



## WATER ALUMINIUM AND ALZHEIMER DISEASE

G.T.SHINDE<sup>1</sup>, S.S.UGLE\*<sup>2</sup>, M.D.BIKKAD<sup>3</sup> AND S.B.INGLE<sup>4</sup>

<sup>1</sup>Health Department, R.P.H.L. Aurangabad, India.

<sup>2</sup>Department of Biochemistry MIMSR Medical college, Latur. India.

<sup>3</sup>Department of Biochemistry MIMSR Medical college, Latur. India.

<sup>4</sup>Department of Pathology MIMSR Medical college, Latur. India.

### ABSTRACT

There is an interesting correlation between the incidence of Alzheimer disease and similar memory disorders and the amount of aluminum in drinking water. A study published in lancet, shown the geographical relationship between the aluminum content of drinking water and prevalence of Alzheimer disease over a ten year period. This study was undertaken to determine aluminum content of the well water and treated tap water supplied by the Municipal corporation and correlates with the increasing incidence of Alzheimer disease in Marathwada region. There is statistical significance of aluminum level between well and tap municipal water. As per various texts and researchers find out that 0.2 mg/lit is permissible value. So we can find out ratio that is  $2.0245 / 0.2 = 10.1225$ . So we conclude that our study shows that tap water has ten times more aluminum content as compared to permissible value. There is also significant increasing Alzheimer cases (3.7) times during year 2001 to 2007 as compared with year 1994 to 2001.

**KEY WORDS:** Aluminum, well water, tap water, Alzheimer diseases.



**S.S.UGLE**

Department of Biochemistry MIMSR Medical college, Latur. India.

\*Corresponding author

## INTRODUCTION

Number of environmental factors have been put forward as possible contributory causes of Alzheimer disease. Among these is municipal drinking water aluminium<sup>1,2</sup>. There is circumstantial evidence linking this metal with Alzheimer disease, but casual relationship yet to be established. As evidence for other causes continues to grow a possible link with aluminium seems increasingly unlikely. Disease results from a combination of different risk factors rather than single cause. Such factors which varies from person to person, may include environmental factors, age, genetic predisposition and other diseases. The aluminum hypothesis was first put forward in 1965 when it was shown that the injection of aluminum compound into rabbits caused tangle like formation in nerve cells. Since then a number of other circumstantial links between aluminum and Alzheimer's diseases have been claimed. In 1989, a study published in *The Lancet*, found that the risk of Alzheimer's disease was 50% higher in areas of England and Wales where aluminum concentrations exceeded 0.11mg/L compared to areas with levels below 0.01mg/L. There is an interesting correlation between the incidence of Alzheimer's diseases and similar memory disorders and the amount of aluminum in drinking water. A study published in *Lancet* the journal of British medical association involved an evolution of the geographical relationship between the aluminum content of drinking water and prevalence of Alzheimer disease over a ten year period. The study reported that a 50% incidence in the risk of Alzheimer disease with high concentration of aluminum even small presence of aluminum in water has

effects (researcher learned that the risk of Alzheimer disease was 1.5 times higher when the aluminum concentration exceeds 0.1 mg / L than in areas where the concentration was 0.01 mg / L). The number of Alzheimer disease cases in urban and rural area of Marathwada region has been increased may be because of addition of huge amount of alum / PAC (polyaluminium chloride) to water by municipal water purification centre staff to remove turbidity. Our aim was to investigate aluminum content in tap water from different places and its association to increased Alzheimer cases.

## MATERIALS AND METHODS

Water samples were collected from different places of Marathwada region. For collection of water plain sterile bottle used. Survey for searching the Alzheimer cases were done in Beed districts of Marathwada region from 1995—2007. Information about the Alzheimer patient were collected by visiting major hospital asking to head of villages, ward members, social workers. History of such diagnosed as Alzheimer diseased patients regarding drinking water, diet, habits, age, sex, family history, use of utensils etc. were collected personally.

## RESULTS

APHA (American Public Health Association) standard method for examination of water and waste water as per is (Indian standard institute) 10500:91<sup>3</sup>.

