The Pharma Innovation

Pavani Ch. SN
Assistant Professor, Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Venkata Ramana K
Professor, Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Reddy KCS
Professor & University Head, Department of Veterinary Gynaecology and Obstetrics, College of Veterinary science, Rajendranagar, Hyderabad, Telangana, India

Kalyani P
Assistant Professor, Department of Veterinary Biotechnology, College of Veterinary science, Rajendranagar, Hyderabad, Telangana, India

Swathi B
Professor & University Head, Department of Veterinary Physiology, College of Veterinary science, Mamnoor, Warangal, Telangana, India

Corresponding Author:
Pavani Ch. SN
Assistant Professor, Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Haemato-biochemical and physiological changes in bitches with open pyometra

Pavani Ch. SN, Venkata Ramana K, Reddy KCS, Kalyani P and Swathi B

Abstract
Pyometra is the most prevalent and life-threatening disease condition in dogs. In the present study, an attempt was made to study haematological, biochemical and physiological parameters in bitches affected with Pyometra to come out with clinical status of bitch and predict the prognosis. Evaluation of various parameters was done before, during and at the end of treatment. Study has been carried out on twenty-four bitches of different age groups and breeds with open pyometra. Six reproductively sound bitches were considered as control group (Group I). Twenty-four pyometra affected bitches were randomly divided into four groups (n=6) namely II, III and IV treated with different protocols. Group II treated with Mifepristone @ 2.5 mg/kg body weight per oral route for 5 days. Group III treated with Mifepristone @ 2.5 mg/kg body weight per oral along with Misoprostol intravaginal route @ 100 mg, Group IV treated with Mifepristone @ 2.5 mg/kg body weight along with Cloprostenol sodium @ 25 μg/day along with normal saline intravaginal douching using catheter and, Group V treated with Mifepristone @ 2.5 mg/kg body weight once daily per oral for five days along with 2% N- Acetyl Cysteine intravaginal douching using catheter. Physiological parameters like temperature, respiratory rate and heart rate were nearly similar in control and pyometra affected bitches. There was significant difference observed in Total Leucocyte Count (TLC), Haemoglobin, packed cell volume and total erythrocyte count between control group and pyometra affected bitches. Anemia and leuckocytosis was observed in the affected bitches. In biochemical parameters alkaline phosphatase differed significantly in pyometra affected bitches than control group. Treatment response was confirmed by disappearance of clinical signs of pyometra, changes in physiological, haematological and biochemical parameters and later by ultrasonography. Results of the present clinical study revealed that combination protocol of Mifepristone with Misoprostol was found to be more advantageous followed by protocols using Mifepristone in combination with Cloprostenol and Mifepristone alone over Mifepristone with 2% N-Acetyl Cysteine.

Keywords: Canine, pyometra, haematological, biochemical, medical management

Introduction
Canine pyometra is a hormonally mediated acute or chronic poly-systemic diestrual disorder, characterized by the accumulation of purulent exudate in the uterine lumen in intact bitches. It is one of the most common reproductive emergencies (Jisna and Sivaprasad, 2020) [8] and is of great practical importance as it results in high mortality if not treated (Sethi *et al.,* 2020; Sharma *et al* 2020; Singh *et al* 2010) [12, 14]. Impacts approximately 23% of unneutered female dogs below the age of 10 (Egenvall *et al*., 2001) [5]. The systemic effects of pyometra are reflected by several laboratory parameters. The haematological and biochemical changes in pyometra may be considered significant to assess the severity and type of the case. Alterations in these parameters in pyometra affected bitches before and after treatment may be suggested for improvement of care and management of breeding and companion bitches.

