ANTICONVULSIVE EFFECTS OF SUPEROXIDE DISMUTASE AND CATALASE
Preliminary Report

SEMA YAVUZER*
ZUHAL YURTASLANI*
ONUR KARAN*
GÜLSELI YILDIRIM*
ADNAN GÜVENER*
SERDAR YADIMCI*

INTRODUCTION

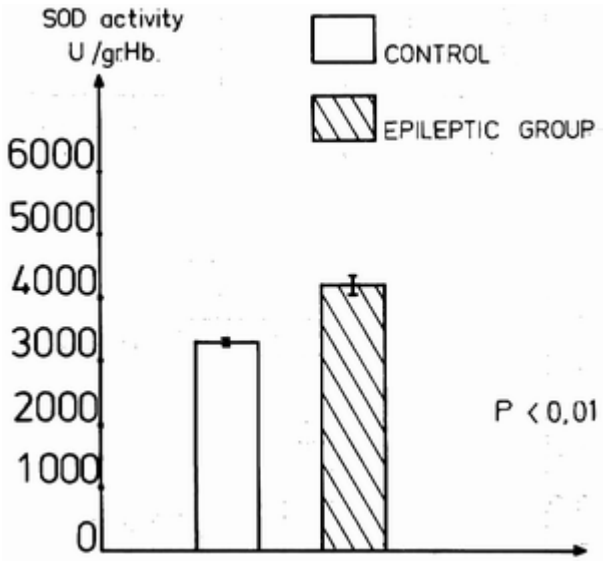
Our previous study as well as literature indicated that deficiency of neuronal antioxidant defence mechanism can play an important role in epileptogenesis with the combination of unsatisfactory inhibiting mechanism (1-3). For this reason, in the present study superoxide dismutase (SOD), catalase activities and levels of serum haptoglobin, transferrin and ceruloplasmin were determined in idiopathic epilepsy cases. On the other hand the effects of SOD and catalase preadministration in response to penthylentetrazol (PTZ) in convulsive dose in New Zealand white and Chinchilla Gray rabbits were investigated electrophysiologically.

MATERIALS AND METHODS

In twenty epileptic patients and twenty normal adults, red blood cell SOD and catalase activities were determined by spectrophotometric methods (4,5). Beckman (Model 26) and Hitachi (100-30) spectrophotometers were used for determination of red cell SOD and catalase activities. Haptoglobin, ceruloplasmin and transferrin levels were determined by radial immunodiffusion, and Nor-partigen immunodiffusion plates (Behring) were used for this purpose.

In the experimental part of the study, 40 rabbits (20 New Zealand and 20 Chinchilla gray type) were used. To half of the rabbits PTZ 100 mg/kg were injected intravenously and followed up electrophysiologically for two hours. As for the other half of rabbits, SOD 1mg/kg and catalase 150.000 IU/kg were administrated intrapertioneally 30 minutes before PTZ in convulsive dose (100 mg/kg). Epileptic activity was recorded by fronto-pariatel electrodes on an electroencephalograph (Grass Model). Penthylentetrazol, Superoxide dismutase (from bovine erytocytes) and catalase (from bovine liver) were obtained from Sigma Chemical Co. Data were analysed by Student's t test.

Figure 1: The red blood cell SOD activities of epileptic patients and healthy adults (control). (mean value ±SD).



*From Departments of Physiology, Biochemistry and Neurology, Faculty of Medicine, Ankara University, Ankara, Türkiye .

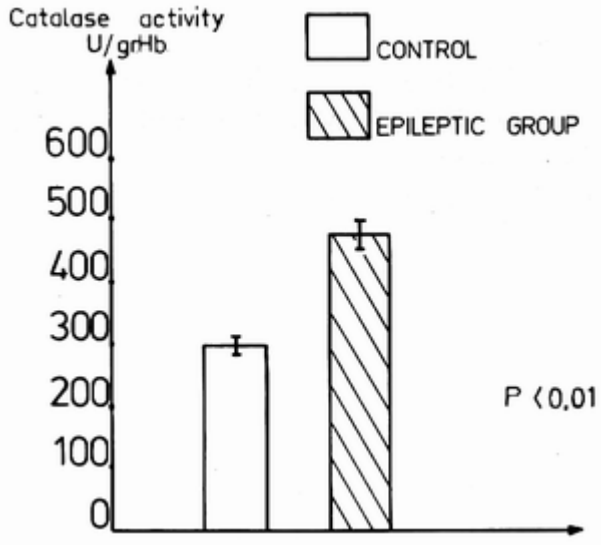


Figure 2: The red blood cell catalase activities of epileptic patients and healthy adults (control). (mean value ±SD).

