Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 3, Issue, 12, pp.091-094, December, 2011

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

THE INFLUENCE OF ALUMINIUM CHLORIDE AND EXTRACT OF *SALACIA OBLONGA* ON BIOCHEMICAL PARAMETERS IN WISTER ALBINO RAT

J. Mary Vimalakumari Kalaiarasi, M. Raja and J. Ambross Dass

P.G & Department of Advanced Zoology and Biotechnology, Loyola College, Chennai-34

ARTICLE INFO

Article History:
Received 25th August, 2011
Received in revised form
09th October, 2011
Accepted 19th November, 2011
Published online 31th December, 2011

Key words:
Aluminium chloride toxicity,
Salacia oblanga,
Wistar Rat.

ABSTRACT

The study has been designed for the evaluation of powder extract of *Salacia Oblanga* for hypolipidemic activity, biochemical changes in normal and Aluminium toxicity induced White Albino Wistar Female Rats. Oral administration of *Salacia* extract and Aluminium chloride for two weeks significantly lowered the serum alkaline Phosphatase, Serum Aspartate aminotransferase, urea, bilirubin and cratinine at 14th day.

INTRODUCTION

In recent years, however, Aluminium chloride ($AlCl_3$) has been implicated in the pathogenesis of several clinical disorders, such as dialysis dementia, the fulminant neurological disorder that can develop in patients on renal dialysis (Yousef, 2004). Aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (AlP), acid phosphatase (AcP), and phosphorylase activities were significantly decreased in liver, testes and food ingestion, weight gain, and total protein concentration in the plasma due to AlCl administration (Mokhtar I Yousef, 2007). Aluminum (Al) is an important element with known toxicity in human body, mainly in the central nervous system (Dominigo, 1995) its toxic effects have been investigated for many years. Al is known as a neurotoxin that can cause certain diseases such as Alzheimer disease, dialysis dementia, Parkinsonism, and amyotropic lateral sclerosis (Alferey, LeGendre, Kaehny, 1976; Bilkei-Gorzo, 1993; Piccardo ,Yanagihara, Garruto, Gibbs, Gajdusek, 1988; Wurtman, 1985).. Aluminium is neurotoxic to experimental animals with wide species and age – variations in susceptible animals, such as rabbits and cats aluminium toxicity is characterized by progressive neurological impairment resulting in death associated with status epileptics. Aluminum can get into the body through food, cooked in aluminum vessels due to leaching. Salts of aluminum are also used in many industries and environmental pollution due to their discharge into air. A wide array of medicinal plants and their active constituents play a role in antioxidant activity. *Salacia oblanga* (Family: Celastraceae/Hippocrateaceae) is an important source of chemicals of immense medicinal and pharmaceutical importance such as salacinol, mangiferin and kotanalol which are effective as antidiabetic, antiobese, hepatoprotective, hypolipidemic and antioxidant agent. Hence, this review consider the importance of the genus *Salacia* and n attempt is made to present macroscopical, phytochemical and pharmacological activities of the genus *Salacia* (Padmaa *et al.,* 2008). So the present study to investigate the serum ALT, AST, ALP, Urea, Billirubin, Creatinine biochemical changes of the powder extract of *S. oblanaga* in normal and aluminium toxicity induced White Albino Wistar female rats.

***Corresponding author:** loyo_raja2003@yahoo.co.in*

MATERIALS AND METHODS

The present study was carried out jointly at Loyola College, Chennai and in the Department of Pharmacology and Environmental Toxicology, Dr. A.L.M. Post Graduate Institute of Basic Medical Sciences (Sekkizhar Campus), Taramani, Chennai. The study has been designed for the evaluation of powder extract of *S. blanga* for hypolipidemic activity, biochemical changes in normal and Aluminium toxicity induced White Albino Wistar female rats.