Materials and Methods
Bitches which were presented to Veterinary Clinical Complex with the signs of illness and suspected for pyometra are subjected to haematological tests, serum biochemical tests and ultrasonographic examination. These bitches were randomly divided into four groups consisting of six bitches in each group. One more group of six bitches with sound reproductive health are also selected as control group in the study (Group l). Twenty-four pyometra affected bitches were randomly divided into four groups (n=6) namely II, III and IV treated with different protocols. Group II treated with Mifepristone @ 2.5 mg/kg body weight per oral route for 5 days. Group III treated with Mifepristone @ 2.5 mg/kg body weight per oral along with Misoprostol intravaginal route @ 100 mg, Group IV treated with Mifepristone @ 2.5

mg/kg body weight along with Cloprostenol sodium @ 25 µg/day along with normal saline intravaginal douching using catheter and, Group V treated with Mifepristone @ 2.5 mg/kg body weight once daily per oral for five days along with 2% N- Acetyl Cysteine intravaginal douching using catheter. All groups except Group l were administered antibiotics as per ABST for three weeks and non-steroidal anti-inflammatory drugs for seven days as per recommended dose. Supportive therapy in the form of intravenous fluids, inj vitamin B-complex, hematinic and inj metoclopramide hydrochloride were given in needy cases.

Blood samples were collected using sterile disposable syringes from all the bitches on day 0 (before treatment), day7 and day14 by peripheral vein puncture (either cephalic or saphenous vein) in 4ml BD vacutainers containing EDTA as anticoagulant in the respective groups. The samples were processed within 2-3 hrs after collection for the hematological parameters like White Blood Cell Count (WBC), Haemoglobin (Hb), Red Blood Cell Count (RBC), Platelets, Packed Cell Volume (PCV) and Neutrophil count. Blood samples were analysed with the help of Haemoanalyser. The serum was separated from blood samples collected in BD vacutainers without anticoagulant by centrifugation at 2000 rpm for five minutes and collected into serum collection vials. Sera samples were subjected to estimation of ALP, ALT, AST, albumin, total protein, serum creatinine and Blood Urea Nitrogen (BUN) as per standard technique on the same day of collection.

Results and discussions
Physiological parameters
The mean rectal temperature between groups before treatment fluctuated non- significantly ($p>0.05$) around their base value. There is no significant difference in mean rectal temperature between control group and pyometra affected groups before, during and after treatment. This is in line with recordings of Chandrakar et al., (2021) [4]. While Hadiya et al., (2021) [6] and Samantha et al., (2018) [11] recorded the mean rectal temperature higher than the normal physiological range (101-102.50 ^{0}F). The mean heart rate in treatment groups before, during, and after treatment was within the normal physiological range (60–140 per minute) and did not differ significantly between days and groups. Similar results were noticed by Chandrakar et al., (2021) [4]. In all groups elevated respiratory rates were noticed before, during, and after treatment. Similarly elevated levels were noticed by Chandrakar et al., (2021) [4]. Contrary to this the mean respiratory rate was 22.6±3.2 per minute and was found to be well within the normal physiological range of 20-30 per minute as studied by Samantha et al (2018). The variation in these findings might be due to the variation in the breed, season, ambient temperature and other conditions. Mean values of physiological parameters are depicted in Table 1.

Haematological parameters
The mean±SE values of haematological parameters of haemoglobin, packed cell volume, total erythrocyte count, total leucocyte count, platelets and neutrophils in control and bitches affected with pyometra before during and at the end of treatment were analyzed and presented in Table 2.

The mean Hb before treatment in all pyometra affected groups is significantly lower ($p\leq0.05$) than control group. This shows that pyometra affected animals are anaemic.

During the course of treatment, by day 7 the mean Hb values decreased in all pyometra affected bitches and by day 14 values increased but did not reach control group levels. During treatment period, there is a marked decrease in mean Hb values in G II and G IV across the period and then started increasing. In G III and G IV there is an increasing trend but not significant. Highest total mean Hb levels were noticed in control group and other groups total means were significantly lower ($p\leq0.05$). In pyometra affected groups good improvement is noticed in G IV than others. When total means were compared between groups, bitches of pyometra affected groups had significantly lower ($p\leq0.05$) Hb levels than control group. These findings are in accordance with the recordings of Samantha et al., (2018) [11]; Unnikrishnan et al., (2020) [17]; Urmila et al., (2022) [18] and Paudal et al., (2023) [10] who noticed anemia in pyometra affected bitches when compared to healthy animals. Conversely, Pati et al. (2021) [9] has reported that there was no significant decrease in hemoglobin in pyometra affected bitches. These variations may be due to the degree of involvement of the infection. The occurrence of anemia (normocytic and normochromic) could be well explained by the erythrocyte diapedesis into lumen of the uterus and decreased erythropoiesis in the bone marrow as a result of chronic uterine inflammatory disease.

