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ORIGINAL ARTICLE

Effect of Aloe-Vera on Liver Functions in Dog

MUHAMMAD ASIF WISAL[1], SHAMSUDDIN BUGHIO[2], MUHAMMAD AARAB[3], HINA MAHREEN[4], SANIYA SOOMRO[5], SAEED AHMED MIRANI[6], MUHAMMAD SHAH[7], ABDUL KABIR[8], NIDA KHANIM[9], AQIB KHAN[10]
[1,2,8]Department of Veterinary Microbiology Sindh Agriculture University Tandojam
[3,6]Assistant Scientific Officer, Department of Quality Control, National institute of Health
[4]Department of Zoology, The Women University Multan
[5]Scientific Officer, Department of Biological Production Division, National Institute of Health
[7]Department of Zoology, Abdul Wali Khan University Mardan
[9]Department of Microbiology, Abbottabad University of Science and Technology
[10]Department of Veterinary Pharmacology, Sindh Agriculture University Tandojam
Corresponding author: Abdul Kabir, Email: kabirvet32@gmail.com

ABSTRACT

Aloe vera is one of the most important plant used in modern science and has gained popularity in homeopathy and conventional medicine. Recent studies on rodents have shown its effect on liver. Therefore, current study was planned to assess the effects of Aloe Vera gel on liver function in normal and induced hyperglycaemic dogs. Aloe Vera gel was administrated orally in dogs (n = 12). The experimental period was divided into two phases. In each phase dogs were divided into three group's i-e., A, B and C. In phase-1, group A was given only basal diet and kept as a control. Whereas group B was treated with Aloe vera gel at the therapeutic dosage of 500mg/kg B.W with basal diet, while group C was treated higher dosage regimen of 1000mg/kg B.W with basal diet once daily for 07 consecutive days. After 21 days washout period, in Phase-2, group A was fed basal with high carbohydrate diet and kept as a control. Whereas group B and C was administered Aloe vera gel at therapeutic dosage regimen of 500mg/kg B.W and 1000mg/kg B.W with basal with high carbohydrate diet once daily for 07 consecutive days respectively. In both phases, blood samples were collected at 0, 2, 6, and 10hr from day 1 to day 7, daily and on 10th and 14th day following Aloe vera treatment and analysed for biochemical parameters including serum Total Protein, Albumin, Globulin, Alanine aminotransferase, Aspartate aminotransferase, Alkaline Phosphatase and Bilirubin. Results revealed significant ($P<0.05$) decrease in biochemical parameters at therapeutic dosage of 500mg/kg as well as in higher dosage regimen of 1000mg/kg B.W against control. During this study in both phases all biochemical parameters decreased ($P<0.05$) at 0, 2, 6 and 10hr from Day 1-14 post Aloe vera treatment. All biochemical parameters did not return to the pre-treatment values following the discontinuation of Aloe vera gel on 10th and 14th day of its treatment. It has been concluded from the current study that, the Aloe vera administration at the therapeutic dosage of 500 mg/kg B.W orally is adequate to reduce increased level of these biochemical parameters in dogs.

Keywords: Aloe-vera, Liver, Function Test, Dog

INTRODUCTION

Aloe vera is a widely distributed short-stemmed xerophytes plant, originated in the Arabian Peninsula of north Africa. It is a member of Liliacease family having more than 300 species identified (Rajasekaran et al., 2006). It is cultivated in arid climates and its flowers are bright orange in colour and are produced in summer annually (Yates, 2002). In many countries of the world Aloe vera gel is used as therapeutic and for curative purposes. So far, more than 75 ingredients of Aloe vera have been identified. There are several medicinal effects of the extracts Aloe vera which are due to the presence of polysaccharides found in the parenchymatous tissue of inner leaf (Ni et al., 2004). Aloe vera gel has hepatoprotective effects in a Paracetamol induced hepatotoxicity in rats (Nayak et al., 2011). It has been reported that Aloe vera gel as a detoxifying product used in natural medicine and is recommended for liver disease (Vogler and Ernst., 1999). It has been stated that Aloe vera gel increased bile flow resulting in the stimulation of the secretary activity of the liver cells. This hepatoprotective action was suggested to protect the metabolic enzymes of the liver through antioxidant activity (Chandan et al., 2007). Above studies indicated that the Aloe vera produced striking effects on liver and number of studies has also been carried out to evaluate the effects of Aloe vera gel in various animal species. To the best of our knowledge, such studies are limited in local dog breeds. Therefore, considering the importance of the dogs as a pet animal and the variety of the effects of the Aloe vera produced in various species, this study was designed to determine the effects of Aloe vera gel with basal and high carbohydrate diet on liver function in dog.

