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Effect of arsenic trioxide along with tannic acid, di-sodium hydrogen phosphate, alum and effects of sand-charcoal-iron-filter bed filtrated water along with alum on body weight and some hematological parameters in rabbit

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Abstract: The effect of arsenic trioxide along with tannic acid, di-sodium hydrogen phosphate (DSHP), alum and effects of sand-charcoal-iron-filter (SCIF)-bed filtrated water along with alum on body weight and some hematological parameters were carried out on a total of 30 (01 month old) adult Newzealand white rabbits. The Rabbits were randomly divided in to 6 equal groups (A,B,C,D,E & F) at the ratio of three males and two females in each group, rats of group A was kept as control without giving any treatment, rabbits of group B received arsenic trioxide@100 ppm, group C received arsenic trioxide @ 100 ppm plus tannic acid @100 ppm, group D received arsenic trioxide @ 100 ppm plus di-sodium hydrogen phosphate @100 ppm, group E received arsenic trioxide @100 ppm plus alum @100 ppm orally daily for 60 days in all cases and group F received alum @100 ppm in SCIF-bed filtrated water orally daily for 60 days. The result showed that body weight gain of control group (A) per week per rabbit was found to increase but in treated group B (arsenic trioxide@100ppm orally daily) the mean body weight of group B were decreased gradually and significant (P<0.05) decrease in body weight was observed at 40 days of feeding and at day 60 it was highly significant (P<0.01). Rabbits of group C, D and E were apparently normal and mild body weight reductions were observed which was statistically insignificant. No body weight loss was observed in rabbit of group F. TEC, Hb and PCV were slightly reduced in group C, D, E and F but highly significant (P< 0.01) reduction of TEC, Hb and PCV were observed in group B. ESR values were slightly increased in group C, D, E and F but highly significant (P< 0.01) increased of ESR value was observed in group B. Leukocytosis was observed in rabbits of group B. In this study, it was concluded that treatment with arsenic oxide at low doses has harmful effects on experimental animals including hematological alterations.

Keywords: arsenic trioxide; tannic acid; DSHP; alum; SCIF-bed; body weight; hematological parameters; rabbit.

1. Introduction

Arsenic (As) is “The Silent killer” for Bangladesh at present. In world water day 1998 arsenic marked as the king of poisons. Contamination of arsenic in Bangladesh is mainly geological. Now how this As comes up in

drinking water is not fully understood but the experts opinion suggest that during the dry season (October-April) the water level of the country goes down due to non-recharge and excessive extraction of ground water every year but when the lost water is not replaced by rain water. The ground water contamination by As in Bangladesh was first identified in 1993 at Chapai-Nawabgonj district. The arsenic disaster of Bangladesh has been called the most terrible environmental catastrophe of the twentyfirst century. WHO described the condition as “the largest mass poisoning of a population in history” (WHO, 2001). About 85 million people are at risk of drinking arsenic contaminated water and foodstuffs (Hossain, 2006; Wahidur, 2006). In a recent report, Chakraborti *et al.* (2010) showed that hand tube wells of the tableland and hill tract regions of Bangladesh are primarily free from arsenic contamination, while the flood plain and deltaic region including the coastal region are highly contaminated with arsenic. The arsenic contamination of drinking water may also be due to industrial pollution. In Bangladesh, the arsenic concentration in drinking water is alarmingly higher than the standard set by WHO. Together with the poor socioeconomic and nutritional status of the population, the chronic exposure to arsenic in drinking water is causing widespread health hazards in both man and animals in Bangladesh. Drinking water normally contains inorganic arsenic as arsenate (As(V)) and arsenite (As(III)). Inorganic arsenic is more dangerous than many other toxic substances. It is four times as toxic as mercury. Anyone who drinks arsenic in water at 60 parts per million (ppm) will soon die. But, organic arsenic in food is less toxic than inorganic arsenic. Most of the ingested arsenic is excreted from the body through urine, stool, skin, hair, and nail. Nonetheless, if the ingestion of arsenic through drinking water is very high, then our body normally cannot escape its toxic effects. Arsenic is deposited in tissues and causes oxidative stress to cells resulting in multiple organ dysfunctions. Arsenic poisoning has previously been considered as one of the most common causes of toxicity in domestic animals and birds (Selby *et al.*, 1977; Doyle & Spaulding, 1978; Jubb *et al.*, 1985; Bazargani *et al.*, 2007). Water and forage containing high concentrations of arsenic are the main ways through which arsenic enters the animal body, consequently gets into the human food chain, and may cause poisoning in humans and animals. Arsenic remains one of the most important carcinogens and diabetogenics in human (Eisler, 1988; Biswas *et al.*, 2000; Mukherjee *et al.*, 2004; Rana *et al.*, 2010). Nowadays it is, after lead considered the most common toxic heavy metal affecting domestic animals (Selby *et al.*, 1977; Doyle & Spaulding, 1978; Bazargani *et al.*, 2007). Arsenic poisoning may occur as peracute, acute, subacute or chronic form. While sudden death without particular clinical signs may occur in the peracute form of poisoning, acute and subacute forms are associated with severe gastroenteritis. Chronic poisoning causes ill thrift, weakness and inability, milk reduction and abortion (Selby *et al.*, 1977; Bazargani *et al.*, 2007; Radostits *et al.*, 2007). Presence of this metal in water has been reported from different countries such as USA, Canada, Mexico, Argentina, Chile, Poland, Japan, China, Taiwan, Nepal, Vietnam, Bangladesh, India and Iran (Wang *et al.*, 2002; Mandal & Suzuki, 2002; Ng *et al.*, 2003; Hosseinpourfeizi *et al.*, 2007; Mosaferi *et al.*, 2008). Several cases of chronic arsenic poisoning in humans have been reported from Iran (Hosseinpourfeizi *et al.*, 2007; Mosaferi *et al.*, 2008), there is, however, only one animal report from an industrial cattle farm (Bazargani *et al.*, 2007). In Bangladesh there is no available data in this context, so this research work has been carried out to study the effect of arsenic trioxide along with tannic acid, DSHP, alum and effects of SCIF-bed filtrated water along with alum on body weight and some hematological parameters in rabbit.

