



EFFECT OF ALOE VERA ON LIVER FUNCTION INDUCED BY ALUMINIUM FLUORIDE IN MALE ALBINO RATS.

Kusum Kushwah*¹, Akansha Rao² and Dharmendra pratap singh³

¹Research scholar, ²Research scholar, ³Professor

¹²³Department of Zoology, Agra College, Agra

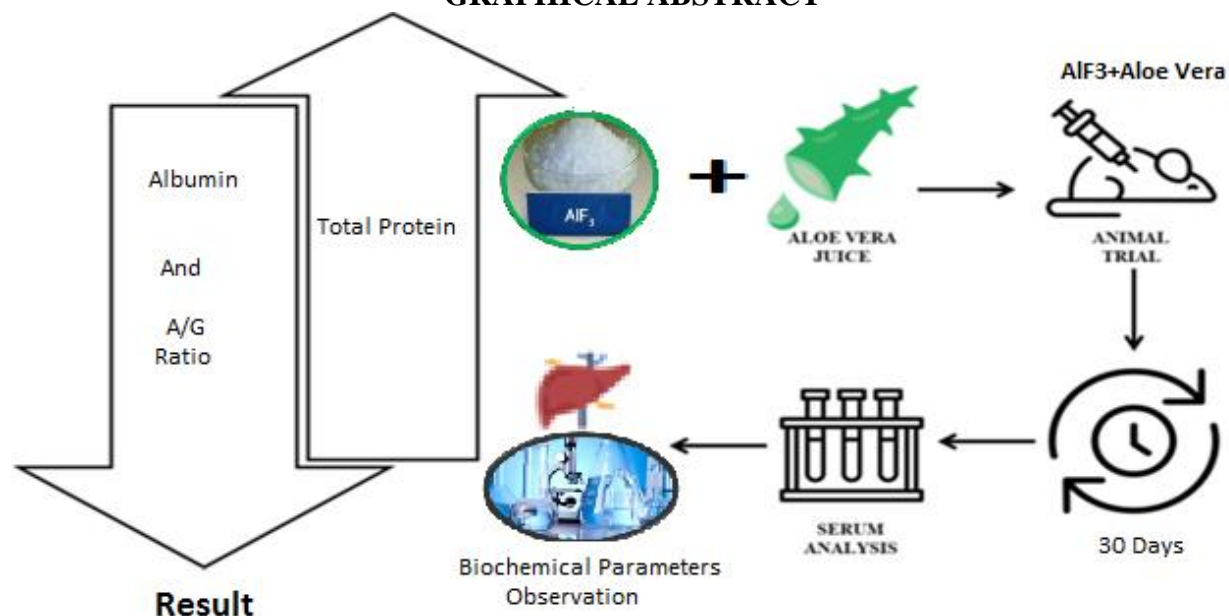
Dr. Bhimrao Ambedkar university, Agra (U.P.) India

Abstract

Aluminium fluoride is widely found in our nature and exposed to them via water, food, soil and contaminated air. It was also suggested that Al toxicity can induce pathological disorders such as hepatotoxicity, gastrointestinal and bone disease. Aluminium is non essential and fluoride is an essential trace element, but fluoride excessive intake can damage skeletal and non skeleton system. Its hepato-renal effects are well recorded but effects on total proteins, albumin and A/G ratio are poorly studied and this the soul of this work. Aloe vera plants are widely used to prevent several diseases. It has anti-tumor, anti-oxidant, anti-inflammatory and laxative properties. Aloe vera plant has been used for around hundred years in cosmetic product and pharmaceutical purpose. Ninety mature male of albino rats weight about 150-200gm were divided into two groups contained 30 rats each. The Ist group act as a control group (received only normal diet and water); the IInd group is treated group, A-group treated by AlF_3 200mg/kg b. w. and B-group treated by AlF_3 +Aloe vera 300mg/kg .b w. had given by orally for one months. The results indicated significant increase in total protein, and decreased significantly albumin and A/G ratio after 30 days when compared to the control group animals and liver damage after its consumption in rats, which can be avoidable by antioxidants. The treatment with Aloe vera combined with AlF_3 improved the backs mentioned biochemical alterations induced by AlF_3 . This study demonstrated that the combination of Aloe vera plant extract with AlF_3 alleviated the toxic effects of AlF_3 . The Aloe vera plants has protective influences on the liver (hepatorenal) functions and it able to resist AlF_3 intoxication.

