

Erythrocyte Catalase Activities in Chronic Leukemias

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Catalase (CAT) enzyme activities were measured in erythrocytes isolated from untreated patients with chronic leukemia, by using Aebi's method. In chronic lymphocytic leukemia, CAT activity was found to be significantly decreased and in chronic myeloid leukemia, it was found to be in normal ranges of activity although in both types of chronic leukemia, the activities were lower than the normal control group with respect to averages. These results suggest that catalase as an erythrocyte antioxidant enzyme may play an important role in chronic leukemias. [Journal of Turgut Özal Medical Center 1997;4(1):7-9]

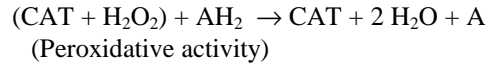
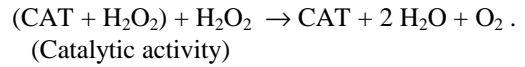
Key Words : Catalase, chronic leukemia, erythrocyte

Kronik lösemili hastalarda eritrosit içi katalaz aktiviteleri

Kronik lösemili hastalarda, eritrosit içi katalaz aktiviteleri, henüz tedaviye başlanmadan önce, Aebi'nin yöntemi kullanılarak tayin edildi. Her iki tip kronik lösemide de katalaz aktiviteleri, ortalamalara bakıldığında normal kontrol grubundan daha düşük olduğu halde, sadece kronik lenfositik lösemide istatistik olarak anlamlı düşüklük saptandı. Bu bulgular, katalazın eritrosit içi bir antioksidan enzim olarak kronik lösemilerde önemli bir role sahip olabileceğini düşündürmektedir. [Turgut Özal Tıp Merkezi Dergisi 1997;4(1):7-9]

Anahtar Kelimeler : Katalaz, kronik lösemi, eritrosit

Catalase (CAT, H₂O₂ : H₂O₂ oxidoreductase, EC 1.11.1.6) is an enzyme that decompose hydrogen peroxide (H₂O₂) to molecular oxygen (O₂) and water (H₂O). This activity of catalase is known as catalytic activity (1). It also exhibits peroxidatic activity and catalyses the oxidation of various hydrogen donors in the presence of relatively lower concentrations of hydrogen peroxide (1,2).



It's a tetrameric hemoprotein containing 4 Hem groups and its molecular weight is about 250 kDa (3,4). This enzyme is found in plants and animal tissues, especially in erythrocytes, hepatic and renal cells (5). The subcellular organelles containing this enzyme are peroxisomes and endoplasmic reticulum

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in hepatic and muscle cells and are cytosol and cell membrane in erythrocytes (6). It was found that catalase and glutathione peroxidase were equally active in detoxification of H_2O_2 in human erythrocytes (7).

In various malignant tumor cells, catalase activity has been found to be decreased (8-10) or in normal ranges of activity (11). Some studies about erythrocyte catalase activities in leukemias that we found have been made in humans by Saito (12) and Gonzales (11) and in animals by Madej (13).

In this study we investigated the erythrocyte catalase activities of untreated patients with chronic leukemia in order to see if there was a relationship between the erythrocyte CAT activity and the type of chronic leukemia.

MATERIALS AND METHODS

The detection was carried out on 12 untreated patients aged between 30 to 67. The distribution of them was as follows : 6 CML and 6 CLL. Twenty healthy volunteers were used as control.

2 ml of heparinized whole blood from each individual were drawn by peripheral venous puncture prior to any chemotherapy and were put into polypropylene tubes and after 10 minutes centrifugation at 1000 g, plasma and buffy coat were drawn and disposed. Then 500 μ l of remaining erythrocyte sediment were washed four times with 5 ml of Phosphate Buffer Saline (PBS) solution centrifuging for 10 minutes at 1000 g after each wash. At the end of procedure 2 ml of icy cold redistilled water were added onto 500 μ l of erythrocyte sediment (five fold dilution), vortexed and left to stand at $+4^\circ\text{C}$ for 15 minutes. So that the hypotonic lysis were achieved. Each obtained 2,5 ml of 5 fold diluted stock hemolysate was diluted again with 0,01 M phosphate buffer (the total dilution factor = 500). These 500 fold diluted lysates were assayed for catalase activity. It was used the catalase assay method defined by Lück (14) and modified by Aebi (15)

Statistical analysis of all data was done using "Mann Whitney U" test.

RESULTS AND DISCUSSION

Although we found that the CAT activities of erythrocytes were lower than control with respect to averages in both types of leukemia, there was a meaningful decrease only in CLL ($p<0.05$). However the activity was in normal ranges in CML (Table 1).

Table 1. Catalase activity in patients and controls

	Patient number	CAT activity (k/g Hb)	activity	
			MIN	MAX
CLL	6	$62.99 \pm 7.85^{a,b}$	51.53	75.14
CML	6	76.68 ± 23.42	38.71	101.57
Control	20	91.50 ± 13.53	71.52	119.60

a : Mean \pm S.D

b : Significant degree of difference ($p<0.05$)

There were two studies about catalase activity in erythrocytes of leukemic patients in the literature. The first, low catalase activity has been found in acute myeloid leukemia (AML) by Saito (12) and second, the enzyme activity has been found in normal ranges of activity in acute myeloblastic leukemia and chronic lymphocytic leukemia by Gonzales (11)

Mammalian red blood cell is particularly susceptible to oxidative damage (16), because;

- 1) It is an an oxygen carrier (it is exposed to high oxygen tension)
- 2) It has no capacity to repair its damaged components
- 3) The hemoglobin is susceptible to autooxidation
- 4) It's membrane components are susceptible to lipid peroxidation

As an antioxidant defense mechanism, catalase enzyme can protect the cells from oxidative damage. If the activity of this enzyme is decreased in the erythrocytes of chronic leukemia patients, then the erythrocytes will be susceptible to oxidative damage.

We believe that the erythrocyte catalase activities usually decrease in chronic leukemias. The results above that we found can explain why hemolytic anemia occurs in chronic leukemia.

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