2. Materials and Methods

2.1. Experimental animals

One month old thirty apparently healthy adult Newzealand white rabbits (*Oryctolagus cuniculus*) weighing between 250-450 g were purchased from a local private farm of Muktagacha, Mymensingh, Bangladesh and brought to the Experimental Pharmacology and Toxicology laboratory at Bangladesh Agricultural University (BAU) for the present study. After two weeks of acclimatization animals were segregated on the basis of their age and body weight without significant differences. They were housed throughout the entire period of study in well ventilated animal house at a room temperature of $23 \pm 1^{\circ}\text{C}$ and were supplied with standard ration formulated by ICDDRDB, Dhaka and supplied fresh water *ad libitum*.

2.2. SCIF –bed filtered water

Sand-Charcoal-Iron-Filter (SCIF) bed was developed and used as arsenic purifying system. The artificially As contaminated water was passed sequentially four times through SCIF bed. The filtrated water was collected and examined by using Merck Arsen test kit and was used in the study.

2.3. Experimental chemicals

The alum, tannic acid, activated charcoal (Merck KGa, Darmstadt, Germany), wood charcoal (kat koila), sand were collected from local source and the Arsenic trioxide (As_2O_3 , MW 197.84g/mol; product No. 37274, Loba chemic pvt ltd, Mumbai, India), di-sodium hydrogen phosphate (Merck, India), iron oxide (BDH Lab., poole, England) were collected from Dhaka for this study.

2.4. Experimental design

The Rabbits were randomly divided in to 6 equal groups (A,B,C,D,E & F) at the ratio of three males and two females in each group, rats of group A was kept as control without giving any treatment, rabbits of group B received arsenic trioxide@100ppm, group C received arsenic trioxide@100ppm plus tannic acid@100ppm, group D received arsenic trioxide@100ppm plus di-sodium hydrogen phosphate@100ppm, group E received arsenic trioxide@100ppm plus alum@100ppm and group F received alum@100ppm in SCIF-bed filtrated water orally daily for 60 days in each cases. Prior to segregation, initial body weight of each rabbit was recorded and kept group wise in cages. After treatment all the rabbit were kept under close observation for a whole period of study and all the parameters (body weight gain or loss, hematological parameters eg. TEC, TLC, Hb%, PCV and ESR was recorded before and during treatment at specific time intervals.

2.5. Measurement of body weight

The body weight of each rabbit was measured just before starting of treatment and body weight gain or loss was recorded in each 10 days interval up to sacrificing of the animals.