MATERIALS AND METHODS

In this study effect of Aloe vera gel was studied on liver functions in dogs. In current study twelve dogs of mixed breed and sex, weighing 10 to 12 kg were selected. Dogs were kept indoor at department of Surgery and Obstetrics, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam. The Aloe vera plant was collected from botanical garden of Sindh Agriculture University Tandojam. The plant was washed with fresh water. The leaves were cut with the help of a sterile sharp knife for the extraction of gel. The gel was weighted with the weighing scale. The accurate dosage of aloe vera gel was mixed in diet separately for each group and administered orally.

Housing of Expermintal Animals: The dogs were kept in cages with free access to water and feed. All dogs were physically examined, vaccinated and dewormed before start of the experiment.

Adaptation period: Before start of the experiment, all the animals were acclimatized for two weeks. During this period, the animals were assigned numbers from A1 to A12 for identification. All animals were randomly divided into three experimental groups (4 dogs/group)

Collection of blood samples: The blood sample were collected from cephalic vein under aseptic condition in plain test tube. The blood samples were brought to post graduate laboratory at Department of Veterinary Physiology / Pharmacology, Faculty of Animal Husbandry and Veterinary Sciences for examination. The serum was separated following centrifugation of blood samples at 1500 rpm for 10 minutes and analysed.

The study was conducted in two experimental phases (experiment-1 and experment-2)

Experimental phases

Phase 1: In Experiment 1, animals were divided into three groups (A, B and C). Group A, was kept as Control and feed on basal diet whereas, group B, was given Aloe vera gel 500mg/kg B.W along with Basal diet and group C, was given Aloe vera gel 1000mg/kg B.W along with Basal diet orally once daily for a week. Following the administration of different dosages of Aloe vera gel, Blood samples were collected from Day 1 to Day 7 (Week 1) at 0, 2, 6 and 10 hrs, whereas, in week 2, no Aloe vera treatment was given to the animals but blood samples were collected only on day 10

and 14 at 0, 2, 6 and 10 hrs. Serum was separated and analysed for biochemical parameters.

Phase-2: After three weeks wash out period, experiment 2 was conducted. In this phase animals were also divided into three groups (A, B and C). Group A, was given basal diet and high carbohydrate diet (Control), group B was given Aloe vera gel 500mg/kg B.W, basal diet and high carbohydrate diet and group C, was given 1000mg/kg B.W Aloe vera gel, basal diet and high carbohydrate diet orally once daily for a week. Blood samples were collected consequently from Day 1 to Day 7 (Week 1) at 0, 2, 6, and 10hr, whereas in 2nd week, no Aloe vera treatment was given to the animals only blood samples were collected on day 10 and 14 at 0, 2, 6 and 10 hrs. Serum was separated and analysed for biochemical parameters.

Arrangement of basal and energy rich diet: The dogs were feed basal diet (Meal, Milk and bones) and energy rich diet (40-gram raw sugar, meat, milk and bones).

Biochemical parameters: Various biochemical parameters i.e. Alanine aminotransferase, Aspartate aminotransferase, Alkaline Phosphatase, Bilirubin, Total Protein (Albumin and Globulin) were recorded. The blood samples were analysed (according to their respective kit methods) in both experimental phases.

RESULTS

This study was carried out in two experimental phases to determine the effects of Aloe vera at therapeutic dose 500mg/kg body weight (Group B) and the higher dose 1000mg/kg body weight (Group C), on various biochemical parameters in dog. Aloe vera was administered orally once daily for a week in experiment-1 (Aloe vera 500mg/kg B.W and 1000mg/kg B.W with basel diet) and in experiment -2 (Aloe vera 500mg/kg B.W +1000mg B.W + basel diet+ energy rich diet) to evaluate different liver functions tests in dogs. The blood samples were collected in both experimental phases at 0, 2, 6 and 10hr in 1st week, whereas, in 2nd week, no Aloe vera treatment was given to animals only blood samples were collected on day 10 and 14 at 0, 2, 6 and 10hr post drug administration.

1Effect of therapeutic dosage of Aloe vera gel at 500mg/kg and higher dosage of 1000mg/kg body weight with basal diet on hourly basis at 0, 2, 6 and 10hr for 14 days following treatment in dogs on biochemical parameters.

Serum Bilirubin: Following the administration of Aloe vera at the therapeutic dosage of 500mg/kg (Group B) and higher dosage 1000mg/kg (Group C) orally once daily for a week with basal diet altered the bilirubin level in dogs (Result of Table 1). The mean control value for both groups was found similar as 0.49mg/dl. Both dosage regimens of Aloe vera decreased (P< 0.05) serum bilirubin level at 0 hr 0.47mg/dl, 0.45mg/dl, 2hr 0.41mg/dl, 0.39mg/dl, 6hr 0.39mg/dl, 0.38mg/dl and at 10 hr 0.35mg/dl, 0.35mg/dl respectively against control. However, both dosage regimens showed maximum decrease at 10 hr following Aloe vera treatment.

