm/h) as compared to the uninfected group (84.19 ± 5.697 mm/h). This is due to decrease in TEC, which in turn might be a result of suppression of erythropoietic activity of bone marrow by parasites (Hayat et al., 1999). An apparent increased in ESR may also be attributed to a significant hypoproteinemia leading to alteration in A/G ratio due to hepatic damage caused by laerval migration. This finding is in accordance with the reports of Yousif et al. (1990), Bhat and Sharma (1990) Varshney and Uppal (1992) and Padmaja et al. (2006).

Table 1: Haematological values (Mean ± SE) in helminth infected and uninfected donkey

Sr. No.	Parameters	Infected (Group-I) Mean ± SE	Uninfected (Group-II) Mean ± SE
1	Hb(g%)	9.26± 0.069[a]	11.35 ± 0.16[b]
2	TLC (10^3/cmm)	13.264 ± 0.45	13.453 ± 0.48
3	TEC (10^6/cmm)	4.71 ± 0.05[a]	5.21 ± 0.098[b]
4	ESR(mm/h)	93.64 ± 7.46	84.19 ± 5.697
5	PCV(%)	34.49 ± 0.249 [a]	40.53 ± 0.437 [b]
6	Neutrophil (%)	53.77:1: 1.74	55 ± 1.82
7	Lymphocyte(%)	39.53± 1.76	38.92±1.73
8	Eosinophil(%)	5.82:1: 0.68	5.57:1: 0.52
9	Monocyte(%)	0.61 ± 0.07	0.58 ± 0.11)

a, b means in the same row for each parameter with different superscripts are significantly different ($p < 0.01$).

The results of blood biochemical analysis (Table 2) revealed significant decrease in glucose, total protein, albumin, globulin, calcium, phosphorus, magnesium and zinc concentration in helminth infected animals. These results are suggestive of poor absorption of the dietary constituents from intestinal tract, which might have been due to gastrointestinal disturbances caused by parasitic infection (Hayat et al., 1999). Strongyles are known to cause necrosis and desquamations of epithelial layer and villi of intestine leading to reduction of absorption area for degraded protein. Low absorption of proteins coupled with less dietary intake as a result of anorexia during infection period could also attribute to reduction in glucose, total protein, albumin and globulin (Benjamin, 1986).

The reduction in glucose might also be due to the fact that Parascaris equorum adult worms thrive on carbohydrate available in GI tract of donkeys depleting the host of the required glucose. It has also been shown that parasite count is inversely proportional to glucose concentration (Jatkar and Singh, 1974). Similarly, the lower level of total protein, albumin, globulin, calcium, phosphorus, magnesium, zinc, iron, copper and TIBC level in helminth infected animals might be a result of decreased appetite of the animal and hence decreased absorption of dietary nutrients into blood stream (Galdhar and Roy,2004). Further, the decreased level of these biochemical analytes may be a result of liver damage due to the migrating second stage larvae of P. equrum or toxins of P. equorum causing liver dysfunctions. The increased level of cholesterol ($p<0.01$) recorded in the present study in infected animal may be attributed to the parasitic stress in infected animals which might have resulted an increase in the output of epinephrine and corticosteroids. The increase of epinephrine and corticosteroids is responsible for elevation of serum cholesterol in infected group (Hayat et al., 1999). The higher concentration of cholesterol in infected animals also reflects negative energy balance created by heavy load of parasitic burden leading to enhanced lipolysis. It is also evident from table 2 that the level of creatinine is higher in infected animals that indicate damage to the kidney and liver by the larvae. These observations corroborate with the reports of Yousif et al. (1990), Momin et al. (1992), Halmandge et al. (2005) and Padmaja et al. (2006) in different animals due to helminth infection.The results of enzyme assay showed significant increase in the activity of AST,ALT,AKP and ACP in group-I animals. The rise in the activity of these enzymes reflects severe muscular damage due to migratory phase of the helminths. Similar trend of enzyme activity was also observed by Chaudhary and Iqbal (2000) and Gutierrez et al. (2005). The alteration in the level of these enzymes provide useful index of cellular necrosis of liver, intestine and other organs (Rajkhowa et al., 1997).

Table 2: Biochemical values (Mean ± SE) in helminth infected and uninfected donkey

Sr. No	Parameters	Infected (Group I) Mean± SE	Uninfected(Group II) Mean ± SE
1.	Glucose (mg/dl)	55.85 ± 2.85 [a]	75.45 ± 3.0I [b]
2.	Uric acid (mg/dl)	6.92 ± 0.19	7.07 ± 0.24
3	Magnesium (mg/dl)	2.0 ± 0.043 [a]	2.29 ± 0.045 [b]
4.	Calcium (mg/dl)	8.45 ± 0.21 [a]	11.14 ± 0.48 [b]
5.	Triglyceride (mg/dl)	329.37 ± 8.82	335.0 ± 13.51
6	Cholesterol (mg/dl)	144.87 ± 7.29 [a]	116.04 ± 2.89 [b]
7.	Phosphorus (mg/dl)	4.22 ± 0.10 [a]	5.78 ± 0.20 [b]
8.	Total Protein (g/dl)	6.11 ± 0.l0 [a]	6.95 ± 0.12 [b]
9.	Albumin (g/dl)	3.14 ± 0.05 [a]	3.80 ± 0.052 [b]
10.	Globulin (g/dl)	2.96 ± 0.06	3.15 ± 0.086
11.	Creatinine (mg %)	2.01 ± 0.08 [a]	1.52 ± 0.055 [b]
12.	Iron (µg/dl)	159.09 ± 3.44	162.86 ± 3.76
13.	TIBC (µg/dl)	477.29 ± 10.34	480.15 ± 14.80
14.	ACP (KA unit/ml)	7.15 ± 0.29 [a]	5.29 ± 0.28 [b]
15.	AKP (KA unit/ml)	58.43 ± 2.83 [a]	33.80 ± 0.95 [b]
16.	ASI (SGOT) (unit/l.)	415.14 ± 5.1 9 [a]	325.2 ± 7.81 [b]
17.	ALT (SGPT) (unit/l.)	43.33 ± 1.32[a]	26.0 ± 1.13 [b]
18.	Zinc (mg/dl)	36.62 ± 1.10 [a]	44.67 ± 0.55 [b]
19.	Copper (mg/dl)	93.83 ± 4.70	105 ± 0.69

a b means in the same row for each parameter with different superscripts are significantly different ($p < 0.01$ %).

CONCLUSION

Present study suggests significant alteration in haemato-biochemical profiles of donkey infected with helminths. The infected animals showed a highly significant decrease in Hb, TEC, PCV, while a major alteration was brought about by helminths in majority of biochemical attributes analysed. The alteration in the level of enzymes studied provide useful index of cellular necrosis of vital organs. The data generated on haemato-biochemical profile may form a basis of monitoring parasitic infection in donkey.

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