Keywords - Aluminium fluoride, Aloe vera, Liver function, Total protein, Albumin and A/G ratio.

GRAPHICAL ABSTRACT



Introduction

Chronic exposure of Aluminium fluoride leads to accumulation elements in the liver, kidney, lungs, brain, gastric endocrine glands. It induced to them via, contaminated air, soil, water, food and drugs. Aluminium is present in different manufactured foods such as processed baking powder, frozen dough, cheese, cake mixes and pancake mixes. Al has also negative impact on humans health and causes histopathological changes in kidney, liver damage, testis and intestine of albino rats. Al has been associated with several diseases, like as Alzheimer's disease, Dialysis encephalopathy, Parkinson's disease, Amyotrophic lateral sclerosis and Guam-Pankinsons's dementia (reported by Kawahar 2005, Bandy 2010, Walton 2011 and Crisponi, Nurchi, Bertolasi and et al 2012), brain, heart, bones and blood. Al also used to drinking water purification and ingestion by humans per day is estimated to be 30-50 mg. Al has perhaps the numerous application because its light weight, relative in expensiveness and corrosion free (reported by Devote E 1994). Al accumulation in organs and tissues has been reported (by Walton JR 2006) to results in their toxicity and dysfunction. The toxic effect of Al on hepatocytes is poorly studies since, liver is the main target organ of Al burden and it is mixed in the metabolism or detoxification of toxic metals (Al). Specification to evaluate the biochemical alteration in albino rats induced to Al.

Fluoride ion has involved in various health problems and one of its general harmful effects is the prompting of oxidative stress. F induce has been found to cause hepato-toxicity through its toxic effects. F induce occurs naturally through drinking water and from dietary sources its artificially consuming by fluoridated water or fluoride containing drugs and accidental exposure. Extend consumption of F in excess (1 ppm <), causes skeletal deformities, dental caries soft tissues damage viz. disablement in the functioning of liver, kidney, brain, heart, muscles, thyroid, ovary and testis etc reported by Bhatnagar M et al 2006, Chirumarik and Reddy 2007, Chlubek D 2003 and Inkielewicz I and Czanowski 2008. F enters in humans amd animals through placenta and also seems in low concentrations in milk sweat and saliva reported by Armstrong 1970 and Gupta S et al 1993. F can generate deformation in the hepato architectonics including degenerative and Inflammatory some changes. Releted results were showed by Chinoy et al 1993.

Aloe vera plant is a natural, medicinal and most widely used plant in the world. A. vera plant nature is xerophytic, and it is famous for its usefulness. It plant is rich in vitamins including vitamins B1, B2, B6, C, E, and folic acid and antioxidant reported by Surjushe A et al., 2008. Scientifically Aloe vera name is Aloe vera Linn., it is belongs to the Aloaceae family, and more than 251 species found in the world. Aloe vera has wide range of therapeutic applications like as curing ulcers, wound healing, reduction of blood sugar in diabetes, for soothing burns, for reducing arthritic swelling, and easing intestinal noted by Shelton RM., 1991 and Davis RH et al., 1994. This antioxidant (Aloe vera) plant may be for management of aluminium fluoride toxicity especially its hepato-renal-toxic effects by removing the free radical. So we managed this study to assess its protective effect on aluminium fluoride hepato-toxicity in male albino rats.

Liver is a large organ in the humans and animals abdomen. The liver is a gland and an organ in the human body and it is an essential organ, presenting around hundred functions mandatory to sustain life. It's a gland because it makes many hormones and proteins for body's need. The main functions of liver:- Liver also clean toxins, metabolizes protein, store vitamins & glycogen to be used by the body, regulates the blood in the all body, production of bile, regulation of blood clotting, clearance of bilirubin, and liver converts the ammonia into urea. The main cause of the damage liver exposed the toxic chemicals regularly, obesity, liver disease, drink alcohol, poor hygiene and sharing personal things and not washing hands. Liver diseases names:- Fatty liver disease, Hemochromatosis, Wilson diseases, Liver cancer, Autoimmune hepatitis, Primary sclerosing cholangitis, Primary biliary cholangitis, Hepatitis A, B and C, and Cirrhosis. The tissues of damaged liver can be recovered itself.