**Table no 1**  
**Permissibal limits for aluminium in water**

Desirable limit mg / l	Permissibal limit	Methods
0.03	0.20	Eriochrome cyanine R

Table no 2 # R-3.1.1 out put  
 > t.test(ALUMINIUM...LEVEL~WATER.TYPE,data=alwater)  
 Welch Two Sample t-test  
 data: ALUMINIUM...LEVEL by WATER.TYPE  
 t = 10.165, df = 39.005, p-value = 1.604e-12  
 alternative hypothesis: true difference in means is not equal to 0  
 95 percent confidence interval:  
 1.611443 2.412057  
 Sample estimates:  
 Mean in group tap water    Mean in group well water  
 2.02450                      0.01275  
 > 2.02450/ 0.01275  
 [1] 158.7843

**Table no 3**  
**Number of Alzheimer cases and period**

Period	Number of cases
1994—2001	59
2001--2007	216

3.7 Times Increase

Chart no – 1  
 > aov(ALUMINIUM...LEVEL~WATER.TYPE\*PLACE,data=alwater)  
 Call:  
 aov(formula = ALUMINIUM...LEVEL ~ WATER.TYPE \* PLACE, data = alwater)

Terms:

	WATER.TYPE	PLACE WATER.	TYPE:PLACE	Residuals
Sum of Squares	80.94276	24.89835	33.43608	2.76775
Deg. of Freedom	1	5	4	69

Residual standard error: 0.2002808

1 out of 12 effects not estimable

Estimated effects may be unbalanced

> summary(aov(ALUMINIUM...LEVEL~WATER.TYPE\*PLACE,data=alwater))

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Water type	1	80.94	80.94	2017.9	<2e-16 ***
PLACE	5	24.90	4.98	124.1	<2e-16 ***
Water type place	4	33.44	8.36	208.4	<2e-16 ***
Residuals	69	2.77	0.04		

---  
 Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

ho there is no significant difference for aluminium level between well and tap water. After testing the hypothesis by applying independent t test, the p value =  $0.604 \times 10^{-10}$  is  $\leq 0.01$ . So we can accept alternative hypothesis and we conclude there is statistical significance of Aluminium level between well and tap water. Now (how much is the level) so as we accept alternative hypothesis, we need to find out the level aluminium tap water as compared to well water. As per various texts and researchers find out that 0.2 mg /lit is permissible value. So we can find out ratio that is  $2.0245/0.2=10.1225$ . So we can conclude that our study shows that tap water has 10 times more aluminium content as compared to permissible value. After applying analysis of variance both in one way and two way we find out aluminium level is significant with the place and water type. Above result displayed in chart no 1. Certainly we run Tukey's honest test as a posthoc we find out that almost differences are significant. So we can conclude that there is no homogenous or scientific method or protocol are followed by water supplied department to mix aluminium.

## DISCUSSION

Now a days government of india continuously insists on supply of treated water to the urban as well as rural areas. This is one of the major source of aluminium in the drinking water. It may be one of the cause of increased incidences of alzheimer's disease. Dementia is a progressive degeneration, brain disease associated with old age. Its symptoms include short term memory loss, slowness in thought and movement, confusion, disorientation, depression, difficulty communicating and loss of physical function. Alzheimer's disease accounts for about half of all senile dementia cases. Although there are many theory about what causes alzheimer's, the fact is its origins remain poorly understood. One theory proposed that the common occurrence of being exposed to aluminium could cause alzheimer's dementia. Aluminium the theory