2.6. Procedures for the collection of blood sample for measuring hematological parameters

Blood was collected just before treatment i.e. day 0 and during treatment on day 20, 40 and day 60 directly from marginal ear vein of rabbit. Immediately after collection blood was transferred to sterile tube containing anticoagulant (4% sodium citrate solution) at a ratio of 1:10 and used for determination of different hematological parameters.

2.7. Hematological parameters

Total erythrocyte count (TEC), total leukocyte count (TLC), hemoglobin content (gm%), erythrocyte sedimentation rate (ESR), packed cell volume (PCV) were determined as per methods cited by Coffin (1955).

2.7.1. Determination of total erythrocyte count (TEC)

The blood was sucked by the red pipette up to 0.5 mark of the pipette. Then the tip of the pipette was placed in to red cell diluting fluid and the pipette was filled with the fluid up to 101 mark. The contents of the pipette were mixed thoroughly by shaking with 8-knot motion for 3-5 minutes. The counting chamber was placed with cover glass under microscope using low power (10X) objective and a small drop of fluid was placed properly on the counting chamber. The cells were counted from the recognized 80 small squares under high power objectives (40X). After completion of counting total cells, the number of RBC recorded from the supplied samples were expressed as, No. of cells counted x 10,000 and the result was expressed in million/ mm^3 .

2.7.2. Determination of total leukocyte count (TLC)

Well mixed blood was drawn up to 0.5 mark of white blood cell pipette. The diluting fluid (N/10 HCL) was filled up to the 11 mark of the pipette and the contents were thoroughly mixed for 2 minutes. The counting chamber was then placed properly and filled with one drop of fluid and examined under low power (10X) objective. The leukocytes in the four large squares (each 1 square mm) of the counting chamber were counted. The number of WBC was calculated as follows: No. of WBC= No. of cell counted x 50. The result was expressed in thousand / mm^3 .

2.7.3. Determination of hemoglobin content (gm%)

The N/10 HCL solution was taken in a graduated diluting tube up to 2 marks with the help of a dropper. Citrated well homogenized blood was then drawn in to Sahli pipette up to 20 μ l mark. The blood of the pipette was immediately transferred in to the diluting tube containing HCl solution. This blood and acid were thoroughly mixed by a glass stirrer in to the diluting tube so that acid hematin mixture is formed. The tube containing acid hematin mixture was kept standing in the comparator for 5 minutes and distilled water was added drop by drop. The solution was mixed well with a stirrer untill the color of mixture resembled the standard color of the

comparator. The result was read in daylight observing the height of the liquid in the tube considering the lower meniscus of the liquid column. The result was then expressed in gm%.

2.7.4. Erythrocyte sedimentation rate (ESR)

The fresh anticoagulated blood was taken in to the Wintrobe hematocrit tube by using special loading pipette exactly up to 0 mark. Then the filled tubes were placed vertically undisturbed the wooden rack for one hour and then ESR was recorded from the top of the pipette and expressed in mm in first hour.

2.7.5. Packed cell volume (PCV)

Blood filled Wintrobe hematocrit tube was centrifuged for 30 minutes @3000rpm. Then the hematocrit or PCV was recorded, the percent volume occupied by the hematocrit was calculated by the following formula as described by Coffin (1955).

PCV% = Height of the red cell volume in cm / Height of total blood in cm x 100

2.8. Statistical analysis

Collected data were statistically analyzed by the computer using statistical package programme MSTAT-C developed by Russel (1996). A one way ANOVA was made by F variance test.

3. Results and Discussion

3.1. Effect on body weight

The mean body weight of rabbits of group F (+9.15%) significantly increased as like control group (group-A) (+6.79%) which was statistically significant ($P < 0.01$). In group B significant decreased of body weight was observed on 60 days of arsenic trioxide feeding which was statistically highly significant ($P < 0.01$). The body weight of group C, D and E was slightly increased on 60 days of arsenic trioxide feeding in combination with tannic acid, DHSP and alum respectively but were statistically not significant (Table-1). The mean body weight of group B were decreased gradually and significant ($P < 0.05$) decrease in body weight was observed at 40 days of feeding and at day 60 it was highly significant ($P < 0.01$). The similar result on body weight was observed by many other workers (Byron 1967; Suren, 1977; confer 1980). Rabbits of group C, D and E were apparently normal and mild body weight reduction were observed at the last part of the experiment which was statistically insignificant, this might be due to the interaction of arsenic oxide with other chemicals like tannic acid, DSHP and alum used in those groups respectively. No loss of body weight in rabbits of group F were observed during the whole experiment period might be due to supplied SCIF bed filtrated water with alum which indicates the successful use of SCIF bed to filtrate arsenic contaminated water as arsenic purifying system. The results of this study was in agreement with the findings of a research conducted by Khan *et al.*, 2014 on mice, ducklings and broiler chicken in Pakistan.