The mean PCV values in pyometra affected animals were significantly lower ($p\leq0.05$) than normal control animals. Among pyometra affected animals very low PCV was noticed in G III than others. The PCV values showed no significant difference between the control group and the pyometra-affected groups by the end of day 14 treatment. However, the total means of all pyometra affected bitches were significantly lower ($p\leq0.05$) than control group. In G III there is significant increase in PCV from day 0 to day 14 of treatment. Our results were in accordance with Pati et al., (2021) [9] and Paudal et al., (2023) [10] emphasizing the severe impact of pyometra on the health of affected dogs. These studies collectively highlight the critical nature of monitoring and managing anaemia in dogs with pyometra.

Pyometra affected animals had significantly lower ($p\leq0.05$) TEC than control group before treatment and showed significantly decreasing trend ($p\leq0.05$) by day 7 of treatment. These values showed significant increase ($p\leq0.05$) by day 14 and were higher than day 0 levels. During the period of treatment there is a slight increase in mean values from day 0 to day 14 of treatment indicating positive response to treatment protocols. Results in the present study were in accordance with Samantha et al., (2018) [11]; Unnikrishnan et al., (2020) [17] and Uçmak et al., (2021) [16] But, Pati et al., (2021) [9] found no significant difference between the TEC levels in their study groups, with Group I showing a TEC of 6.68±0.17 and Group II at 5.53±0.22. These studies collectively illustrate the progression and understanding of anaemia in pyometra-affected dogs over the years, from severe cases to nuanced differences between healthy and affected groups, aiding in better diagnostic and treatment strategies.

During treatment period, there is a marked decrease ($p\leq0.05$) in mean TLC in GII, GIII across the period indicating a significant response to treatment protocols being applied. In GIV and GV there is a decreasing trend similar to GII and GIII but less dramatic. The statistical annotations show significant difference ($p\leq0.05$) during the period of treatment but overall changes are less drastic. Leukocytosis was most

consistent finding in all bitches affected with pyometra. The total means of TLC differ significantly ($p \leq 0.05$) between control and pyometra affected groups and lowest noticed in control group. Results of the present study were in accordance with Chandrakar et al., (2021) [4], Pati et al., (2021) [9], Uçmak et al., (2021) [16], Urmila et al., (2022) [18] and Paudal et al., (2023) [10]. In studies focusing on leucocytosis in pyometra-affected bitches, a trend of varying total leucocyte counts (TLC) has been observed over the years, indicating the degree of inflammatory response due to the condition. These studies collectively document the persistent, variable, and significant presence of leucocytosis in pyometra, underlining its diagnostic and prognostic importance.

The mean platelet counts before, during and at the end of 14 days of treatment all groups was within normal physiological range. This is in accordance with the study done by Unnikrishnan et al., (2020) [17] whereas Samantha et al., (2018) [11] concluded that the mean platelet was found to be less than the normal physiological value in dogs as studied. Normal range of values in thrombocyte count in the present study might be due to lower endotoxic effects on bone marrow or less severity of infection in bitches.

In all groups before the start of treatment, the mean neutrophil percentage was nearly similar to that of control group. The same trend continued at day 7 and day 14 in all the groups except in GIII where a slight decrease ($p \leq 0.05$) is noticed than other groups at day 14. Overall total means showed no significant variation in Neutrophil count between the control group and pyometra affected groups. Similar reports were presented by Al Zubaidi et al., (2024) [2] and Chandrakar et al., (2021) [4]. Whereas Samantha et al (2018); Unnikrishnan et al (2020) [17]; Uçmak et al., (2021) [16]; and Urmila et al., (2022) [18] noticed marked neutrophilia. While Paudal et al., (2023) [10] recorded mean Neutrophil count in 45 pyometra affected bitches lower than normal reference values (51.99 ± 20.78 vs 66.5 ± 14.5).

Biochemical parameters
The mean values of Alanine transaminase, Aspartate transaminase, Total protein, Albumin, Alkaline phosphatase, BUN and Creatinine in control and bitches affected with pyometra before during and at the end of treatment were presented in Table 3.

