Indian J Physiol Pharmacol 1992; 36(4) : 289–290

LETTER TO THE EDITOR

ACETYLCHOLINE AND CHOLINESTERASE LEVELS IN THE BRAIN OF METHANOL TREATED RATS

Sir,

(Received on July 4, 1992)

Methyl alcohol (CH_3–OH) (Methanol) is commonly used as an adulterant in illicit liquor and also widely used in industries as a solvent. Methanol poisoning usually occurs after the consumption of illicit brew adulterated with methanol or as an occupational hazard in industrial workers handling methanol. The signs and symptoms of methanol toxicity is well known and the morbidity of methanol poisoning is due to a combination of systemic acidosis, and central nervous system depression.

In addition to generalized depression of the central nervous system, bilateral infarction of putamen and Parkinsonian syndrome with typical motor dysfunction has been reported following methanol poisoning (1,2,3,4). Since methanol may be used as a fuel either alone or in combination with other petroleum products in future, the problem of methanol toxicity forms one of the major hazards in the next century (5). Though the systemic effects of methanol has been well documented, perusal of literature has shown that there is a lacuna regarding the effect of methanol on cholinergic transmission in the central nervous system. Hence this study was undertaken to elucidate the effect of acute methanol toxicity on the acetylcholine (Ach) and cholinesterase (ChE) in the rat brain.

Twenty four, Wistar strain albino rats (150-170g), of either sex, obtained from Indian Institute of Science, Bangalore was used in this study. The animals were housed under standard laboratory conditions and fed with standard rat pellet feed (Gold mohur– Hindustan Lever) and water *ad libitum*. The animals were divided in to four groups viz A, B, C, and D of 6 rats each.

To the methanol treated test groups (B&D), single dose of methanol (3 g/kg body weight) was administered by Intraperitoneal (I.P.) route. The control animals (A & C) received equivalent volume of saline. The methanol/vehicle was administered to the experimental animals between 8-9 am. Both the control and test animals were sacrificed 30 minutes after the respective treatment by near freezing method with liquid nitrogen (6). Brain tissue was homogenized in 10% TCA for estimation of Ach (groups A & B) and in distilled water for the estimation of ChE (groups C & D).

Ach and ChE in the control and methanol treated animals brain were estimated by standard bioassay technique using frog rectus (7) and a single channel recorder coupled to a force transducer. The total Ach content brain was expressed as nM of Ach/g wet weight of the brain tissue and that of ChE as nM of Ach hydrolyzed/g/minute. The data obtained was analyzed by student t test for statistical significance.

Administration of a single dose of methanol (3 g/kg) to albino rats resulted in an increase in Ach content of the whole brain from 17.5 ± 2.5 to 37.13 ± 5.33 nM/g wet weight of brain, at 30 minutes ($P<0.02$). This change in Ach was accompanied by a corresponding decrease in ChE activity which decreased from control value of 9.942 ± 0.445 to 5.9 ± 0.8 nM of Ach hydrolyzed/gm/min ($P<0.01$).

Methanol being an aliphatic alcohol similar to ethanol and shares common enzymatic degradation system, it could also affect neurotransmitter release, synthesis and degradation similar to ethanol. Such an influence may be responsible for the certain chronic sequela of methanol toxicity. Since the primary aim of this study is to elucidate whether methanol affect the brain content of Ach and ChE, which should not be secondarily influenced by metabolic acidosis, rat model was chosen for this study as this species show the least tendency to go into metabolic acidosis following

methanol administration. Thus our results have shown that methanol influences the brain Ach and ChE content even in an animal which shows least tendency for metabolic acidosis which lend support to the concept that methanol probably acts *per se* and not through its acidic metabolic intermediaries. Our previous studies on methanol toxicity on brain biogenic amines have also shown similar findings (8).

Methanol may bring out the changes observed in this study by interfering with the synthesis of Ach by interfering with the activity of Choline Acetyl transferase or the availability of choline and Acetyl co A. Alteration of the storage, release and inactivation mechanisms, may also play a part in the genesis of the changes observed. Though, this study has shown the effect of methanol an Ach and ChE content of the rat brain, further work is necessary to understand the exact mechanisms by which these effects are brought about.

R. SURESH BABU, R. UMA,
K. SEMBULINGAM* AND
A. NAMASIVAYAM**

Department of Physiology,
Dr. A.L.M. PG. Institute of Basic Medical Sciences,
University of Madras,
Taramani, Madras - 600 113

and

**Department of Physiology,*
Sri Ramachandra Medical College
Porur, Madras - 600 112

REFERENCES

1. Aquilonius SM, Ashmark H, Enoksson P, Lundberg PO, Mostro U. Computerized Tomography in severe methanol intoxication. *Br Med J* 1978; 1: 929-930.
2. Mc Lean DR, Jacobs H, Mielka BW. Methanol Poisoning : A Clinical pathological Study. *Ann Neurol* 1980; 8: 161-167.
3. Ley CO, Gali FG. Parkinsonian syndrome after methanol intoxication. *Eur Neurol* 1983; 22: 405-409.
4. Guggenheim M, Couch JR, Weinberg W. Motor dysfunction as a permanent complication of methanol intoxication. *Arch Neurol* 1971 ; 24: 550-554.
5. Posener, HS. Biohazards of Methanol in proposed new uses. *J Toxicol Environ Health* 1975 1: 153-171.
6. Takahashi R, Aprison MH. Ach content in discrete areas of the brain obtained by near freezing method. *J Neurochem* 1964; 11 : 887–895.
7. Pharmacological Experiments on isolated preparations. 2nd ed. Edinburgh : Churchil Livingstone 1970: 38-42.
8. Jeganathan PS, Namasivam A. Role of acidosis in the changes of rat brain monoamines after methanol administration and effect of blocking methanol metabolism by 4-methyl pyrazole & 3-amino 1,2,4 triazole. *Ind J Med Res* 1988; 88: 282-290.

**Corresponding Author