Alkaline phosphatase: The treatment of Aloe vera at therapeutic dosage of 500mg/kg and higher dosage of 1000mg/kg body weight orally once for a week along with basal diet amended serum alkaline phosphatase level in dog (Table 1). The mean control value of both groups noted as 48.6u/l. Alkaline phosphatase level decreased (P<0.05) following both dosages at 0 hr 41.7u/l and 26u/l, 2hr 34.2u/l and 25.7u/l, 06 hr 34.3 u/l and 25.16u/l and at 10hr 32.26u/l and 23.84u/l respectively. However, the maximum decrease occurred at 10 hr with higher dosage of Aloe vera treatment.

Alanine aminotransferase: Aloe vera administration at therapeutic dosage of 500mg/kg and higher dosage of 1000mg/kg altered ALT level in both treated groups in dogs (Table 1). The mean control value for both treated groups was observed 5.91u/l. Following both Aloe vera dosage regimens ALT decreased (P<0.05) at 0hr 4.12u/l and 3.87u/l, at 2hr 3.99u/l and 3.65u/l, at 6hr 3.98u/l and 3.64u/l, at 10 hr 3.95u/l and 3.52u/l respectively. However, the maximum decrease was observed with higher dosage treatment at 10hr after Aloe vera treatment.

Aspartate aminotransferase (AST): The administration of Aloe vera at the therapeutic dosage 500mg/kg and higher dosage 1000mg/kg orally once daily for a week modified) the serum AST level in dogs (Table 2). The mean control value for both groups was examined as 5.57u/l. Following Aloe vera treatment AST level decreased (P<0.05) at 0hr 4.97u/l and 5.13u/l, at 2hr 4.91u/l and 4.85u/l, at 6hr 4.90u/l and 4.78u/l and at 10hr 4.71u/l and 4.92u/l respectively. However, the maximum decrease was found at 10th hr following therapeutic dosage regimen.

Total protein: Aloe vera administration at 500 mg/kg and 1000mg/kg once daily for a week in dogs modified serum protein level in dogs (Table 2). The mean control value for both groups was noted as 7.72mg/dl. It was found that Aloe vera treatment reduced (P<0.05) serum protein level at 0hr 7.28mg/dl, 7.20mg/dl and at 2 hr 6.91mg/dl, 6.69mg/dl and at 6 hr 6.72mg/dl, 6.55mg/dl and at 10hr 5.97mg/dl, 6.33mg/dl respectively. However, therapeutic dosage regimen of Aloe vera showed a significantly decrease(P<0.05) at 10hr.

Albumin: Aloe vera treatment at a dose rate of 500mg/kg and 1000mg/kg once daily for a week amended the serum albumin level in dogs (Table 2). The mean control value for both groups was observed as 3.7mg/dl. Following Aloe vera administration serum albumin level reduced (P<0.05) at 0hr 2.65mg/dl, 2.65mg/dl, at 02 hr 2.46mg/dl, 2.61mg/dl, at 06 hr 2.24mg/dl, 2.51mg/dl and at 10hr 2.44mg/dl, 2.44mg/dl respectively. However, the maximum declined occurred at 6th hr following therapeutic dosage regimen of Aloe vera.

Table 1: Hourly effect of therapeutic and higher dose of Aloe vera gel @500mg/kg and @1000mg/kg body weight administered orally for 07 days with basal diet on biochemical parameters in dogs.

Group	Hours	Biochemical parameters		
		Blb mg/dl	ALP u/l	ALT u/l
Control A	0	0.49[a]	48.6[a]	5.91[a]
Group B		0.47[bc]	41.7[b]	4.12[c]
Group C	2	0.45[c]	26[d]	3.87[de]
Group B		0.41[de]	34.2[c]	3.99[cd]
Group C	6	0.39[ef]	25.7 [d]	3.65[e]
Group B		0.39[e-g]	34.3 [c]	3.98[cd]
Group C	10	0.38[e-g]	25.16 [d]	3.64[e]
Group B		0.35[fg]	33.26[c]	3.95[cd]
Group C		0.35[g]	23.84[d]	3.52[e]
LSD (0.05)		0.0392	4.1603	0.2789
SE±		±0.0190	±2.0157	±0.1352

Means with different superscripts in same column (a, b, c, d, e, f, g, h, I, j, k, l and m) varied significantly from one another.

Group A, B and C represents control value, 500mg/kg and 100mg/kg of Aloe vra gel respectively.

Table 2: Hourly effect of therapeutic and higher dose of Aloe vera @500mg/kg and @1000mg/kg body weight administered orally for 07 days with basal diet on biochemical parameters in dogs.

Group	Hours	Biochemical parameters			
		AST u/l	TP mg/dl	Alb mg/dl	Glb mg/dl
Control A	0	5.57 [a]	7.72[a]	3.7[a]	4.38[a]
Group B		4.97[d]	7.28[bc]	2.65[d]	4.63[b]
Group C	2	5.13[b]	7.20[c]	2.65[d]	3.67[c]
Group B		4.91[d]	6.91[cd]	2.46[fg]	4.45[c]
Group C	6	4.85 [de]	6.69[de]	2.61[de]	3.95[bc]
Group B		4.90[e]	6.72[de]	2.44[g]	4.28[a]
Group C	10	4.78 [de]	6.55[de]	2.51[de]	4.04[a]
Group B		4.71[cd]	5.97[f]	2.24[ef]	3.72[b]
Group C		4.92[cd]	6.33[ef]	2.44[ef]	3.89[b]
LSD (0.05)		0.1473	0.5237	0.1533	0.4652
SE±		±0.0714	±0.2081	±0.0743	±0.2254

Means with different superscripts in same column (a, b, c, d, e, f, g, h, I, j, k, l and m) varied significantly from one another.