The mean ALT values showed no significant difference between the control group and the pyometra-affected groups across varying durations of treatment and between different groups. Similar results were obtained by Samantha et al., (2018) [11] and Chandrakar et al., (2021) [4].

The mean AST values showed no significant difference between the control group and the pyometra-affected groups across varying durations of treatment and between different groups. All the means in different groups were within normal physiological limits. In accordance with our study, Urmila et al. (2022) [18] found no significant difference in mean AST levels between pyometra-affected and control group bitches, indicating similar serum AST concentrations in both groups.

The mean total protein values of pyometra affected bitches were similar to control group and all the values fluctuated within physiological range. When total means between different groups were compared G II, G IV and G V values were nearly close to G I but values of GIII were significantly lower than other groups. These values are in agreement with the result of Samantha et al (2018) [11]; Chandrakar et al.,

(2021) [4]. Whereas before treatment the levels of mean total protein were higher than the normal physiological value in all four groups (Ahmed et al., 2015) [1]. Significantly high total protein values were reported by Shah et al., (2017) [19] in pyometric bitches (9.53 ± 0.78).

Mean albumin values before treatment were significantly lower in GII, G III and G IV than control group. By day 14, there was an increase in the mean albumin values in pyometra affected bitches than zero day but these levels were significantly lower ($p \leq 0.05$) than control group. While comparing the total means, in G I significantly higher values were noticed than pyometra affected groups and G III bitches showed significantly lower values than other four groups. All the values were within the normal physiological limits. There values are in accordance with the results of Shah et al., (2017) [19] who reported that albumin was decreased in pyometric bitches. Hypoalbuminemia ($2.77[+ \text{ or } -]0.09$) was recorded in the study conducted by Srinivas et al., (2018) [15]. This might be due to renal impairment that might culminate to renal loss of albumin. Similar to this in the study done by Chandrakar et al., (2021) [4] before treatment, the mean albumin level was slightly lower in group II (test treatment) compared to the normal physiological range but increased gradually to post-treatment. The mean serum albumin levels in pyometra affected bitches was lower (2.16 ± 0.88) than the standard reference (2.7 ± 0.7) as studied by Paudal., et al (2023) [10].

Mean values of ALP of pyometra affected bitches before treatment were significantly higher ($p \leq 0.05$) than control group. After the end of treatment still higher mean ALP values were noticed in bitches affected with pyometra than control group. When total means were compared, significantly higher ALP values were noticed in pyometra affected bitches than healthy control bitches ($p \leq 0.05$). Similar results were obtained by several researchers like Moderate to severe elevation of ALP levels ($138.93[+ \text{ or } -]6.63$) were recorded by Shah et al., (2017) [19], Pati et al., (2021) [9], Urmila et al (2022) [18] and Paudal et al (2023) [10] which might be due to toxaemia that resulted from pyometra inhibiting synthesis of liver enzymes and damage the hepatic membrane (Bigliardi et al., 2004) [3].

Before treatment, significant lower ($p \leq 0.05$) BUN levels were noticed in G I and II than in G IV. While, G III and G V had significantly higher values. The mean BUN values fluctuated similar to that of day 0. Higher BUN values were noticed in pyometra affected groups than control group by the end of 14 days. Upon comparing total means of BUN, control animals showed significant lower ($p \leq 0.05$) values than group II and these two differed significantly from rest of the three groups. Nevertheless, all the values were within physiological limits. The values are in agreement with the results of Hagman et al., (2009) [7] and Samantha et al., (2018) [11] demonstrating normal kidney function.

The mean serum creatinine levels before treatment in G I and G V were higher than the other three groups. By day 7, though variation was noticed, it did not differ significantly. After the end of fourteen days, G IV and G V had higher values than normal physiological range. Even after treatment the values showed no decrease. The total mean values of creatinine revealed that G IV and G V had significant higher ($p \leq 0.05$) values than G I, G II and G III. The values are in accordance with the results of Hagman et al., (2009) [7]; Samantha et al., (2018) [11]. While elevated serum creatinine values were reported by Shah et al., (2017) [19]; Chandrakar et

al., and Pati *et al*., (2021) [9].