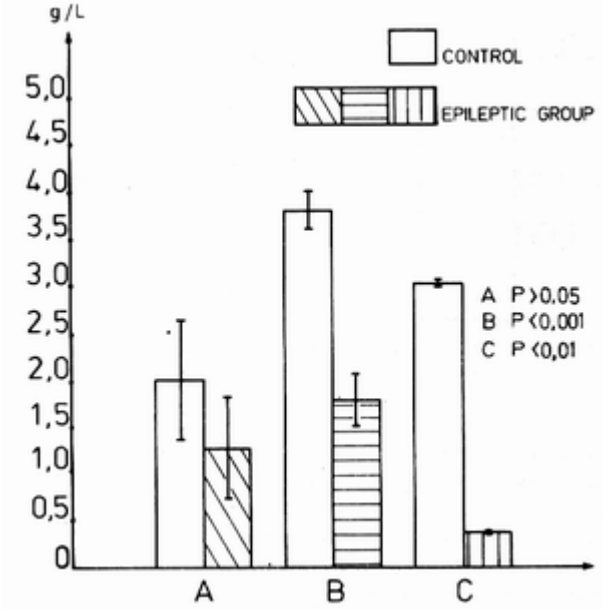


Figure 3: Serum haptoglobin (A), transferrin (B) and ceruloplasmin (C) levels of healthy and epileptic groups. (mean value ±SD).

RESULT AND DISCUSSIONS

In epilepsy cases, red blood cell SOD and catalase activities were found to be significantly higher than normal adults (P<0.01) (Figures 1 and 2). The mean serum haptoglobin levels in normal ranges, but in five patients serum haptoglobin values were under normal levels (Figure 3). The mean transferrin and ceruloplasmin levels were significantly lower than controls (P<0.001, P<0.01). But transferrin values were in normal limits (at lower levels of normal ranges).

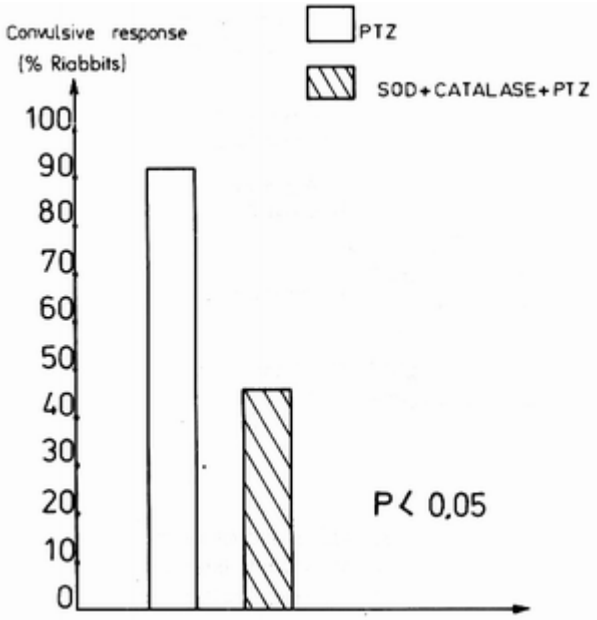


Figure 4: The effect of SOD and catalase preadministration on the convulsive response to PTZ in rabbits.

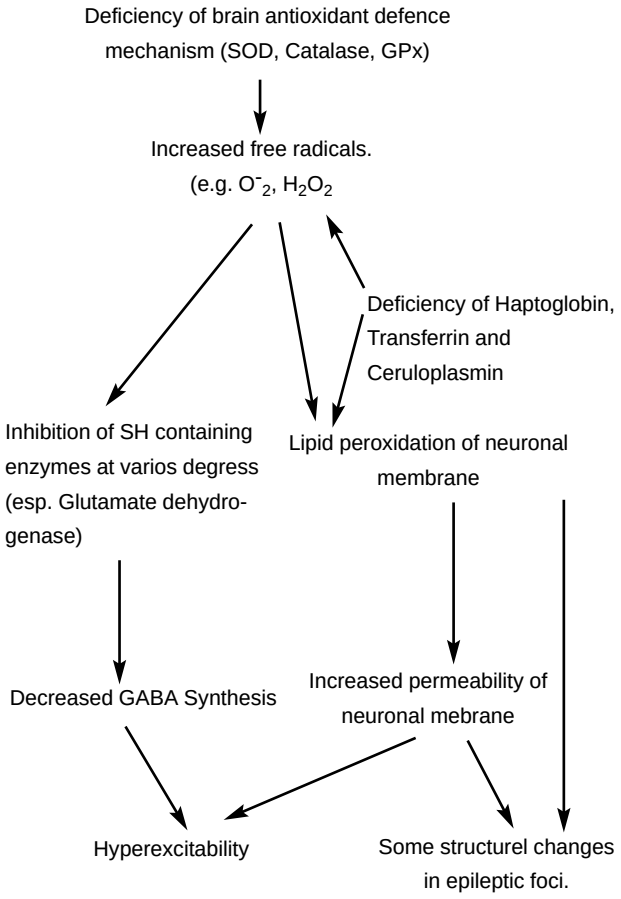


Figure 5: The relationship between epilepsy and anantioxidant defence mechanism.

