RESEARCH ARTICLE

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Protective role of *Alove Vera* against aluminum induced changes in the body weight reduction of albino rats, *Rattus norvegicus*

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ABSTRACT
The current study was carried out to investigate protective role of *Alove Vera* against aluminum induced changes in the body weight reduction of albino rats due to its deleterious effects. *Aloe vera* is a medicinal plant belonging to the family –*Liliaceae,* which has a wide range of therapeutic applications such as wound healing, diabetes, burns, for easing intestinal, curing ulcers and arthritic swellings. 30 adult rats were taken and divided into 3 groups 10 (5+5) for each. Animals were fed with normal diet and water *ad-libitum,* as Group I or control group. Group II animals were fed with normal diet and received aluminium in a dose of 98 mg/kg of body weight orally for 30 and 60 days. Group III were fed with normal diet and received aloin (100mg/kg body weight) and aluminium sulphate (98 mg/kg body weight) for 15, 30 and 60 days. On the last day of the experiment, animals were weighed on 15, 30th and 60th days respectively. The results of the present study clearly indicated that aluminium sulphate *per se* treated group has significantly reduced the body weight of albino rats. But after co treatment of rats with aloin the extract of *Aloe vera* and aluminum sulphate, the restoration of body weight was observed in co treatment group, indicating the protective role of aloin against aluminium sulphate toxicity.
Keywords: Aluminium Toxicity, Aloe vera, Albino Rats, Body weight reduction, Aluminium sulphate.

Introduction

Aluminium (Al), the third most common element approximately 8% of total mineral components in the earth's crust found combination with oxygen, silicon, fluorine and other elements in the soil, rocks, clays and gems has a significant toxic potential for humans (Ver-straeten *et al.,* 2008)[1]. Aluminium enters the human body via food, air, water and drugs and is present in many manufactured foods such as processed cheese, baking powders, cake mixes, frozen dough, pancake mixes and pharmaceutical products, especially antacids (Wang, et al., 2002)[2]. Aluminium has the potential to cause neurological disorders in human and animals, it's accumulation in the brain has been linked to various neurodegerative diseases (Yokel *et al.,* 2002; Zatta *et al.,* 2003)[3,4]. Chronic exposure to aluminium is involved in neuro-degenarative disorders, such as Alzheimer's disease (Campbell A. (2002)[5], Parkinson's dementia (Hirsch *et al.,* 1991)[6] and hepatotoxicity (Yumoto *et al.,* 1993, Muhammad *et al.,* 2014 Crane *et al.,* 2014).[7,8,9] Body weight decreases were reported for male Golden Syrian hamsters acutely exposed via whole-body inhalation to 3, 10, or 33 mg Al/m^3 as alchlor, a common component of antiperspirants (Drew *et al.,* 1974)[10]. In another report, significant reduction in body weight (>10%) was observed in Fischer 344 rats after 24 months of exposure to 6.1 mg/m3 as aluminum chlorhydrate (Steinhagen *et al.,* 1978)[11]. Increased aluminum concentration diminishes collagen synthesis by osteoblasts, and slows mineralization processes, which is a direct cause of a drop in the normal amount of bone tissue (Alessio *et al.,* 1989)[12].

Plants have been used to treat various diseases and have been an exemplary source of medicine over the years (Ates *et al.,* 2003)[13]. It has been reported that plant extracts detoxify various kinds of environmental pollutant (Salt *et al.,* 1998)[14]. *Aloe vera* is one such ancient plant it's medicinal properties (Shelton *et al.,* 1991)[15] have been known since centuries and has wide range of therapeutic applications such as wound healing effect, reduction of blood sugar in diabetes, for soothing burns, for easing intestinal, for curing ulcers and for reducing arthritic swellings (Davis *et al.,* 1994)[16]. *Aloe vera* gel contains anthroquinones (aloin, aloe-emodin) which

may have a variety of properties of anti oxidant agent, including the protective role for heavy metal toxicity Purohit et al (2009)[17], Richa Gupta *et al.,* (2005)[18]; Yadav *et al.,* (2009)[19]; Zubaydi *et al* (2009)[20]. The goal of this study was to investigate the protective role of *Aloe vera* on aluminium induced changes in testicular enzymes of albino rats.