MATERIALS AND METHODS

Experimental Animals

Ninety healthy male albino rats weighed 150-200g were purchased. The albino rats were bred in the animal house of the school of life science, university of agra. The albino rats were kept in cages under controlled according weather conditions with normal water and food of libitum. Albino rats were randomly selected to there groups of 20 rats each groups. G – 1st control group fed with normal diet and water. G – II nd Administrated by Aluminium fluoride 200mg/body weight for 30 days. G - IIIrd Administrated Aluminium fluoride with Aloe vera extract 300mg/body weight (*reported by Choudhary D et al., 2017, Koroye OC et al., 2010 and Madhusudha N et al., 2010*) for 30 days. After one day the study was finish, the albino rats were sacrificed under light anesthesia and collect the blood in bile for biochemical parameters analysis.

Chemical

Aluminium fluoride is an inorganic, colourless solids, odorless compounds, and its formula - AlF_3 . Aluminium fluoride is highly corrosive chemical. The treatment was administered to the albino rats orally by gavage tube 200mg/kg b. w. and Aloe vera 300mg/kg b. w. for 30 days.

Plant Extract

Aloe vera (*Aloe barbadensis*) plant was obtained after collection of aloe vera plant fresh leaves were washed with tap water to remove dirt parts and dried then weighing and cut by sharp knife in small-small pieces of middle part and blended by an electric grinder. The Aloe vera gel was separated by spatula into a clean beaker and squeezed in a muslin cloth piece than collect in to a sterilize bottle.

Serum Biochemistry

The serum biochemical parameters Total protein was observed by biuret methods (Lowry et al 1951), Albumin measured according to methods of (Doumas and Biggs 1972) and A/G Ratio observed according to method of centrifuge tubes.

Data analysis – Analytical methods for liver function tests. The p value $p < 0.05$, $p < 0.01$ and $p < 0.001$ were considered normally distributed variable results are showed as Mean+S.em. The difference between control group and treated group were calculated by student's t test (using SYSTAT software program version 7.0) and p values were compared with standard values.

Result

The recent research showed that there was a significant difference in total protein, albumin and A/G ratio among study groups $p < 0.05$, $p < 0.01$ and $p < 0.001$ as shown in table. The study suggested that the subjects who were included in aluminium fluoride has significantly high conc. of total protein 5.28 vs 4.06 mg/dl; $p < 0.001$, albumin 3.42 vs 4.24 %; $p < 0.001$ and A/G ratio 1.65 vs 1.83 gm/dl; $p < 0.001$ compared to the control group, Total protein is increased and albumin and A/G ratio are decreased after 7 days. The subject in Aloe vera group Total protein 5.33 vs 4.06 mg/dl; $p < 0.001$, albumin 3.65 vs 4.24 %; $p < 0.001$, A/G Ratio 1.69 vs 1.83 gm/dl; $p < 0.01$ comparead to the control group, Total protein, albumin and A/G Ratio significantly increased after 7 days.

The subject in Aluminium fluoride group Total protein 5.47 vs 4.37 mg/dl; $p < 0.001$, albumin 3.32 vs 4.48 %; $p < 0.001$ and A/G Ratio 1.51 vs 1.90 gm/dl; $p < 0.001$ compared to the control groups, Total protein is increased and albumin and A/G Ratio are decreased after 15 days. The subject in Aloe vera group Total protein 5.60 vs 4.37 mg/dl; $p < 0.001$, albumin 4.84 vs 4.48 %; $p < 0.05$ and A/G Ratio 1.97 vs 1.90 gm/dl; $p < 0.05$ compared to the control groups, Total protein, albumin and AG Ratio significantly increased after 15 days.

The subject in Aluminium fluoride group, Total protein 5.85 vs 4.75 mg/dl; $p < 0.001$, albumin 3.14 vs 4.49 %; $p < 0.001$ and A/G Ratio 1.31 vs 2.0 gm/dl; $p < 0.001$ compared to the control groups Total proteins continue significantly increased and albumin and A/G Ratio significantly continue decreased after 30 days. The subject in Aloe vera group, Total protein 5.78 vs 4.75 mg/dl; $p < 0.001$, albumin 4.88 vs 4.49 %; $p < 0.01$ and A/G Ratio 2.70 vs 2.0 gm/dl; $p < 0.05$, compared to the control group, Total protein, albumin and A/G Ratio significantly increased after 30 days.