In Chinchilla Gray rabbits red cell SOD and catalase activities were found to be significantly higher than those in New Zealand rabbits ($P<0.01$, $P<0.05$). And this group was much more sensitive to penthylentetrazol (6, 7). In about half of the rabbits, intraperitoneal administration of SOD (1 mg/kg) and catalase (150.000 IU/kg) 30 minutes before penthylentetrazol (100 mg/kg i.v.) inhibited convulsions, whereas in the other half of the cases single and short convulsive period following penthylentetrazol was observed (Figure 4).

These clinical and experimental findings, and the literature findings (8-10) - increased lipid peroxidation in epileptogenic foci and augmented lipid peroxidation products in the cerepbrospinal fluid and in peripheral blood plasma in the epileptic cases-indicate the important pathogenetic role of antioxidant denciency and/or oxidant stress in idiopathic epilepsy (Figure 5). This is probably due to decrease glutathione peroxidase activity and/or decreased haptoglobin, transferrin and ceruloplasmin functions.

Therefore we think that the combination of traditional antiepileptic and antioxidant agents in idiopathic epilepsy therapy can be more effective. This subject is to be investigated further from this point of view.

ACKNOWLEDGEMENT

This study was supported by the Research Foundation of Ankara University, project number: 86 - 090016.

REFERENCES

1. Yavuzer S, Güvener A, Özelçi G, Zaloglu N, Akçil E, Bilgen I, Karan O, Aydin N, Karagöl U: Idiopathic Epilepsy-Trace elements and Antioxidant Mechanism. Turk. Res. Med. Sci. 3 (1):82-87, 1985.

2. Nikushkin EV, Braslavskii VE, Kryzhanovskii GN: Activation of Lipid Peroxidation in Neuronal Membranes is a Pathogenetic Mechanism of Epileptic Activity. ZH. Neuropathol. Psikhiatr. 81(6):810, 1981.

3. Kryzhanovskii GN, Nikushkin EV, Tupeev IR, Braslavskii VE: Anticonvulsive Effect of Superoxide Dismutase. Biull. Eksp. Med. (USSR) 103(4):396-398, 1987.

4. Bergmeyer HU: Methoden der Enzymatischen Analyse Band 1, 713 Verlag Chemie Weinheim, 1974.

5. Winterbourn B, Hawkins R, Brian M, Carrel RW: The Estimation of Red Cell Superoxide Dismutase Activtiy. J. Lab. Clin Med. 85:337, 1975.

6. Yavuzer S, Güvener A, Özelçi G, Yildirim G: Idiopatik Epilepsi ve hücresel antioxidant mekanizmalarin iliskisi. Türk Fizyolojik Bilimler Dernegi XI. Ulusal Kongresi, 23-27 Eylül (1985) Çesme/Izmir.

7. Yavuzer S, Yurtaslani Z, Yildirim G, Güvener A, Karan O: Idiopatik Epilepsi -Hücresel Antioksidan Savunma Mekanizmalari iliskisi (Katalaz Aktivitesi Yönünden). 9th Convention of Istanbul Faculty of Medicine, September 22-25, 1987. Communications III, pp:63-70.

8. Willmore L, Hiramatsu M, Kochi H, Mori A: Formation of Superoxide Radicals After $FeCl_3$ Infection into Rat Isocortex. Brain Res. 227(2):393-6, 1983.

9. Kryzhanovskii GN, Nikushkin EV, Voronko VA, Kovalenko VM, Pronina IG: Concentration of Lipid peroxidation Products and Free Fatty Acids in the Plasma and Cerebrospinal Fluid of Epileptics. ZH. Neuropathol. Psikhiatr. 84(6):806-809, 1984.

10. Panter S, Sdarzadeh S, Halaway P, Haines J, Andersen V, Eaten J: Hypohaptoglobinemia Associated with Familial Epilepsy. J. Exp. Med. 161(4): 748-54, 1985.

Correspondence:
Sema Yavuzer
Department of Physiology
Faculty of Medicine
Ankara University
Ankara, TURKIYE.