3.2. Effect on hematological parameters

3.2.1. Total erythrocyte count (TEC)

In rabbits of group B, treated with arsenic trioxide @100ppm, TEC started to decrease from 20 days onward and the significant reduction ($P < 0.05$) was observed on 40 days of feeding. The decrease was highly significant ($P < 0.01$) on 60 days of feeding (Table-2). The results was in accordance with the findings of few workers (Chinoy *et al.*, 2004; Rana *et al.*, 2008; Ferzand *et al.*, 2012; Gyasi *et al.*, 2012). The suppressed TEC, Hb concentration could be due to impaired function of bone marrow and a suppression of erythropoiesis following chronic arsenic toxicity. In other groups, TEC values were slightly altered but not statistically significant. This might be due to interaction of tannic acid, DSHP, Alum with arsenic trioxide and the use of SCIF bed filtered water. It was noticed that arsenic toxicity depends on the nature of arsenic compounds and roots of absorption. High concentration of arsine (10 ppm) caused death within hours due to red blood cell haemolysis in man. Low levels of arsenic (0.5-5.0 ppm) brought about these effects in a few weeks, and an average concentration of 0.5 mg/l (0.2mg/m³) was considered acceptable in the work place for human (Sittig, 1985). Renal damage was secondary and occurred due to clogging of nephrons with hemolytic debris. Mono-, di-, and trimethylarsines were strong irritants but were found less hemolytic than arsine (NIOSH, 1979). Arsine exposure by humans was found fatal without proper therapy. Arsine breaks down in the body to inorganic arsenic and methylated derivatives which was less toxic than arsine (Fowler and Weissburg, 1974). The mechanism of hemolysis involved depletion of intracellular GSH, resulting in oxidation of sulfhydryl groups in the hemoglobin from ferrous to ferric in mice and rats. Haemocyanin combines with arsenic, which reduced oxygen uptake by cells and therapy prevents hatching (Calabrese *et al.*, 1987).

Table 1. Effect of arsenic trioxide along with tannic acid, DSHP, alum and effects of SCIF-bed filtrated water along with alum respectively on body weight (gm) and in rabbits.

Gr.	Chemicals with dose & route	Pretreatment				During treatment				% increased/ decreased
		Day 0	Day 10	Day 20	Day 30	Day 40	Day 50	Day 60		
A	Control(untreated)	1620± 1.7029	1630± 1.7029	1650± 1.7029	1670± 1.7029	1695±2.5298	1720± 3.5214	1730± 3.5355	+6.79	
B	Arsenicosis control group AS ₂ O ₃ @100ppm orally	1650± 1.7029	1660± 3.7947	1663± 1.0000	1600± 1.7029a	1550± 3.2275a	1520± 2.0412* a	1480± 5.7735** b	- 10.30	
C	AS ₂ O ₃ @100ppm +Tannic acid @100ppm orally	1350± 3.5355	1358± 3.4059	1367± 3.2249	1373± 3.3823	1376± 3.4059	1368± 3.2249	1360± 3.5355	+0.75	
D	AS ₂ O ₃ @100ppm +DSHP @100ppm orally	1715± 3.5355	1719 ±3.4059	1725± 3.5355	1730± 3./5355	1726± 3.6878	1722± 3.8601	1720± 3.5355	+0.29	
E	AS ₂ O ₃ @100ppm +Alum @100ppm orally	1430± 1.7029	1435± 3.2619	1441± 1.3638	1444± 1.4142	1446± 1.5811	1445± 3.5355	1440± 3.5355	+0.69	
F	SCIF –bed filtrated water + Alum @100ppm orally	1420 ±1.7029	1423± 2.4083	1428± 3.4059	1433± 1.1402	1439± 3.5355	1445± 1.8439	1550± 1.7029	+9.15	

Values above represent the mean ± SE of 5 rabbits

a= Mean+ SE of four rabbits

b= Mean+ SE of two rabbits

* Indicates significant values

** Indicates highly significant values

+ indicates % increased – indicates % decreased.