Powder extract: The powder extract of *S. oblonga* was purchased from Department of Pharmacology and Environmental Toxicology, Dr. A.L.M. Post Graduate Institute of Basic Medical Sciences (Sekkizhar Campus), Taramani, Chennai. The nature of the powder was dark brown powder. All the extracts were stored in refrigerator at 4°C.

Experimental animals: The present study was conducted after obtaining the approval of the experiment protocol by the Institutional Animal Ethical Committee and CPCSEA (PROPOSAL NO: 01/ 039/ 2010, dated 1st June). This protocol met the OECD Guidelines for testing of chemicals. Number of animals approved for the study was 24 rats weighing between 240-290g, nulliparous and non-pregnant

were used in this test. All animals used in this study were procured from Central Animal House Facility, Dr. A.L.M. Post Graduate Institute of Basic Medical Sciences, (Sekkizhar Campus), Taramani, Chennai (Reg No : 205/ CPCSEA).

Housing: The animals were housed in well ventilated air conditioned Animal House at a constant temperature of 23±2°C, with the relative humidity of 55-60%. Lighting was artificial with the sequence of 12 hours light and 12 hours dark. The animals were housed on spacious polypropylene cages with paddy husk as bedding material. The animals were maintained on standard pellet diet and purified water (Aquaguard). The animals were well fed with water. Each animal in the cage was marked on its tail with marker for appropriate identification.

Experimental setup: The Aluminium chloride and *S. oblonga extract* was subjected to biochemical studies at two dose levels: 200 mg/kg and 400 mg/kg (by mouth) for 21 days. Animals were grouped into 4 groups (n=6): Group 1 served as normal control, received Distilled water (1 ml), Group 2 served as treated, and received Aluminium Chloride (300 mg / kg); Group 3 served as Treated, and received plant extract of *Salacia oblonga* (400mg / kg). Group 4 Treated with both Aluminium chloride and plant extract (250mg/ml, 100 mg/ml). The treatments were given for 21 days. The blood samples were withdrawn from retro orbital plexus at 1st, 7th, 14th day and the biochemical studies were conducted.

Acute Toxicity Studies: The acute oral toxicity study was carried out according to the guidelines set by Organization for Economic co-operation and development (OECD). Healthy Wistar rats (150-180 g) were used for this study. The two doses of 2000 mg/kg (by mouth) and 5000 mg/kg (by mouth) of the test samples were given to two groups containing 5 animals in each group. The treated groups were monitored for 14 days, for mortality and general behavior

Experimental procedure

Powder Extract of Salacia oblonga and Aluminium chloride treated: Animals received 200mg/kg body weight of the powder extract of *S. oblonga*. Animals received 300mg/kg body weight of aluminium chloride and 400mg/kg of powder extract of *S. oblonga*. The powder extract of *S. oblonga* and aluminium chloride were administered in the form of solution with double distilled water using 16 gauge oral feeding tube continuously for 21 days.

Isolation of serum: On the 0th, 7th and 14th day, the rats were anesthetized using anesthetics ether and blood was collected from retro – orbital plexus. After collection, the blood was kept at 37°C for 30 min. Later it was centrifuged at 2000 rpm for 15 min to separate serum, which was used for biochemical estimations (Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Alkaline Phosphatase (ALP), Urea (Varley, 1976), Bilirubin (Malloy and Evelyn, 1937). and Creatinine (Slot, 1965) and values were tabulated. The tabulated values were analysed with suitable statistical method.