Group A, B and C represents control, 500mg/kg and 100mg/kg of Aloe vera gel respectively.

Globulin: Aloe vera treatment at 500mg/kg and 1000mg/kg dosage once for a week decreased (P<0.05) the globulin level (Table 2). The mean control value is 4.38mg/dl. Alo vera administration showed the reduction in serum globulin level at 0hr 4.63mg/dl, 3.67mg/kg and at 02 hr 4.45mg/dl, 3.95mg/kg and at 06 hr 4.28mg/kg, 4.04mg/dl and at 10hr 3.72mg/dl, 3.89mg/dl. However, higher dosage regimen showed a maximum decrease at 10hr.

2Effect of therapeutic dosage regimen of Aloe vera at 500mg/kg and higher dose 1000mg/kg body weight with basal diet from 1 to day 14 post treatment on biochemical parameters in dogs

Serum Bilirubin: The administration of therapeutic dosage regimen of Aloe vera at 500mg/kg and 1000mg/kg body weight orally once daily for seven consecutive days with basal diet amended the blood serum bilirubin level in dogs (Table 3). The mean control value of blood serum bilirubin was found similar for both groups 0.53mg/dl. The blood bilirubin level of dogs treated with Aloe vera decreased (P<0.05) on day 1, 0.45mg/dl and 0.39mg/dl, day 2, 0.47mg/dl and 0.53mg/dl, day 3, 0.45mg/dl and 0.44, day 4, 0.47mg/dl and 0.45mg/dl, day 5, 0.45mg/dl and 0.38 mg/dl, day 6, 0.37mg/dl and 0.31mg/dl, day 7, 0.31mg/dl and 0.28mg/dl, day 10 0.43mg/dl and 0.46mg/dl and on day 14, 0.44mg/dl and 0.37mg/dl respectively against control. The maximum decrease was observed on day seven in both dosage regimens. On day 10 and day 14, the values started to increase because in these days no Aloe vera treatment was given but still the serum bilirubin level remained declined(P<0.05) during these days. Moreover, similar (P> 0.05) effects were noted with therapeutic and higher dosage regimens.

Alkaline Phosphatase: The therapeutic dosage of Aloe vera, i.e. 500mg and higher 1000mg/kg body weight orally for seven consecutive days with basal diet altered the blood serum alkaline phosphatase level in dogs (Table 3). The mean control value was 47.75mg/dl. The Aloe vera treatment decreased(P<0.05) serum alkaline phosphatase level in dogs on day 1, 46.6u/l and 25u/l, day 2, 37.2u/l and 27.3 u/l, day 3, 43.9u/l and 25.9u/l, day 4, 36.4u/l and 26.3, day 5, 34.2u/l and 23.45u/l, 6, 32.7u/l and 24.29u/l, day 7, 34.8u/l and 26.91u/l, day 10, 26.9u/l and 23.43u/l and on day 14, 26.86u/l and 23.93u/l respectively. The maximum decrease was observed on day 6 with therapeutic dosage whereas higher dosage showed maximum decrease on day 5. However, on day 10 and 14 in both groups ALP level was also decreased (P<0.05). Moreover, similar (P>0.05) effects were noted with therapeutic and higher dosage regimens.

Alanine aminotransferase: Aloe vera treatment following 500mg/kg BW and 1000mg/kg BW orally for seven consecutive days along with basal diet modified the blood serum alanine aminotransferase level in dogs (Table 3). The mean control value of both groups was observed 5.8u/l. Aloe vera administration decreased (P<0.05) serum ALT level on day 1, 4.9u/l and 3.12u/l, day 2, 3.42u/l and 3.7, day 3, 4.41u/l and 3.41, day 4, 4.2u/l and 3.67u/l, day 5, 3.62u/l and 3.79, day 6, 3.65u/l and 3.76u/l, day 7, 3.75u/l and 3.05u/l, day 10, 3.84u/l and 4.08u/l and on day 14, 4.01u/l and 4.24u/l respectively. The maximum decrease occurred on day 5th and day 1st in both groups respectively. While on day 10 and day 14 the values also declined (P<0.05) in both dosage regimens. Moreover, similar (P>0.05) effects were noted with therapeutic and higher dosage regimens.