postulated become concentrated in the characteristic lesion (senile plaques & neurofibrillary tangles) that develop in the brain during the course of the disease. At first, medical scientists thought this theory was absurd. Aluminium they believed to accumulate merely as a result of a destructive process caused by some other factor. Much like lead, aluminium is a powerful neurotoxicant that can kill brain cells, even at small concentrations. Several mechanisms explaining the role of aluminium in Alzheimer's disease have been proposed. It is believed aluminium may disrupt the blood brain barrier, allowing amyloid beta, which would normally be stopped, to pass through the barrier and into the brain. Amyloid beta proteins are the primary component of the plaques observed in the brain of Alzheimer's patients. Aluminium binds various organelles and proteins in the nucleus, cytoplasm, axon and synapse in neurons, exerting effects on the biological activity of magnesium, Fe, and Ca, thus interfering with the phosphorylation/dephosphorylation of nucleotides<sup>4</sup>. These actions may thus induce synaptic dysfunction aberrant neuronal gene expression<sup>5</sup>, over-stimulation of NMDA receptors leading to disruption of Ca homeostasis<sup>6</sup>, oxidative stress<sup>7</sup>, ER stress<sup>8</sup>, mitochondrial damage<sup>9</sup> and others<sup>10</sup>. In recent years, however, the aluminium hypothesis have been gaining respect. For example, studies have discovered a direct association between the level of aluminium in the municipal drinking water and the risk of alzheimer's dementia<sup>2</sup>. One study found aluminium in drinking water was related to only this specific type of dementia<sup>11</sup>. Aluminium can not be excreted and hence accumulated in the brain and other tissues. This is one of the cause of alzheimer. Researches shows that alzheimer patient have more blood aluminium levels<sup>12</sup>. Although the aluminium / alzheimer's link remains unproven. We believe that waiting for definitive proof before taking a few easy & protective measures is foolhandy & more scientists are starting to agree<sup>13, 14</sup>. This is too common an illness to ignore preventive measures until we can know for certain why it develops.

## CONCLUSION

Our study shows that because of addition huge amount of alum / PAC to water by water purification staff may be one of the cause of increased incidences of alzheimer

.Other causes may be consumption of processed food ,aluminium containing , antacids and foods and use of aluminium utensils. Presently it is very difficult to conclude the cause ,because further study is required among psychiatric cases and other causes.

## REFERENCES

1. Mc Lachlan DRC. Aluminium and risk of Alzheimer disease , *Environmetrics* , 6,233-75:1995,
2. Mc Lachlan DRC. Bergerron M.D at al. Risk for neuropathologically confirmed Alzheimer disease & residual aluminium in municipal drinking water . *Neurology*,46,401-405 ( Pub-Med ):1996
3. APHA ISI : 10500 : 1991
4. McLachlan DR, Kruck TP, Lukiw WJ, Krishnan SS ( Would decreased aluminum ingestion reduce the incidence of Alzheimer's disease? *CMAJ* 145: 793-804.:1991
5. Alexandrov PN, Zhao Y, Pogue AI, Tarr MA, Kruck TP, et al. Synergistic effects of iron and aluminum on stress-related gene expression in primary human neural cells. *J Alzheimers Dis* 8: 117-127:2005.
6. Exley C A molecular mechanism of aluminium-induced Alzheimer's disease? *J Inorg Biochem* 76: 133-140:1999.
7. Exley C (2004) The pro-oxidant activity of aluminum. *Free Radic Biol Med* 36: 380-387.
8. Ghribi O, Herman MM, Savory J The endoplasmic reticulum is the main site for caspase-3 activation following aluminum-induced neurotoxicity in rabbit hippocampus. *Neurosci Lett* 324: 217-221. :(2002)
9. Savory J, Herman MM, Ghribi O Intracellular mechanisms underlying aluminum-induced apoptosis in rabbit brain. *J Inorg Biochem* 97: 151-154 :(2003).
10. Julka D, Gill KD Altered calcium homeostasis: a possible mechanisms of aluminium-induced neurotoxicity. *Biochem Biophys Acta* 1315: 47-54.:(1996)
11. Marytyn C.N at al *lancet* 1,59-62 :1989
12. Zapatro M.D . *Biological trace elem res* . 47.235-40:1995
13. lukiw w .j. *Minral & metel neurotoxicology* 1/3 -26 crc . Press 1997
14. Mclachain D. R etal *can .med . Ass. J* 147 ( 7 ) 793-803.1991.