MATERIALS AND METHODS

Healthy adult male albino rats (*Rattus norvegicus*) weighing 175 ± 5 gm were used for the experiments, procured from Mhow, Bhopal (MP) India, and maintained in our laboratory. The rats were acclimatized in laboratory conditions for two weeks and were maintained at 28 ± 2^0C room temperature and relative humidity (60 ± 10%) with a 12 hours light-dark cycle in the animal house of biotechnology laboratory, Saifia Science College, Bhopal. Food and water were provided *adlibitum* throughout the experiment to avoid effects of starvation. No mortality was observed during the acclimatization period and during whole experimentation period up to 60 days.

Collection and preparation of plant materials for experiment

Aloe vera plant leaves were used for the present study Leaves of *Aloe vera* were collected in and around the Bhopal. Preparation of *A. vera* (leaf gel) extract was done according to the method of Arunkumar, S., Muthuselvam (2009)[21] with slight modifications. Skin of the leaves were pealed and the gel inside was used for extraction. 100 gms of the gel was added to 250 mL of ethanol and extracted using the Soxlet assembly. Later on, the solvent of the extracted material was removed at low temperature in a rotary vacuum evaporator and the resulting dried extract was lyophilized in a freeze dryer.

Experimental design

All the experimental animals were divided into three groups as group I, II and III.

Group I: - This group of 10 (5+5) animals was fed with normal diet and water *ad libitum,* as control group. **Group II:** - This group of 10 (5+5) animals was fed with normal diet and aluminium in a dose of 98 mg/kg of body weight orally for 30 and 60 days. **Group III:** - This group of 10 (5+5) animals were fed with normal diet and received aloin (100mg/kg body weight) and aluminium sulphate (98 mg/kg body weight) for 30 and 60 days.

Detection of LD50 Value

Detection of LD_{50} value for aluminum sulphate was determined by static bioassay method of (Sprague JB, 1969)[22]. The LD50 of aluminum sulphate was estimated and was found to be 980 ± 90 mg-Al/kg body weight and almost tenfold lower concentration of LD50 i.e. 98 mg/kg body weight was selected as sub lethal dose for toxicological evaluation in the present study.

RESULTS

BODY WEIGHT STUDIES

Growth performance was the most sensitive parameter measured for studying deleterious effects of aluminum alone (*per se*) and along with co treatment of *Aloe vera* extract containing aloin. In the present study, reduction in body weight has been used as an indicator for the deterioration of the general health status of experimental animals. Reduction in body weight has been related with reduction in efficiency of conversion of food energy. Reduced efficiency of food conversion may be an indication of impaired absorption of nutrients from the gastrointestinal tract or of a metabolic defect at the cellular level in presence of toxic substances. In this series of experiments male rats, *Rattus norvegicus* gained body weight in an identical manner during the experimentation in the control group during the whole experimental period of 15, 30 and 60 days.

Effects of aluminum sulphate on body weight (in grams) of treated male rat, *Rattus norvegicus* along with well matched controls.

Replicates (N)	Mean ± SE	P-Value
Control	176.95 ± 0.18	0.0003
Alum *Per se*	153.71 ± 0.21	0.0001
Aloin +Alum	152.86 ± 0.15	0.0021

Table 1: Showing changes in body weight (in grams) of control, aluminum sulphate per se and aluminum sulphate+aloin treated rats, Rattus norvegicus for 15 days of exposure.

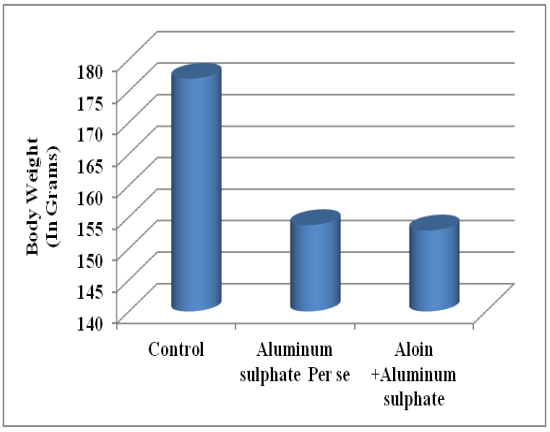

Figure 1: Showing change in body weight (in grams) of control, aluminum sulphate per se and aluminum sulphate+aloin treated rats, *Rattus norvegicus* for 15 days of exposure.