Aspartate Aminotransferase: The administration of Aloe vera 500mg/kg BW and 1000mg/kg BW orally for seven consecutive days along with basal diet amended the blood serum aspartate aminotransferase level in dogs (Table 4). The mean control value of both groups was observed 5.2u/l. Aloe vera treatment of both dosage regimens reduced (P<0.05) blood serum AST level on day 1st 5.04u/l and 5.54u/l, day 2nd 5.02u/l and 5.09u/l, day 3rd 4.93u/l and 4.93u/l, 4th day 4.92u/l and 5.07u/l, day 5th 4.95u/l and 5.03u/l , day 6th 4.82u/l and 4.87u/l, day 7th 4.93u/l and 4.87u/l, day 10th 4.81u/l and 4.84u/l, and on day14th 4.31u/l and 4.11u/l respectively. However, the maximum decrease was occurred at day 14th of both 500mg/kg and higher dose. Moreover, similar (P>0.05) effects were noted with therapeutic and higher dosage regimens.

Total protein: Following administration of Aloe vera once daily for a week at 500mg/kg and 100mg/kg dosage regimens altered the serum total protein level in dogs (Table 4). The mean control value for both groups was observed 7.72mg/dl. Aloe vera treatment in both groups reduced (P<0.05) total protein level on day 1st, 7.56mg/kg, 7.91mg/kg and day 2nd, 7.16mg/dl, 7.25mg/dl day 3rd, 7.16mg/dl, 7.18mg/dl day 4th, 6.42mg/dl, 6.45mg/dl day 5th, 5.71mg/dl, 6.02 mg/dl day 6th, 5.1mg/dl, 5.65mg/dl day 7th, 6. 54mg/dl, 5.95mg/dl day 10th,7.5mg/dl, 6.63mg/dl and at day 14th, 7.32mg/dl, 7.18mg/dl. However, the maximum decrease was detected on day 06 in both dosage regimens. Moreover, similar (P>0.05) effects were noted with therapeutic and higher dosage regimens.

Albumin: The administration of therapeutic dose of Aloe vera 500mg/kg and 1000mg/kg body weight orally for seven consecutive days with basal diet amended the blood serum albumin level in dogs (Table 4). The mean control value of blood serum albumin was found similar in both groups i.e. 3.71mg/dl. The blood serum albumin level of dogs treated with Aloe vera decreased (P<0.05) on day 1st, 2.83mg/dl and 2.7mg/dl, day 2nd, 2.58mg/dl and 2.42mg/dl, day 3rd, 2.42mg/dl and 2.23mg/dl, day 4th, 2.18mg/dl and 2.08mg/dl, day 5th, 2mg/dl and 2.11mg/dl, day 6th, 2.1mg/dl and 2.15mg/dl, day 7th, 3.51mg/dl and 1.92mg/dl, day 10th, 2.93mg/dl and 3.22mg/dl and on day 14th, 3.3mg/dl and 3.15mg/dl respectively against control. In therapeutic and higher dosage regimens, maximum decrease was observed on day 5 and 7 respectively. On 14th day serum albumin started to increase because during these days no Aloe vera treatment was given. Moreover, similar (p<0.05) effects were noted with therapeutic and higher dosage regimens of Aloe vera.

Table 3: Effect of therapeutic dosage and higher doses of Aloe vera at 500mg/kg and 1000mg/kg body weight with basal diet from 1 to day 14 post treatment on biochemical parameters in dogs

Groups	Days	Biochemical parameters		
		Blb	ALP	ALT
Group A		0.53^{ab}	47.75^{a}	5.8^{ac}
Group B	1	0.45^{c-e}	46.6^{a}	4.9^{e}
Group C		0.39^{ef}	25^{c}	3.12l
Group B	2	0.47^{a-d}	37.2^{b}	3.42^{k-l}
Group C		0.53^{a}	27.3^{b}	3.7^{i-k}
Group B	3	0.45^{cde}	43.9^{a}	4.41^{ef}
Group C		0.44^{d-e}	25.9^{c}	3.41
Group B	4	0.47^{a-d}	36.4^{b}	4.2^{e-h}
Group C		0.45^{c-e}	26.3^{b}	3.67^{i-k}
Group B	5	0.45^{c-e}	34.2^{b}	3.62^{jk}
Group C		0.38^{f}	23.45^{b}	3.79^{h-k}
Group B	6	0.37^{f}	32.7^{bc}	3.65^{jk}
Group C		0.31^{gh}	24.29^{bc}	3.76^{i-k}
Group B	7	0.31^{gh}	34.8^{b}	3.75^{i-k}
Group C		0.28^{h}	26.91^{b}	3.05^{l}
Group B	10	0.43^{fg}	26.9^{cd}	3.84^{g-j}
Group C		0.46^{c-d}	23.43^{d}	4.08^{e-i}
Group B	14	0.44^{fg}	26.86^{ef}	4.01^{f-j}
Group C		0.37^{f}	23.93^{cd}	4.24^{e-g}
LSD (0.05)		0.0587	6.2404	0.4184
SE±		±0.0285	±3.0236	±0.2027

Means with different superscripts in same column (a, b, c, d, e, f, g, h, I, j, k, l and m) varied significantly from one another.