RESULTS AND DISSCUSSION

In the present study, its influence on the biochemical changes induced by aluminium chloride has been studied from 1st, 7th and 14th day. Oral administration of *Salacia* extract and Aluminium chloride for two weeks significantly lowered the serum alkaline Phosphatase, Serum Aspartate aminotransferase, urea, bilirubin and cratinine at 14th day. The entire test was shown increased in 7th day and decreased in 14th day. When compared to the control group (52.35±44.90) from Serum alanine aminotransferase (ALT) significant changes were seen in Group IV treated with both aluminum and *Salacia* extract at 14th day (46.69 ±22.17). But no change was noted in group II treated with Aluminium chloride, Group III treated with *Salacia* extract at 14th day (Table 1). Assay of Serum Aspartate aminotransferase (AST) shows significant changes were seen in Group II treated with Aluminium (55.23±12.86), Group III treated with *Salacia* extract (42.54±21.71) and Group IV treated with both aluminum and *Salacia* extract (76.66±37.56) at 14th day (Table 1). Assay of serum alkaline phosphatase (ALP) shows significant changes were seen in Group II treated with Aluminium (51.10±16.36), Group III treated with *Salacia* extract (76.18±32.25) and Group IV treated with both aluminum and *Salacia* extract (76.66±37.56) when compared to the control group I (82.85±14.75) (Table 1). When compared to the control group in Urea (mg/dl) no significant change was seen in Group II treated with Aluminium, Group III treated with *Salacia* extract and Group IV treated with both aluminum and *Salacia* extract (Table 2). When compared to the control group Bilirubin (mg/dl) changes were seen in Group II treated with Aluminium, Group III treated with *Salacia* extract (1.26±0.77) and Group IV treated with both aluminum and *Salacia* extract (1.89±1.06) at 14th day but no changes occurred in group II treated with aluminum (Table 2). When compared to the control group (3.45±4.14) Creatinine (mg/dl) significant changes was seen in Group II treated with Aluminium, Group III treated with *Salacia* extract (0.67±0.33), and Group IV treated with both aluminum and *Salacia* extract (0.97±0.23) at 14th day but no change in group II treated with Aluminium (Table 2).

Prolonged exposure to some of these contaminants may induce teratogenic effects, abortion, reproductive failure and/ or immunotoxicity (Piramanayagam *et al.,* 1996;Carson, 2000 and Sharma and Mishra, 2006) both by their direct cellular toxic action and by interfering indirectly with the ypothalamo-hypophyseal function (Flora *et al.,* 2003). Nowadays, aluminum (Al) is widely used in treatment of drinking water, drugs (e.g., Antacids), deodorants and antiperspirants preparations, preservation of wood; the disinfection of stables and slaughter houses and in manufacture of alloys (WHO, 1997 and ATSDR, 2006). Al is present also in many food products, vegetables, cereals and beverages (Filipek *et al.,* 1987; U. S. Public Health Service, 1992; Beliles, 1994 and ATSDR, 2006). It has been reported that parentral exposure to Al chloride caused a developmental toxicity syndrome in rats and mice (Benett, 1975; Wide, 1984 and Cranmer *et al.,* 1986). Alternatively, considerable evidence has been provided for an interaction of Al with the cholinergic system (Meiri *et al.,* 1993). Al was described to interfere with cholinergic transmission and signalling, for example, acetylcholine metabolism may be affected by Al (Bielarczyk *et al.,* 1998), and reduced choline acetyl transferase (ChAT) and acetylcholinesterase (AChE), but not glutamic acid decarboxylase (GAD) activity was observed after Al injections in rabbits (Yates *et al.,* 1980). Moreover, carbachol-induced

Table 1: Effect of Aluminium chloride and *Salacia oblonga* on Serum alanine aminotransferase, Serum Aspartate aminotransferase and Serum alkaline phosphatase (U/L) in Wistar albino rats

Groups	Serum alanine aminotransferase (U/L)		Serum Aspartate aminotransferase (U/L)		Serum alkaline phosphatase (U/L)	
	7^{th} day	14^{th} day	7^{TH} day	14^{th} day	7^{TH} day	14^{th} day
Group I	52.35 ± 44.90	52.35 ± 44.90	26.34 ± 15.67	26.34 ± 15.67	82.85 ± 14.75	82.85 ± 14.74
Group II	31.27 ± 14.45	50.11 ± 37.96	65.47 ± 04.87	55.23* ± 12.86	221.58 ± 039.17	51.10* ± 16.36
Group III	43.62 ± 18.73	51.74 ± 10.87	61.26 ± 09.00	42.54* ± 21.71	288.65 ± 151.53	76.18* ± 32.25
Group IV	76.92 ± 32.01	46.69* ± 22.17	79.39 ± 14.12	49.51* ± 07.15	242.62 ± 062.48	76.66 * ± 37.56