It is concluded that the analysis of various parameters in pyometra affected bitches helps in the assessment of the clinical status and in prediction of the prognosis. Thus, the clinical status of the animal, as evident from the study, helps in deciding whether to perform surgery or to initiate medical management, thereby increasing the survival chance of the patient.

Table 1: Physiological parameters before, during and at the end of treatment (Mean±SE)

Parameters studied	Groups	Duration			Total mean
		Day 0	Day 7	Day 14	
Temperature (∘F)	G I	102.07 ± 0.29^{ax}	101.98 ± 0.19^{ax}	102.07 ± 0.08^{ax}	102.04 ± 0.03^{A}
	G II	101.70 ± 0.37^{ax}	101.87 ± 0.55^{ax}	101.53 ± 0.51^{ax}	101.70 ± 0.10^{A}
	G III	102.62 ± 0.67^{ax}	100.98 ± 0.36^{cy}	101.35 ± 0.31^{bx}	101.65 ± 0.49^{A}
	G IV	102.17 ± 0.17^{ax}	102.28 ± 0.32^{ax}	102.23 ± 0.29^{ax}	102.23 ± 0.03^{A}
	G V	102.40 ± 0.37^{ax}	101.75 ± 0.34^{ax}	102.10 ± 0.10^{ax}	102.08 ± 0.19^{A}
	Total mean	102.19 ± 0.16^{1}	101.77 ± 0.22^{1}	101.86 ± 0.17^{1}	
		Day 0	Day 7	Day 14	
Respiratory Rate (breaths/min)	G I	39.50 ± 5.84^{ax}	37.83 ± 3.18^{ax}	37.83 ± 2.55^{ax}	38.39 ± 0.56^{A}
	G II	44.67 ± 6.57^{ax}	42.67 ± 6.04^{ax}	39.00 ± 5.45^{ax}	42.11 ± 1.66^{A}
	G III	37.50 ± 4.05^{ax}	32.17 ± 2.96^{ax}	29.33 ± 1.58^{cx}	33.00 ± 2.39^{B}
	G IV	41.83 ± 6.34^{ax}	34.83 ± 5.47^{ax}	42.17 ± 9.26^{ax}	39.61 ± 2.39^{A}
	G V	38.33 ± 5.53^{ax}	42.17 ± 6.88^{ax}	42.67 ± 5.20^{ax}	41.06 ± 1.37^{A}
	Total mean	40.37 ± 1.30^{1}	37.93 ± 2.04^{1}	38.20 ± 2.40^{1}	
		Day 0	Day 7	Day 14	
Heart rate (beats/ minute)	G I	108.33 ± 4.27^{acx}	91.43 ± 18.13^{bcx}	106.67 ± 1.28^{bx}	102.14 ± 5.38^{B}
	G II	99.83 ± 5.64^{cx}	107.00 ± 6.85^{abx}	107.83 ± 5.99^{bx}	104.89 ± 2.54^{A}
	G III	124.83 ± 11.59^{ax}	122.00 ± 6.67^{ax}	107.17 ± 4.85^{bx}	118.00 ± 5.48^{A}
	G IV	112.83 ± 10.06^{acx}	111.33 ± 4.43^{abx}	110.17 ± 3.96^{bx}	111.44 ± 0.77^{A}
	G V	118.00 ± 2.08^{ax}	100.50 ± 7.67^{bx}	105.83 ± 1.11^{bx}	108.11 ± 5.18^{A}
	Total mean	112.77 ± 4.24^{1}	106.45 ± 5.13^{1}	107.53 ± 0.73^{1}	

Table 3: Biochemical changes before, during and at the end of treatment (Mean±SE)