Group A, B and C represents control value, 500mg/kg and 100mg/kg of Aloe vra gel respectively.

Globulin: The administration of therapeutic and increased dose of Aloe vera 500mg/kg and 1000mg/kg body weight orally for seven consecutive days with basal diet altered the blood serum globulin level in dogs (Table 4). The mean control value of blood serum

albumin was established similar for both groups i.e. 3.76mg/dl. The blood serum albumin level of dogs treated with Aloe vera @500mg and 1000mg significantly decreased (P<0.05) at day 1, 4.63mg/dl and 3.67mg/dl, at day 2nd 2.58mg/dl and 4.83mg/dl, at day 3, 4.4 mg/dl and 4.94 mg/dl, at day 4, 4.23mg/dl and 4.3 mg/dl at day 5, 3.71mg/dl and 3.84 mg/dl, at day 6, 3 mg/dl and 3.43mg /dl, at day 7, 3.03 mg/dl and 4.03 mg/dl respectively against control. The maximum decrease occurred at day 14 of both therapeutic doses. After that at day 10, and at day 14 non-significant decrease (P<0.05) was found and the value gradually returned to normal because no Aloe vera treatment was given in these days. Moreover, similar (P>0.05) effects were noted with therapeutic and higher doses.

Table 4: Effect of therapeutic dosage and higher doses of Aloe vera at 500mg/kg and 1000mg/kg body weight with basal diet from 1 to day 14 post treatment on biochemical parameters in dogs

Group	Days	Biochemical parameters			
		AST	TP	Alb	Glb
Group A		5.2^{b}	7.72^{a-c}	3.71^{a}	3.76^{h-j}
Group B	1	5.04^{e-h}	7.56^{a-c}	2.83^{g}	4.73^{a-e}
Group C		5.54^{a}	7.91^{a}	2.7^{gh}	5.21^{a}
Group B	2	5.02^{f-i}	7.16^{c-e}	2.58^{hi}	4.58^{a-f}
Group C		5.09^{d-f}	7.25^{b-d}	2.42^{ij}	4.83^{a-c}
Group B	3	4.93^{f-i}	7.16c-e	2.42^{ij}	4.74^{a-d}
Group C		4.93^{f-i}	7.18^{c-e}	2.23^{jk}	4.95^{ab}
Group B	4	4.92^{f-i}	6.42^{fg}	2.18^{kl}	4.23^{c-h}
Group C		5.07^{d-g}	6.45^{fg}	2.08^{k-m}	4.37^{b-h}
Group B	5	4.95^{f-i}	5.71^{hi}	2.l^{m}	3.71^{e-g}
Group C		5.03^{f-i}	6.02^{f-h}	2.11^{k-m}	3.91^{f-j}
Group B	6	4.82^{h-i}	5.1^{i}	2.1^{k-m}	3^{k}
Group C		4.87^{f-i}	5.65^{hi}	2.15^{kl}	3.5^{ik}
Group B	7	4.93^{f-i}	6.54^{e-g}	3.51^{n}	3.03^{ab}
Group C		4.87^{g-i}	5.95^{gh}	1.92^{m}	4.03^{e-j}
Group B	10	4.81i	7.5^{a-c}	2.93^{fg}	4.57^{a-f}
Group C		4.84^{h-i}	6.63^{d-f}	3.22^{de}	3.41^{jk}
Group B	14	4.31j	7.32a-c	3.3ce	4.02f-j
Group C		4.11^{j}	7.18^{c-e}	3.15^{ef}	4.03^{e-j}
LSD (0.05)		0.2210	0.6442	0.2300	0.6977
SE±		±0.1071	±0.3121	±0.1114	±0.3381

Means with different superscripts in same column (a, b, c, d, e, f, g, h, I, j, k, l and m) varied significantly from one another.

Group A, B and C represents control value, 500mg/kg and 100mg/kg of Aloe vra gel respectively.

Effect of therapeutic dosage of Aloe vera at 500mg/kg and higher dosage 1000mg/kg body weight with basal and basal with high energy rich diet on hourly basis following treatment on biochemical parameters in dogs.

Serum bilirubin: Following the therapeutic dosage of 500mg/kg and higher dosage of 1000mg/kg B.W of Aloe vera once daily for a week with basal and energy rich diet modified the blood serum bilirubin level in dogs (Table 5). The mean control value of both groups was observed as 0.54 mg/dl. It was noted that Aloe vera treatment decreased (P<0.05) serum bilirubin level at 0 hr, 0.49mg/dl and 0.49mg/dl, 2hr 0.42mg/dl and 0.45mg/dl, 6hr 0.43mg/dl and 0.43mg/dl and at 10 hr 0.42mg/dl and 0.42mg/dl respectively. However, the maximum decrease was observed in both groups at 10hr.