Group I : Control (Distilled water = 1 ml); Group II : Aluminium Chloride (300mg / kg); Group III : Plant extract of *Salacia oblonga* (400mg / kg); Group IV : Aluminium Chloride and plant extract. Values are mean± S.D.: n=6 in each group; $p \leq 0.05$; * Experimental group compared with control group; where the significance performed by one- way ANOVA followed by Post Hoc Dunnett's test

Table 2: Effect of Aluminium chloride and *Salacia oblonga* Urea, Bilirubin and Creatinine (mg/dl) on in Wistar albino rats

Groups	Urea (mg/dl)		Bilirubin (mg/dl)		Creatinine (mg/dl)	
	7^{th} day	14^{th} day	7^{TH} day	14^{th} day	7^{TH} day	14^{th} day
Group I	11.83 ± 03.31	11.83 ± 03.11	1.21 ± 0.78	1.21 ± 0.78	3.45 ± 4.14	3.34 ± 4.14
Group II	11.50 ± 01.51	11.17 ± 02.98	1.47 ± 0.68	1.12 ± 0.44	0.08 ± 0.13	1.98 ± 2.96
Group III	16.13 ± 04.18	14.17* ± 02.63	3.02 ± 2.27	1.26* ± 0.77	1.17 ± 0.23	0.67* ± 0.33
Group IV	12.13 ± 02.78	11.67* ± 03.91	2.05 ± 1.71	1.89* ± 1.06	1.12 ± 0.24	0.97* ± 0.23

Group I : Control (Distilled water = 1 ml); Group II : Aluminium Chloride (300mg / kg); Group III : Plant extract of *Salacia oblonga* (400mg / kg); Group IV : Aluminium Chloride and plant extract. Values are mean± S.D.: n=6 in each group; $p \leq 0.05$; * Experimental group compared with control group; where the significance performed by one- way ANOVA followed by Post Hoc Dunnett's test

phosphoinositol signaling was found to be inhibited by Al (Shafer *et al.,* 1993). Administration of aluminium for 7 days has been found to cause an increase in serum Aspartate Aminotransferase(AST) to a significant extant. Similarly, exposure to *S. oblonga*, has resulted in a significant increase after exposure of 7 days. This influence on Aspartate Aminotranferase (AST) by aluminium as well as *S. oblonga*, is reflected when they were given together also. This effect of both aluminium as well as *S. oblonga*, is not seen after 14 days of treatment, indicating that, this effect is temporary and can be seen only during the initial phase of exposure. Though Aspartate aminotransferase (AST) is found in all the tissues as an intracellular enzyme, its acute increase in serum, is identified as an indication of cardiac damage since this exposure is found to be more in cardiac tissue compared to liver or other tissues. Thus the initial increase of this enzyme in serum needs one to investigate for any cardio-toxic effect, and needs to be confirmed for that toxic potential by screening for other cardiac damage parameters (Abd El- Azeim A. Khalaf *et al.,* 2007).