Oral administration of aluminum sulphate in pre-decided dose of 98 mg/kg body weight showed alteration in body weight of male rat, *Rattus norvegicus*. In 15 days of exposure period the body weight of treated rats were reduced to 153.71 ± 0.21(gms) as compared to the control rats 176.95 ± 0.18 (gms) (Table 1; Figure 1).
In the 30 days intoxicated group the body weight decreased from the control value of 181.83 (gms) ± 0.24(gms) to 156.69 ± 0.17 (gms) as shown in Table 2 & Figure 2.

Replicates (N)	Mean ± SE	P-values
Control	**181.83 ± 0.24**	**0.0006**
Alum *Per se*	**156.69 ± 0.17**	**0.0002**
Aloin +Alum	**171.21 ± 0.22**	**0.0001**

Table 2: Showing changes in body weight (in grams) of control, aluminum sulphate *per se* and aluminum sulphate+aloin treated rats, *Rattus norvegicus* for 30 days of exposure.

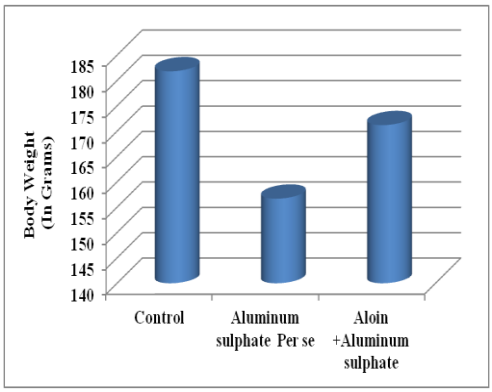

Figure 2: Showing change in body weight (in grams) of control, aluminum sulphate *per se* and aluminum sulphate+aloin treated rats, *Rattus norvegicus* for 30 days of exposure.

When the time of exposure of aluminum sulphate was further increased up to 60 days, the body weight of treated animals was further decreased in respect to time with a control value of 177.43 ± 0.19 (gms) to 141.76 ± 0.13 (gms) (Table 3; Figure 3).

Replicates (N)	Mean± SE	P- Values
Control	177.43 ± 0.19	0.0022
Alum Per se	141.76 ± 0.13	0.0010
Aloin +Alum	161.49 ± 0.21	0.0009

Table 3: Showing changes in body weight (in grams) of control, aluminum sulphate *per se* and aluminum sulphate+aloin treated rats, *Rattus norvegicus* for 60 days of exposure

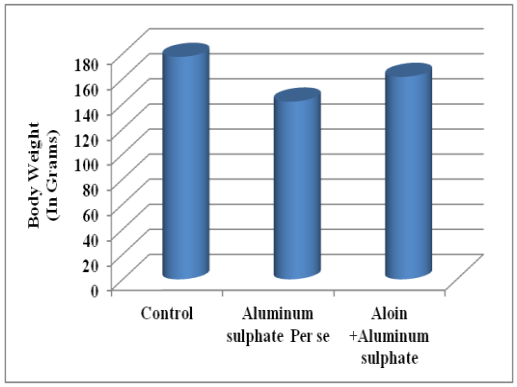

Figure 3: Showing change in body weight (in grams) of control, aluminum sulphate *per se* and aluminum sulphate+aloin treated rats, *Rattus norvegicus* for 60 days of exposure.

Thus the data clearly showed that aluminum sulphate in a dose range of 98 mg/kg body weight was significantly reduced the body weight of all rats from 15 to 60 days of treatment with aluminum sulphate.