Parameter	Groups	duration			Mean
		Day 0	Day 7	Day 14	
Blood Uria Nitrogen (BUN)mg/dl	GI	8.12 ± 1.78^{cy}	9.12 ± 1.07^{cy}	12.97 ± 2.00^{bcy}	10.07 ± 1.48^{C}
	GII	7.53 ± 0.98^{cy}	9.81 ± 1.86^{cy}	16.83 ± 5.76^{aby}	11.39 ± 2.80^{B}
	GIII	19.75 ± 3.64^{ax}	21.01 ± 6.70^{ax}	23.85 ± 7.76^{ax}	21.53 ± 1.21^{A}
	GIV	12.73 ± 2.49^{by}	12.95 ± 2.62^{by}	20.82 ± 7.74^{ax}	15.50 ± 2.66^{A}
	GV	23.73 ± 10.54^{ay}	18.25 ± 4.43^{ay}	16.34 ± 2.28^{aby}	19.44 ± 2.21^{A}
	MEAN	14.37 ± 3.20^{1}	14.23 ± 2.34^{1}	18.16 ± 1.89^{1}	
		Day 0	Day 7	Day 14	
Creatinine, mg/dl	GI	1.40 ± 0.13^{ax}	1.25 ± 0.12^{bx}	1.10 ± 0.09^{bx}	1.25 ± 0.09^{B}
	GII	0.98 ± 0.07^{ay}	1.06 ± 0.10^{by}	1.39 ± 0.15^{aby}	1.14 ± 0.12^{B}
	GIII	1.22 ± 0.16^{ax}	1.17 ± 0.21^{bx}	1.30 ± 0.25^{bx}	1.23 ± 0.04^{B}
	GIV	1.37 ± 0.11^{ay}	1.65 ± 0.57^{by}	2.40 ± 0.94^{ax}	1.80 ± 0.31^{A}
	GV	1.47 ± 0.33^{ax}	1.70 ± 0.78^{bx}	1.57 ± 0.55^{abx}	1.58 ± 0.07^{A}
	MEAN	1.29 ± 0.09^{1}	1.36 ± 0.13^{1}	1.55 ± 0.23^{1}	

A, B, C, D Total means of different group values with different superscripts in columns differ significantly ($p\leq0.05$)

1, 2, 3.. Total means of different duration values with different superscripts in columns differ significantly ($p\leq0.05$)

a, b, c, d…group wise values with different superscripts in columns differ significantly ($p\leq0.05$)

x, y, z…. duration wise values with different superscripts in rows differ significantly ($p\leq0.05$)

Table 2: Haematological changes before, during and at the end of treatment (Mean±SE)

Parameter	Groups	Duration			Mean
		Day 0	Day 7	Day 14	
Total leucocyte Count ($\times 10^3$ /μl)	GI	9.58 ± 0.90^{cx}	10.55 ± 0.38^{cx}	10.52 ± 0.46^{bx}	10.22 ± 0.31^{C}
	GII	45.32 ± 7.32^{ax}	30.40 ± 4.83^{ay}	20.32 ± 3.75^{ay}	32.01 ± 7.26^{A}
	GIII	44.63 ± 10^{ax}	25.78 ± 7.24^{ay}	20.97 ± 3.56^{ay}	30.46 ± 7.21^{AB}
	GIV	29.23 ± 2.10^{bx}	26.62 ± 4.76^{ax}	16.98 ± 2.08^{ax}	24.28 ± 3.72^{AB}
	GV	24.23 ± 7.20^{bx}	22.49 ± 4.34^{ax}	19.91 ± 3.05^{ax}	22.21 ± 1.25^{B}
	MEAN	30.60 ± 6.70^{1}	23.17 ± 3.40^{2}	17.74 ± 1.93^{2}	
		Day 0	Day 7	Day 14	
Total Erythrocyte Count ($\times 10^6$ / μl)	GI	6.71 ± 0.40^{ax}	6.46 ± 0.29^{ax}	6.37 ± 0.26^{ax}	6.51 ± 0.10^{A}
	GII	5.01 ± 0.29^{bx}	4.74 ± 0.34^{cx}	5.36 ± 0.41^{bx}	5.04 ± 0.18^{BC}
	GIII	4.79 ± 0.72^{bx}	4.67 ± 0.42^{cx}	4.87 ± 0.30^{bx}	4.78 ± 0.06^{C}
	GIV	5.35 ± 0.20^{bx}	5.29 ± 0.24^{cx}	5.65 ± 0.25^{bx}	5.43 ± 0.11^{B}
	GV	5.23 ± 0.19^{bx}	5.26 ± 0.37^{cx}	5.44 ± 0.26^{bx}	5.31 ± 0.07^{BC}