Unlike AST, serum Alanine AminoTransferase (ALT) was not affected to any significant extent by either aluminium or *S. oblonga* or a combination of both during exposure for 7-14 days. As this enzyme is mainly found as an intracellular enzyme in hepatic tissues, an increase is regarded as an indicator of hepatic damage. Considering this, it could be assumed that, both aluminium as well as *S. oblonga* will do not cause any hepatic injury during very short period of exposure as no fluctuations in the enzyme level was found during exposure for 14 days. Absence of any hepatic damage by both the metal as well as the extract is conspicuous by the fact that, the other indicator of hepatic damage namely, Serum Alanine Phosphatase is also not altered during exposure for 7-14 days by aluminium or *S. oblonga*. Serum bilirubin is recognized as an important indicator of hepatic cellular damage or biliary obstruction or damage. In the present study, serum bilirubin level has been found to be within normal levels in all the groups. However compared to the control animals, a higher level of serum bilirubin level was noticed, in the group treated with *S. oblonga* for 7 days. However, such increase was not seen after exposure for 14 days. Thus the given dose of aluminium as well as *S. oblonga* have been found to cause no biochemical changes indicative of any hepatic damage. As most of the metals have been reported to cause renal damage, the present study has been designed to include two clinical parameters that can indicate any alteration in renal function, namely blood urea and serum creatinine. Both blood urea and serum creatinine, showed no significant change during exposure to aluminium or *S. oblonga* or combination of both. The values were found to be within normal limits. Thus the given doses of aluminium as well as *S. oblonga* have been found to cause no perceptible damage to renal function with reference to serum biochemistry.

Acknowledgements: We the author thankful to Dr. R. Venkatakrishna Murali, Professor and Head and Dr. S.L. Maheswari, Professor (National Facility on Neurotoxicity to assist Drug Development), and Mr.B. Senthilkumar, Research Scholar, Department of Pharmacology and Environmental Toxicology, Dr. A.L.M Post Graduate Institute of Medical Science, University of Madras, Taramani, Chennai for permitting and his excellent guidance and support to carry out the project.

REFERENCES

Abd El- Azeim A. Khalaf; Ashraf M. Morgan; Mohey M. Mekawy and Maged F. Ali, 2007. Developmental

toxicity evaluation of oral Aluminum in rats. *J. Egypt. Soc. Toxicol.,* 37: 11-26.

A.T.S.D.R. 2006. Toxicological Profile for Aluminum (Update). Draft for public comment. Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services. Atlanta, GA.

Alferey, A.C, LeGendre, G.R, Kaehny, W.D.1976.The dialysis encephalopathy syndrome. Possible aluminium intoxication. *N. Engl. J. Med.* 294:184-188.

Beliles, R. P. 1994. The metals. In: Patty's Industrial Hygiene and Toxicology (II/C). 4th Ed. G.D. Clayton and F.E. Clayton, eds. John Wiley & Sons, New York: 1879–2352.

Benett, R.W.; T.V.N. Persaud and K.L. Moore,1975. Experimental studies on the effects of aluminum on pregnancy and fetal development. *Anat. Anz. Bd.*, 138: 365- 378.

Bielarczyk, H.; M. Tomaszewicz and A. Szutowicz, 1998. Effects of aluminum on acetyl-CoA and aetylcholine metabolism in nerve terminals. *J. Neurochem.* 70: 1175–81.

Bilkei-Gorzo A. 1993. Neurotoxic effect of enteral aluminium. *Food Chem. Toxicol*.31:357-361.

Bonsnes R.W and Taussaky, H.A. 1945. The colorimetric determination of Creatinine by the Jaffe reaction. *J. Biolo.Chem.,* 158: 581.

Carson, B. L. 2000. Aluminum compounds: Review of toxicological literature. Abridged final report, National nstitute of Environmental Health Sciences. Integrated Triangle Park, north Carloina, 27709.

Cranmer, J.M.; J.D. Wilkins; D.J. Cannon and L. Smith, 1986. Fetal-placental- maternal uptake of aluminum in mice following gestational exposure: Effect of dose and route of administration. *Neurotoxicology*, 7: 601- 8.

Dominigo JL. 1995. Reproductive and developmental toxicity of aluminium: a review. *Neurotoxicol Teratol*. 17:515-521.