Beneficial effects of Aloe vera extract in liver functions (Total Proteins, Albumin and A/G Ratio) of albino rat after aluminum fluoride intoxication.

S.No.	Parameters	No. of Albino rat	Period(days)	Control Group		Treated-I (AlF ₃)		Treated-II (AlF ₃ +Aloe vera)	
				Mean	±S.Em.	Mean	±S.Em.	Mean	±S.Em.
1.	Total Proteins (g/dl)	10	7	4.06	0.10	5.28	0.14****	5.33	0.24****
		10	15	4.37	0.1	5.47	0.18****	5.60	0.19****
		10	30	4.75	0.2	5.85	0.20****	5.78	0.18****
2.	Albumin %	10	7	4.24	0.13	3.42	0.15****	3.65	0.04****
		10	15	4.48	0.13	3.32	0.15****	4.48	0.09**
		10	30	4.49	0.12	3.14	0.18****	4.88	0.09***
3.	A/G Ratio (mg/dl)	10	7	1.83	0.04	1.65	0.01****	1.69	0.05****
		5	15	1.9	0.04	1.51	0.06****	1.97	0.02**
		5	30	2	0.37	1.31	0.02****	2.70	0.83**

S.Em. = Standard Error of Mean,

**** = Very Highly Significant ($p < 0.001$), *** = Highly Significant ($p < 0.01$), ** = Significant ($p < 0.05$), * = non-significant ($p > 0.5$)

The present study revealed that assessment of the ameliorative role of Aloe vera in Liver functions of aluminium fluoride induced male albino rats. Aloe vera leaf extract showed improvement in biochemical parameters suggesting an ameliorative effect of Aloe vera on damage caused by Aluminium fluoride toxicity on liver organ. This research found that Aloe vera extract showed a hepato-protective role against injury reported by *Muserref H S et al., 2019*. This study the future of Aloe vera as effective-antioxidant is back discussed and bio-active compound and health promoting effect of Aloe vera are founded reported by *Marzanna H et al 2019*.

Discussion

Among toxic metals Aluminium fluoride have a remarkable toxic metal for both humans and animals. This study on available evidence that acute exposure of albino rats to Aluminium fluoride induce toxicity which demonstrated as a deficiency in water and food consumption, body weight and functional integrity of the vital organs. The hatred to water and food intake decreased rats body weight, as also noted by *Chawla et al., 2008*. Induce to AlF₃ caused reduction in body weight in the male albino rats, recommending that the chemical are toxic, their acute dose (AlF₃ - 200mg/kg b. w.) aluminium fluoride is the most toxic chemical.

After long period time induce of AlF₃ may cause deleterious effects on the biochemical parameters namely Total protein, albumin and A/G Ratio differentials were observed during experimental time show chronic toxicity in albino rats. The evaluation of biochemical characteristics has become an important health impact factor measurements and laboratory processes and toxicological reported by *Saravanan M et al 2011*. The result of this study suggested that AlF₃ administration showed significantly decrease albumin and A/G ratio and

increased total protein values similar results reported by Sharma S et al., 2010, and Singh DP, Singh PK and Kumari R 2021.

Liver function includes in serum, total protein, albumin and A/G ratio, which measure hepatocellular necrosis; serum albumin and hepatic (liver) clotting factors indicate that the biosynthetic capacity. Significant changes in biochemical parameters indices, which indicated different types of toxicity in the all groups. This research revealed that hepato-toxic nature of the tested AlF_3 chemicals and intoxication induced biochemical alterations in albino rats. Aluminium fluoride by oral intubation to albino rats appeared some symptoms of toxicity.

The scarcity in liver proteins observed in this study increased with increasing cons. and longaninity of the toxicant exposure, revealed that AlF_3 exposure may tamper with protein synthesis. In the present study showed that efforts were made to observed the biochemical effects of aluminium fluoride on some selected biochemical parameters. The results indicated that aluminium fluoride administration in male albino rats dignified these serum enzyme after 30 days. Many previous researches suggested that sever toxic effect of acute or chronic administration of Al, which include hepatotoxicity reported by Al-Qayim and Saadon 2013.