Alkaline phosphatase: Following administration of Aloe vera at the doses of 500mg/kg and 1000mg/kg body weight orally for a week with combination of basal and high energy diet altered the alkaline phosphatase level in dogs (Table 5). The mean value was observed in both groups that is 47.5u/l. The alkaline phosphatase level in dogs in both groups reduced (p<0.05) at 0hr 32.31u/l and 13.1u/l, 02hr 32.16u/l and 15.62u/l, 6 hr 32.78u/l and 17.23u/l and at 10hr 32.33u/l and 26.56u/l respectively. However, the maximum decrease was examined at 10hr in higher dosage regimen.

Alanine aminotransferase: Aloe vera treatment 500mg/kg and 1000mg/kg body weight orally once daily for a week with basal and high energy diet modified the ALT level in dogs (Table 5). The mean control value for both groups was 5.90u/l. Following Aloe vera treatment the mean ALT level was reduced (P<0.05) at 0hr 3.29u/l and 3.26 u/l, 2hr 3.26u/land 2.91u/l, 06hr 3.05u/l and 2.88u/l and at 10hr 3.17u/l and 3.11u/l respectively. However, the maximum decrease was detected in 1000mg/kg BW dosage regimen at 06hr.

Aspartate aminotransferase: Following the two dosages of Aloe vera at 500mg/kg and 1000mg/kg body weight orally once daily for a week with basal and high energy diet altered the ALT level in dogs (Table 6). The mean control value for both groups was 5.74u/l. After treatment, the mean ALT level was reduced (P<0.05) at 0hr 4.86u/l and 5.05u/l, 2hr 4.90u/l and 4.80u/l, 06hr 4.99u/l and 5.02u/l and at 10hr 4.81u/land 4.91u/l respectively. However, the maximum decrease was noticed at 2hr following higher dosage.

Total protein: Aloe vera 500mg/kg and 1000mg/kg body weight orally once daily for a week along with basal and high energy diet amended the total protein level in dogs (Table 6). The mean control value for both groups was observed 7.78mg/dl. Following Aloe vera treatment the mean total protein level was decreased (P<0.05) at 0hr 6.24mg/dl and 6.86mg/dl, 2hr 6.50mg/dl and 6.91mg/dl, 06 hr 6.84 mg/dl and 6.02mg/dl and at 10hr 6.33mg/dl and 6.50mg/dl respectively. However, the 1000mg/kg BW dosage caused a maximum decrease at 6hr.

Albumin: The therapeutic dosage of Aloe vera at 500mg/kg and 1000mg/kg BW orally once daily for a week along with basal and high energy diet amended the albumin level in dogs (Table 6). The mean control value for both groups was examined as 4.1mg/dl. Following Aloe vera treatment, the mean total protein level was decreased (P<0.05) at 0hr 3.26mg/dl and 2.65 mg/dl, 2hr 2.78mg/dl and 2.78mg/dl, 06 hr 2.97mg/dl and 2.97mg/dl and at 10hr, 3.11mg/dl and 2.79mg/dl respectively. However, 1000mg/kg BW dosage regimen showed a maximum decrease in serum albumin level at 6hr in dogs.

Globulin: The therapeutic dose of Alo vera @500mg/kg and higher dose 1000mg/kg body weight orally once daily for a week along with basal and high energy diet amended the globulin level in dogs (Table 6). The mean control value for both groups was 4.29mg/dl. Following Aloe vera treatment the mean total protein level was significantly decrease (P<0.05) at 0hr 2.98mg/dl and 4.21 mg/dl, at 2hr 3.72mg/dl and 4.13mg/dl, at 06 hr 3.87 mg/dl and 3.00 mg/dl, at 10hr, 3.22mg/dl and 3.71mg/dl respectively. However, the maximum decrease occurred at 10hr at therapeutic dose.

DISCUSSION

The medicinal history of herbs is as old as civilization of human being. Medicinal plants are the leading source of distinctive phytoconstituents, they are used extensively for the development of new drugs against various disorders and diseases (Kokate et al., 2008 and Balakrishnan et al., 2012). Medicinal herbs play vital role in the treatment of liver diseases like hepatitis, cirrhosis and loss of appetite. Silymarin, a flavonollignan mixture extracted from the milk thistle (Silybummarianum) is a popular remedy for hepatic diseases. (Das et al., 2012). Among the medicinal plants, Aloe vera (Family – Xanthorrhoeaceae) is a useful Indian medicinal plant which has been recognised with therapeutic properties to treat numerous diseases. Alo vera is generally administered orally in different forms (gel, extract, dried, powder, latex) and in various doses (150mg/kg,200mg/kg, 300mg/kg, 500mg/kg, 1000mg/kg B.W) in animals as well as in humans (Tanaka et al., 2006; Rajasekaran et al., 2006 and Sharma et al., 2009). Prolonged administration of Aloe vera gel was found to improve liver enzyme function and was found to have no negative effect on hepatic damage markers (Gupta and Flora, 2005; Iji et al., 2010). It has been reported that hepatic damage induced by carbon tetrachloride in mice model was reduced significantly following the administration of aqueous extract of dried aerial parts of Aloe vera (Chandan et al., 2007). Aloe vera is also useful in various clinical conditions such as liver complaints, type II diabetes, arthritis,