Filipek, L.H.; D. K. Nordstorm; and W.H. Ficklin, 1987. Interaction of acid mine drainage with waters and sediments of West Squaw Creek in the West Shasta mining district, California. *Environ. Sci. Technol*. 21: 388- 396.

Flora, S.J.; A. Mehta; K. Satsangi; G.M. Kannan and M. Gupta, 2003. Aluminum induced oxidative stress in rat brain: response to combined administration of citric acid and EDTA. *Comp. Biochem. Physiol.* Part C, 134: 319-28.

Malloy, H. T., and Evelyn, K. A. 1937. *J. biol. Chem.,* 119: 481. and Lowenstein, L., 1940. *Canad. med. Ass. J.,* 42, 122.

Meiri, H.; E. Banin; M. Roll and A. Rouesseau,1993. Toxic effect of aluminum on nerve cell and synaptic transmission. *Prog. Neurobiol*., 40: 89- 121.

Mokhtar I Yousef, 2007. Aluminium-induced changes in hemato-biochemical parameters, lipid peroxidation and enzyme activities of male rabbits: protective role of ascorbic acid. *J. Dent. Res*. 86(9):848-51. PMID: 15125998.

Moog, G. 1946. Acid alkaline phosphatase in chick embryo. *J. Cell. Comp. Physiol.,* 28: 197-208.

Padmaa M Paarakh, Leena JP, Angelin ST. 2008. Genus *Salacia*: A comprehensive review. *J. Natural Remedies*, 8(2): 116-131.

Piccardo, P.,Yanagihara, R., Garruto, R.M., Gibbs, C.J Jr., Gajdusek, D.C. 1988. Histochemical and X-ray micro analytical localization of aluminium in amyotropic lateral sclerosis and Parkinsonism dementia of Guam. *Acta Neuropathol*. 71:1-4.

Piramanayagam, S.; B.M. Manohar and A. Sundararaj, 1996. Pathology of malathion toxicity in rats. *Indian Vet. J.,* 73(7): 734-737.

Shafer, T.J.; W.R. Mundy and H.A. Tilson, 1993. Aluminum decreases muscarinic, adrenergic, and metabotropic receptor-stimulated phosphoinositide hydrolysis in hippocampal and cortical slices from rat brain. Brain Res., 629: 133-40.

Sharma, P. and K.P. Mishra, 2006. Aluminum induced maternal and developmental toxicity and oxidative stress in rat brain: response to combined administration of Tiron and glutathione. *Reprod. Toxicol.,* 21(3): 313-21.

Slot .C. 1965. Plasma creatinine determination; a new and specific Jaffe reaction Method. *Scan J. Clinical. Lab invest.,* 107: 381- 387.

U. S. Public Health Service, 1992. Toxicological Profile for Aluminum Compounds. *Clement International Corp* (Contact No. 205-88-0608).

Varley, H. 1976. Blood and urine urea. In practical clinical biochemistry,Arnold Heinemann publisher (India) Pvt. Ltd. New Delhi, 158- 167.

WHO (World Health Organization), 1997. Aluminum, international programs on chemical safety environmental health criteria: Geneva: World Health Organization: 194.

Wide, M., 1984. Effect of short-term exposure to five industrial metals on the embryonic and fetal development of the mouse. *Environ. Res.,* (33): 47–53.

Wooten, I.D.P. 1964. Microanalysis in medical biochemistry. J&A Churchill Ltd. London.

Wurtman, R.J. 1985. Alzheimer's disease. *Sci Am.* 252:62-66,72-74.

Yates, C.M.; J. Simpson; D. Russell and A. Gordon, 1980. Cholinergic enzymes in neurofibrillary degeneration. *Brain Res.,* 197: 269 - 74.

Yousef, M.I. 2004. Aluminium-induced changes in hemato-biochemical parameters, lipid peroxidation and enzyme activities of male rabbits: protective role of ascorbic acid. *Toxicology.* 199(1):47-57.

****