Sodium fluoride to experimental rats induce serious hepatorenal disturbance and histopathological changes in kidney and liver function. So human F to decline the harmful effects of sodium fluoride on kidney and liver noted by Elsayed Azab A et al., 2018. In some of the previous studies in which effect of chronic or acute F doses were investigated in liver's, the kidneys were also diagnosed for toxicity. In present study to observed the histologic toxic effects of sodium fluoride directly on the Liver, vacuolization the liver cells, dilated, cellular necrosis and engorged hepatic tissue that was not seen in the control group animals noted by shashi and Thapar, 2001. Hepato renal (liver) is associated with the metabolism and cancelation of toxicant from the body and biochemical parameters are contemplated as key points to illuminate toxicity of the metals.

Aloe vera plant has minerals, vitamins, salicylic acid, amino acid, enzymes, various polysaccharides, tannins and more than 75 nutrients materials reported by Botes L et al 2008. In recent study of aloe vera plant extract is used against Aluminium fluoride toxicity for 30 days treated albino rats. The natural plant of aloe vera is selected in recent study because of the following qualities – Aloe vera plant has many great ability to reach deep inside the targeted organs, it normalize body's metabolism and detoxifies, Aloe vera effectively solve problems of body's nervous system and its helpful in regeneration of tissues.

Previous studies on Aluminium fluoride toxicity have been suggested that AlF_3 accumulation in liver is associated with biochemical parameters changes, which include of damage liver's enzyme marker and alterations in oxidant status reported by Moumen R et al 2001.

Hepatoprotective potential of Aloe vera gel as a diet supplement (noted by Nahar T et al., 2013), the Liver organ which were damaged due to toxicity of aluminium fluoride were revealed more recovery in liver tissues. The exogenous feeding of aloe vera plant to aluminium fluoride treated albino rats maintain normal physiology. After giving the diet supplement the structure abnormalities can't be observed weirdly as compared to the aluminium fluoride treated groups. Natural food supplementation of aloe vera extract was given for 30 days treated albino rats with the concentration of 300mg/kg of body weight, treated albino rats showing hepatic cells of liver to cure the hepatocyte divulged structure same as to normal groups.

Conclusion

Acute induce of AlF_3 affected on the health of male albino rats by make difference their functional integrity and physiology of vital organ and aluminium fluoride salts are toxic for liver. Its results showed that several disturbances and imbalances in liver functions. The use of Aloe vera plant extracts combined with AlF_3 was detection to relieve the harmful effects of AlF_3 in the described parameters. This study showed that Aloe vera extract may have liver organs rhythm effects. It recommended that plant extract having protection potential to hepatic tissues. The outcomes also suggested that Aloe vera extracts not showed unfavorable effects and are non toxics for meditational purposes.

Bibliography

Kawahara M, 2005, Effectsof aluminum on the nervous system and its possible link with neurodegenerative diseases. *J Alzheimers Dis.* 8(2):171-182.

Bandy SC 2010, The neurotoxicity of environmental aluminium is still an issue. *Neurotoxicology.* 31(5);575-581.

Walton JR 2011, Bioavailable aluminium : Its effects on human health. *Encyclopedia of environ heal.* 331-342.

Crisponi G, Nurchi VM and Bertolasi V 2012, Chelating agents for human diseases related to aluminium overload. *Coord Chem Rev.* 256:89-104.

Devote E and Yokel RA 1994. The biological and toxicokinetics of aluminium. *Environ Health Respect,* 102:940-951.

Walton JR 2006. Aluminium in hippocampal neurons from humans with Alzheimer's disease. *Neurotoxicology,* 27:385-394.

Bhatnagar M, Roop Saxena A, Bhatnagar R, Meena R, Barbar S, Chouhan A and Vimal S 2006. Biochemical changes in brain another tissues of young adult female mice from fluoride in their drinking water, *Fluoride.* 39:280.

Chirumari K and Reddy KP 2007. Dose – dependent effects of fluoride on neurochemical milieu in the hippocampus and neocortex of rat brain. *Fluoride.* 40:101.

Chlubek D, 2003. Fluoride and oxidative stress. *Fluoride,* 36(217).

Inkielewicz I and Czanowski W, 2008. Oxidative stress parameters in rats exposed to fluoride and aspirin. *Fluoride.* 41:76.

Armstrong WD, Singer L and Makowski EL 1970. Placental transfer of fluoride and calcium, *Americ J Obstet Gynecol,* 107:432.

Gupta S, Seth AK, Gupta A and Gavane AG ,1993. Transplacental passage of fluoride. *J Pediatr,* 123:139.