Table 2. Effect of arsenic trioxide along with tannic acid, DSHP, alum and effects of SCIF-bed filtrated water along with alum respectively on total erythrocyte count(TEC)(X 10⁶/mm³) and total leukocyte count(TLC)(X 10⁶/mm³) in rabbits.

Gr.	Chemicals with dose & route	Pretreatment				During treatment			
		Day 0		Day 20		Day 40		Day 60	
		TEC	TLC	TEC	TLC	TEC	TLC	TEC	TLC
A	Control(untreated)	6.71±3.415	7.31± 1.703	6.79± 3.536	7.26 ±1.0000	6.81± 3.536	7.22± 1.158	6.83± 3.302	7.17± 1.140
B	Arsenicosis control group AS ₂ O ₃ @100ppm orally	6.31± 3.536	6.83± 1.140	6.20± 3.536	7.17± 1.703	5.81± 4.301 ^{*a}	8.92 ±1.140 ^{*a}	4.86± 5.774 ^{**b}	11.83± 1.844 ^{**b}
C	AS ₂ O ₃ @100ppm +Tannic acid @100ppm orally	6.41± 3.406	7.02 ±7.071	6.38± 3.302	6.21± 1.581	6.33± 3.302	6.58 ±1.140	6.30± 3.536	6.84± 1.703
D	AS ₂ O ₃ @100ppm +DSHP @100ppm orally	6.53± 3.302	6.91± 1.304	6.49± 3.406	6.73± 8.602	6.45 ±3.536	6.52 ±1.140	6.42± 4.050	6.43± 1.140
E	AS ₂ O ₃ @100ppm +Alum @100ppm orally	6.39± 2.915	6.39 ±1.304	6.33± 2.267	6.28± 1.140	6.21± 3.415	6.12± 1.140	6.15± 3.406	6.01± 0.1858
F	SCIF –bed filtrated water + Alum @100ppm orally	6.65± 3.536	6.57± 7.071	6.71± 3.501	6.38 ±1.140	6.72± 3.696	6.21± 1.844	6.73± 3.302	6.19± 2.0225

Values above represent the mean ± SE of 5 rabbits

a= Mean+ SE of four rabbits

b= Mean+ SE of two rabbits

* Indicates significant values

** Indicates highly significant values

Table 3. Effect of arsenic trioxide along with tannic acid, DSHP, alum and effects of SCIF-bed filtrated water along with alum respectively on hemoglobin content(gm%),Packed cell volume(PCV%) and erythrocyte sedimentation rate(mm in 1st hour)in rabbits.

Gr.	Chemicals with dose & route	Pretreatment						During treatment					
		Day 0			Day 20			Day 40			Day 60		
		Hb	PCV	ESR	Hb	PCV	ESR	Hb	PCV	ESR	Hb	PCV	ESR
A	Control(untreated)	13.93 ± 0.7071	41.55± 0.7071	2.0± 0.3225	13.88± 0.7071	41.56 ± 0.7071	2.0± 0.3302	13.84 ± 0.7071	41.43± 0.7071	2.01 ± 1.030	13.81± 0.7071	41.20± 0.7071	2.0±3 1.140
B	Arsenicosis control group AS ₂ O ₃ @100ppm orally	12.74 ± 0.7071	41.03 ± 0.7071	2.0± 0.2702	12.07 ± 0.7071	40.03 ± 0.7071	3.67± 0.3178	10.58 ± 1.732 ^a	37.18± 0.8124	7.97± 0.7071 ^a	8.0 ± 0.5774 ^{**b}	32.83 ± 0.5099 ^{**b}	13.39 ± 1.0000 ^{**b}
C	AS ₂ O ₃ @100ppm +Tannic acid @100ppm orally	12.63± 0.7071	41.11 ± 0.7071	2.0± 0.1304	12.45± 0.7071	41.07± 0.7071	2.0 ± 7.810	12.29± 0.7071	40.61± 0.6881	2.11± 1.140	12.03± 0.7071	40.03 ± 0.7071	2.17± 1.140
D	AS ₂ O ₃ @100ppm +DSHP @100ppm orally	12.86 ± 0.1129	41.19 ± 0.7071	2.0± 0.1844	12.71± 8.746	41.10 ± 0.7071	2.0 ± 1.0000	12.51 ± 9.818	40.63± 0.7071	2.09± 1.414	11.98± 3.072	39.97± 0.7071	2.14± 7.071
E	AS ₂ O ₃ @100ppm +Alum @100ppm orally	12.83± 0.7071	41.78 ± 0.7071	2.0± 0.1612	12.61 ± 0.7071	41.71± 0.7071	2.0± 3.302	12.11± 0.7071	41.36± 0.7071	2.04 ± 4.341	11.90± 0.7376	41.11± 0.7071	2.13± 1.140
F	SCIF –bed filtrated water + Alum @100ppm orally	12.97 ± 0.7071	41.33 ± 0.7071	2.0± 1.000	12.94± 0.7071	41.41 ± 0.7071	2.0± 7.071	12.88± 0.7071	41.28± 0.7071	2.0 ± 1.281	12.82± 0.7071	41.17± 0.7071	2.01± 7.071