Effect of aluminum sulphate along with co treatment of aloin the extract of *Aloe vera* on the body weight of the rat, *Rattus norvegicus*

In the next series of experiment all the rats (*Rattus norvegicus*) were treated with 100 mg/kg body weight of aloin after which they were subjected to aluminum sulphate exposure for different experimental periods i.e. 15, 30 and 60 days. In the 15 days co treatment of aloin the extract of *Aloe vera* (100 mg/kg feed) and aluminum sulphate (98 mg/kg body weight) the body weight of rats got decreased from 176.95± 0.18 (gms) to 152.86 ± 0.15 (gms) (Table 1; Figure 1). But the reduction in body weight was much lesser than aluminum sulphate treated group.

Similarly in 30 days co treatment of aloin, it was found that aloin attenuated the reduction in body weight reduced by aluminum sulphate *per se*. It was found to increase significantly to171.21 ± 0.22 (gms) in comparison to the aluminum sulphate *per se* treated value of 156.69 ± 0.17 (gms) (Table 2; Figure 2). When the duration of exposure was further increased up to 60 days, the body weight of treated animals was further found to decrease in respect to time with a control value of 177.43 ± 0.19 to 161.49 ± 0.21. But the reduction in body weight due to aluminum sulphate and aloin the extract of *Aloe vera* was much lesser than that of aluminum sulphate *per se* (Table3; Figure 3).

The results indicated that aluminum sulphate administration had a detrimental effect on the body weights of rats and lower body weight could indicate that aluminum sulphate treatment influences the bioavailability of some nutrients. In another group when extract of *Aloe vera*, aloin was also given to rats before aluminum sulphate treatment, the weight loss in the treated groups got substantially slower than that of aluminum sulphate *per se* treated group. Apart from this after co treatment of aloin the extract of *Aloe vera* with aluminum sulphate slight recovery in body weight was also observed in 30 days and 60 days treated animals showing the abolishment of deleterious effect of aluminum sulphate, on general body weight of the exposed animals.

DISCUSSION:

Body weight Studies of *Rattus norvegicus* exposed to Aluminum with and without Aloin treatments

From the data of the present study with regard to the body weight of experimental rats *Rattus norvegicus*, it is clear that weight of all the rats exposed to aluminum sulphate alone decreased significantly in the exposure periods of 15 to 60 days as shown in Table No. 1, 2 and 3. There was no mortality observed during the whole experimentation period.

It has been observed that initially the rate of growth and percent reduction was slow, but as the exposure period increased, the rate of growth and percent reduction also got reduced in a linear manner. In the 15 days exposure period the weight reduction was in significant, however the body weight of the rats exposed to aluminum decreased markedly after 30 days of exposure of the metal (Table & Figure No. 1, 2, 3).

Data of the present findings that aloin can ameliorate the body weight induced by aluminum can be correlated with similar findings of Grape seed extract (GSE), which has been reported to have many other beneficial effects like hepato protection and increased body weight, protection for silica-induced pulmonary fibrosis and ethanol-induced cell death (Wen-Hsiung *et al*, 2006; Hasseeb *et al.*, 2011)[23,24] as well as antioxidant properties and free radical scavenging activities (Bouchet *et al.*, 1998)[25]. The complex grape seed proanthocyanidin mix (including catechin and epicatechin monomers and oligomers) has been similarly reported to counter the oxidative stress, increase body weight, protect the circulatory system, and has anti-inflammatory and anticancer effects (Katiyar, 2008; Sharma *et al.*, 2007)[26,27].

In another recent study by Mahmoud and Elsadooa (2013)[28], it was found that rats that were administered aluminum had significantly lower body weight when compared to controls, aluminum administration had a detrimental effect on the body weights of rats, which is in agreement with previous reports (Julka *et al.*, 1996)[29]. The lower body weight could indicate that Al treatment influences the bioavailability of some nutrients. The data of the present study are also in full corroboration with the findings reported here with regard to decrease in weight of the body of rats exposed to aluminum.

The results of the present study clearly indicated that aluminium sulphate *per se* treated group animals has significantly reduced the body weight in 15, 30 and 60 days experiment groups as compared with control groups. Whereas in co treated group (aloin plus aluminium sulphate) animals were restored the body weight as compared with aluminium *per se* treated group. Thus the values of body weight in the present study clearly showed that aloin treatment resulted in reversal of body weight loss considerably in the long term exposures i.e. of 30 and 60 days of treatments, indicating protective role of aloin against aluminium sulphate toxicity.

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