Chinoy NJ, Sharma M and Michael M 1993. Beneficial effects of ascorbic acid and calcium on reversal of fluoride toxicity in male rats. *Fluoride.* 26(1):45-56.

Surjushe A, Vasani R and Saple D, 2008. Aloe vera: a short review. *Ind J Dermatol.* 53(4):163.

Shelton RM 1991. Aloe vera its chemical and therapeutic properties. *Int J Dermatol.* 30:679-683.

Davis RH, Donato JJD. Hartman GM and Haas RC 1994. Anti-inflammatory and wound healing activity of a growth substance in Aloe vera. *J America Podiatric Medical Association.* 84:77-81.

Choudhary D, Goirola B, Roy D and Sikidon P, 2017. Evaluation of analgesic activity of aqueous extract of Aloe vera (AEAV) in albino wistar rats. *Int J Pharma Sci Res,* 8(4):1850-1857.

Koroye O C, Siminialayi I M and Etebu E N, 2010. Effects of oral administration of aloe vera plus on the heart and kidney:A subacute toxicity study in rat models.

Madhusudhan N, Basha MP, Rai P, Ahmed F and Prasad RG 2010. Effects of maternal fluoride exposure on developing CNS of rats: Protective role of Aloe vera curcumailonga and ocimum sanctum. *Int J Exp Bio.* 48:830-836.

Lowry OH, Rosebrough NJ, Farr AL and Randall RJ 1951. *J Biol Chem.* 193:265-275.

Doumas BT, Biggs HG 1972. Determination of serum albumin. IN standard methods of clinical chemistry. GA Cooper, ed, Academic Press Inc, New York. 7:175.

Muserref HS, Ishan K, Aslikiraz and Hasan A, 2019. The hepatoprotective effect of Aloe vera on ischemia – reperfusion injury in rats. *North Clin Istanbul*, 6(3):203-209.

Marzanna H, Krzysztof D, Danuta G, Anna J G and Elzbieta G, 2019. Aloe vera (L) webb: Natural sources of antioxidants – A review, *plant foods for human nutrition*, 74:255-265.

Chawla

Saravanan M, Kumar KP and Ramesh M, 2011. Haematological and biochemical responses of fresh water teleost fish cyprinus carpio (Actinopterygii; Cypriniformes) during acute and chronic sublethal exposure to lindane pesticide biochemistry and physiology, 100:206-211.

Sharma S, Sharma D, Sharma S, Rajawat A, Jain S, Upreti N, Yadav A, Pandey A and Sharma KP, 2010. Comparative study on acute toxicity of fluoride, aluminium and aluminium fluoride to swiss albino mice. *Austra J Ecotoxicol.* 16:41-47.

Singh DP, Singh PK and Kumari R 2021. Effect of aluminium fluoride on liver functions of *Rattus norvegicus* after amelioration by vitamin C. *J Sci Techno Res.* 3(2):31-35

Al-Qayim AJM and Sadoon D, 2013. Assessment of the ameliorative role of propolis and malic acid in intestinal and liver functions of aluminum exposed male rats. *Int J Sci Na.* 4:552-558.

Elsayed Azab A, Omer Albasha M, Bireal JM, and Adwas AA, 2018. Sodium fluoride induces hepato-renal oxidative stress and pathophysiological changes in experimental animals. *Open J Apopt.* 7(1).

Shashi A and Thapar SP, 2001. Histopathology of fluoride – induced hepatotoxicity in rabbits. *Fluoride.* 34 (1):34-42.

Botes L, Van der Westhuizen FH, and Loots DT, 2008. Phytochemical contents and antioxidant capacities of two Aloe greatheadii var. davyana extracts. *Molecules*, 13(9):2169-2180.

Moumen R, Aitqukhaton N, Bureau F, Fleury C, Bougle D, and Arhan P, 2001. Aluminium increases xanthine oxidase activity and disturbs antioxidant status in the rat. *J Trac Elem Med Biol.* 15:89-93.

Nahar T, Uddin B, Hossain S, Sikder AM and Ahmed S, 2013. Aloe vera gel protects liver from oxidative stress induced damage in experimental rat model. *J Comple Integr Med.* 10(1).

Iji OT, Oyegbemi AA and Azeez OI, 2010. Assessment of chronic administration of aloe vera gel on haematology, plasma biochemistry lipid profile and erythrocyte osmotic resistance in wistar rats. *Nig J Physiol Sci.* 25:107-113.