		Day 0	Day 7	Day 14	
	MEAN	5.42±0.34[1]	5.29±0.32[1]	5.54±0.24[1]	
		Day 0	Day 7	Day 14	
Haemoglobin (g/dl)	GI	14.88±0.86[ax]	14.75±0.61[ax]	14.13±0.62[ax]	14.59±0.23[A]
	GII	10.92±0.66[cx]	10.18±0.72[bx]	11.38±0.93[bx]	10.83±0.35[BC]
	GIII	9.70±1.12[cx]	10.02±1.02[bx]	10.95±0.62[bx]	10.22±0.38[C]
	GIV	11.22±0.39[cx]	11.40±0.58[bx]	12.52±0.60[bx]	11.71±0.41[B]
	GV	11.00±0.63[cx]	10.75±0.98[bx]	11.40±0.98[bx]	11.05±0.19[BC]
	MEAN	11.54±0.88[1]	11.42±0.87[1]	12.08±0.58[1]	
		Day 0	Day 7	Day 14	
Platelets (× 10³ /μl)	GI	336.33±30.51[cx]	335.67±9.78[ax]	334.17±31.43[ax]	335.39±0.64[A]
	GII	204.50±43.49[cz]	421.50±97.04[ax]	341.67±58.87[ax]	322.56±63.37[A]
	GIII	219.33±41.95[cy]	425.67±90.68[ax]	423.67±92.93[ax]	356.22±68.45[A]
	GIV	240.00±33.71[cz]	401.33±50.08[ax]	306.17±43.33[ax]	315.83±46.82[A]
	GV	221.00±43.62[cz]	373.33±93.98[ax]	442.17±74.73[ax]	345.50±65.34[A]
	MEAN	244.23±23.71[2]	391.50±16.75[1]	369.57±26.69[1]	
		Day 0	Day 7	Day 14	
PCV (%)	GI	41.62±2.56[ax]	40.45±1.68[ax]	39.13±1.58[ax]	40.40±0.72[A]
	GII	30.33±1.92[bx]	28.97±2.33[bx]	33.20±2.40[ax]	30.83±1.25[B]
	GIII	23.47±5.81[cz]	28.38±2.08[bz]	38.90±7.16[ax]	30.25±4.55[B]
	GIV	33.00±1.53[bx]	33.43±1.66[bx]	35.67±1.40[ax]	34.03±0.83[B]
	GV	32.72±2.17[bx]	32.68±2.66[bx]	34.58±1.81[ax]	33.33±0.63[B]
	MEAN	32.23±2.91[1]	32.78±2.16[1]	36.30±1.18[1]	
		Day 0	Day 7	Day 14	
Neutrophils (%)	GI	60.65±6.56[ax]	62.70±1.87[bx]	63.67±1.93[ax]	62.34±0.89[A]
	GII	67.42±5.23[ax]	62.58±3.34[bx]	64.35±2.68[ax]	64.78±1.41[A]
	GIII	67.83±5.65[ax]	69.17±5.33[ax]	51.85±5.28[by]	62.95±5.56[A]
	GIV	70.72±6.65[ay]	69.03±6.43[ay]	65.65±4.35[ay]	68.47±1.49[A]
	GV	68.78±5.53[az]	75.50±2.83[az]	65.62±4.30[az]	69.97±2.91[A]
	MEAN	67.08±1.71[1]	67.80±2.41[1]	62.23±2.62[1]	

A, B, C, D Total means of different group values with different superscripts in columns differ significantly ($p \leq 0.05$)

1, 2, 3.. Total means of different duration values with different superscripts in columns differ significantly ($p \leq 0.05$)

a, b, c, d…group wise values with different superscripts in columns differ significantly ($p \leq 0.05$)

x, y, z…. duration wise values with different superscripts in rows differ significantly ($p \leq 0.05$)

Table 3: Biochemical changes before, during and at the end of treatment (Mean±SE)