Values above represent the mean ± SE of 5 rabbits

a= Mean+ SE of four rabbits

b= Mean+ SE of two rabbits

* Indicates significant values, ** Indicates highly significant values

3.2.2. Total leukocyte count (TLC)

In rabbits of group B, treated with arsenic trioxide @100ppm, the TLC count was increased from day 20, from day 40 it was significant ($P<0.05$) and from day 60 it was highly significant ($P<0.01$) (Table-2). The results was in accordance with the findings of yeasmin *et al.*, (2011) and Sarker *et al.*, (2012) in mice but dissimilar to the findings of Ferzand *et al.*, (2012); Gyasi *et al.*, 2012 in mice. This might be due to counteract the poisonous effect of arsenic, duration of exposure and dose variability. The haematopoietic system was also affected by both short-and long-term arsenic exposures. Anemia and leukopenia were common effects of poisoning and have been reported as resulting from acute, intermediate and chronic oral exposures (Armstrong *et al.*, 1984). These effects might be due to a direct haemolytic or cytotoxic effect on the blood cells (Lerman *et al.*, 1980). In other groups, TEC values were not altered significantly. This might be due to interaction of tannic acid, DSHP, Alum with arsenic trioxide and the use of SCIF bed filtered water.

3.2.3. Hemoglobin content (Hb content)

In rabbits of group B, treated with arsenic trioxide @100ppm, hemoglobin content started to reduce from day 20 onward and on days 40 amount decreased was significant ($P<0.05$). However, highly significant ($P<0.01$) change was observed at 60 days of feeding (Table-3). The results was in accordance with the findings of Blair *et al.*, (1990); Ferzand *et al.*, (2012); Gyasi *et al.*, (2012) and Sarker *et al.*, (2012). In the same type of studies conducted by Breton *et al.*, (2006) and Gupta and Flora (2006) and they examined the hematological alteration due to arsenic and their results were correlated with our results that TEC and Hb was decreased. This could be due to binding ability of arsenic to Hb that led to inhibition of heme synthesis pathway. PCV decrease was the result of the decrease of prior parameters. In other groups, hemoglobin content was slightly altered but not statistically significant. This might be due to interaction of tannic acid, DSHP, Alum with arsenic trioxide and the use of SCIF bed filtered water.

3.2.4. Packed cell volume (PCV)

In rabbits of group B, treated with arsenic trioxide @100ppm, the PCV value started to decrease from day 20 onward, from day 40 reduction was significant ($P<0.05$) and from day 60 it was highly significant ($P<0.01$). The result was in accordance with the findings of Islam *et al.*, (2011). The decrease in PCV could be due to reduction of red marrow in chronically exposed animals. In other groups, the PCV values were not altered significantly (Table-3).

3.2.5. Erythrocyte sedimentation rate (ESR)

In rabbits of group B, treated with arsenic trioxide @100ppm, the ESR values was increased from day 20, significant ($P<0.05$) increased from day 40 and from day 60 it was highly significant ($P<0.01$). The result was in accordance with the findings of Islam *et al.*, (2011). This increase ESR value might be due to the alterations of the other parameters of blood. In other groups, TEC values were not altered significantly (Table-3).

4. Conclusions

Treatment with arsenic oxide at low doses has harmful effects on experimental animals including hematological alterations. Therefore, intake of alum treated SCIF bed filtered water might be helpful to reduce the body burden of arsenic toxicities.

Conflict of interest

None to declare.

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