diseases of eye, tumour, spleen enlargement, vomiting, bronchitis, asthma, jaundice, gastric and duodenal ulcers, inflammatory bowel diseases constipation and non-ulcer dyspepsia. The current study was conducted to further evaluate the effects of Aloe vera at 500mg/kg and 1000mg/kg, supplemented with basal diet and high energy diet on different biochemical functions of liver in dogs (serum bilirubin, alkaline phosphatase, ALT, AST, total protein, albumin and globulin). It was noticed that during the Aloe vera treatment for a week all the biochemical parameters tested were changed from normal values.

Blood Serum Bilirubin: Aloe vera administration at the therapeutic dosage of 500mg/kg and 1000mg/kg body weight orally once daily for a week with basal diet and basal +energy rich diet caused a significant decrease (P<0.05) in blood serum bilirubin level at hourly and on daily basis in dogs (Table 1st, 3rd, 5th, 7th, appendix I and VIII). In the examined parameter, no dose dependent effect was observed between the dosage regimens. Bilirubin is one of the most important clinical indicator to measure liver necrosis and its accumulation is a measure of binding, conjugation and excretory capacity of hepatocyte. Serum bilirubin was reported to return normal level following Aloe vera treatment. This may be due to the prevention of intracellular enzyme leakage resulting from cell membrane stability or cellular regeneration in diabetic rats (Tabrizi, 2012). Aloe vera gel (AVG) also consists of some lipid soluble vitamin tocopherol.

Alkaline phosphatase: Aloe vera treatment at the therapeutic dosage of 500mg/kg and 1000mg/kg body weight orally once daily for a week with high energy diet decreased (P<0.5) the serum alkaline phosphatase level in dogs (Table 1st, 3rd, 5th, 7th and appendix II and IX). It has been reported in different studies that Aloe vera has potential to change the alkaline phosphatase level of blood serum. Alkaline phosphatase is another liver marker enzyme that is used to check liver functionality. (Tietz, 2000).

Alanine aminotransferase (ALT): Following Aloe vera treatment at the dosage of 500mg/kg and 100mg/kg orally once daily for a week decreased (P<0.05) serum alanine aminotransferase level (Table 1st, 3rd, 5th, 7th and appendix III and X).Among Hepatic Enzyme Measurement an increase in serum ALT, formerly known as serum glutamate pyruvate transaminase (SGPT), is more specific for hepatocellular injury than an increase in aspartate aminotransferase (AST), which can also signify abnormalities in muscle, heart or kidney (Dufour et al., 2000). Alanine aminotransferase (ALT) is an enzyme present in hepatocytes. When hepatocytes are damaged, the cells leak this enzyme into the blood (Sharma et al., 2009). The aminotransferases functions as a strategic link between carbohydrate and protein metabolism by converting α ketoglutarate acid and pyruvic acid on one hand and alanine and aspartic acid on the other hand (Knox and Greengard, 1965). The toxicity is due to formation of a reactive metabolite tri chloro methyl radical by microsomal fixed function oxidase.

Aspartate aminotransferase (AST): Following Aloe vera treatment at the dosage of 500mg/kg and 100mg/kg orally once daily for a week decreased (P<0.05) serum aspartate aminotransferase level at hourly and on day basis in dogs (Table 2nd, 4th, 6th, 8th and appendix IV and XI). Furthermore, no dose dependent effect was observed between both dosage regimens in all examined parameters. It is obvious from the present study that the administration of Aloe vera modified the ALT level during both dosage regimens in dogs. It has been reported that various antioxidants are existed in alo vera i-e., vitamins A (beta-carotene), C and E, B1, B2, B6, C, β-carotene, choline, folic acid, α-tocopherol. These antioxidants are stated to break down the oxidative metabolites and free radicals through oxidative stress suppression by improving the reduced glutathione conjugation metabolism reaction of hepatocytes (Hamman., 2008).

After the administration of Aloe vera at the dose of 500mg/kg and 1000mg/kg orally once daily for a week reduced (P<0.05) serum total protein, albumin and globulin level in dogs (Table 2nd, 4th, 6th, 8th and appendix V and XII, VII and XIII, VIII and XIV). The main function of albumin is to regulate the oncotic pressure of blood. Albumin, is synthesized mainly in the liver, constitute about two third of the total protein in serum and is responsible for transport of various materials including drugs in circulation (Neetika et al., 2015).

CONCLUSION

- Both dosage regimens of Aloe vera reduced biochemical parameters in dogs.
- No dose dependent effect was noticed when Aloe vera was administered in two concentrations i.e 500mg/kg b.w and 1000 mg /kg b.w in dogs.
- Clearance of Aloe vera therapy once daily for 7 days was not recorded until 14th day post treatment.

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