Parameter	Groups	Duration			Mean
		Day 0	Day 7	Day 14	
ALT (U/L)	GI	41.68±5.56[ax]	47.32±5.97[ax]	42.40±3.92[ax]	43.80±1.77[A]
	GII	26.62±3.75[ax]	48.53±20.35[ax]	42.45±16.50[ax]	39.20±6.53[A]
	GIII	55.55±18.24[ax]	64.63±19.34[ax]	45.88±13.08[ax]	55.36±5.41[A]
	GIV	28.23±4.35[ax]	31.72±7.42[ax]	67.44±33.80[ax]	42.46±12.53[A]
	GV	54.12±27.86[ax]	42.75±8.77[ax]	49.85±15.15[ax]	48.91±3.32[A]
	MEAN	41.24±6.14[1]	46.99±5.32[1]	49.60±4.66[1]	
		Day 0	Day 7	Day 14	
AST (U/L)	GI	45.92±5.93[bx]	44.10±6.25[bx]	46.95±5.57[bx]	45.65±0.83[BC]
	GII	81.38±36.96[ax]	61.63±9.89[ay]	70.83±16.65[ax]	71.28±5.71[A]
	GIII	52.02±14.42[ax]	50.98±8.10[ax]	52.52±7.48[ax]	51.84±0.45[AB]
	GIV	53.20±6.71[ax]	35.10±2.66[by]	54.66±6.19[ax]	47.65±6.29[AB]
	GV	45.93±7.99[bx]	38.72±4.61[bx]	41.86±2.59[bx]	42.17±2.08[BC]
	MEAN	55.69±6.60[1]	46.11±4.71[1]	53.36±4.90[1]	
		Day 0	Day 7	Day 14	
ALP (U/L)	GI	73.62±7.00[by]	89.32±19.73[ay]	69.47±4.31[by]	77.47±6.04[B]
	GII	127.80±13.02[az]	141.12±23.27[az]	170.90±36.19[az]	146.61±12.74[A]
	GIII	198.82±37.60[ax]	158.85±26.32[ax]	141.27±26.59[ax]	166.31±17.03[A]
	GIV	144.22±25.62[ay]	101.87±18.62[ay]	165.20±62.25[ay]	137.09±18.63[A]
	GV	188.25±52.87[ax]	136.26±25.66[ax]	126.57±28.14[ax]	150.36±19.15[A]
	MEAN	146.54±22.52[1]	125.48±12.92[1]	134.68±18.17[1]	
		Day 0	Day 7	Day 14	
Albumin (g/dl)	GI	3.43±0.12[ax]	3.21±0.17[ax]	3.35±0.19[ax]	3.33±0.07[A]
	GII	2.32±0.14[cy]	2.67±0.20[acy]	2.68±0.19[dcy]	2.56±0.12[B]
	GIII	2.37±0.31[cy]	2.51±0.17[cy]	2.39±0.33[dy]	2.42±0.04[C]
	GIV	2.38±0.16[cy]	2.52±0.22[cy]	2.90±0.15[bcy]	2.60±0.16[B]
	GV	2.80±0.17[acx]	2.85±0.16[acx]	2.96±0.18[bx]	2.87±0.05[B]
	MEAN	2.66±0.21[1]	2.75±0.13[1]	2.86±0.16[1]	
Total Protien (g/dl)	GI	7.52±0.31[ax]	7.61±0.19[ax]	7.33±0.33[ax]	7.49±0.08[A]
	GII	7.37±0.54[abx]	7.07±0.28[ax]	7.35±0.44[ax]	7.26±0.10[A]

	GIII	6.38 ± 0.80^{by}	6.87 ± 0.29^{ay}	6.43 ± 0.37^{by}	6.56 ± 0.15^{B}
	GIV	8.38 ± 0.47^{ax}	7.42 ± 0.32^{ay}	7.45 ± 0.30^{ay}	7.75 ± 0.32^{A}
	GV	7.33 ± 0.21^{abx}	7.19 ± 0.20^{ax}	7.37 ± 1.53^{ax}	7.30 ± 0.05^{A}
	MEAN	7.40 ± 0.32^{1}	7.23 ± 0.13^{1}	7.19 ± 0.19^{1}	

A, B, C, D Total means of different group values with different superscripts in columns differ significantly ($p\leq0.05$)

1, 2, 3.. Total means of different duration values with different superscripts in columns differ significantly ($p\leq0.05$)

a, b, c, d…group wise values with different superscripts in columns differ significantly ($p\leq0.05$)

x, y, z…. duration wise values with different superscripts in rows differ significantly ($p\leq0.05$)

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