Estimation the Activity of ADA in Individuals with Cataract and Glaucoma

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Abstract

The activity of ADA was evaluated in the serum of (40) individuals (15 patients with cataract, 15 patients with glaucoma and 10 individuals as a control). The results showed significant reduction in ADA activity value in individuals with cataract and glaucoma comparing with control (147.86±2.4 Iu/mg), (164.06±2.5 Iu/mg) and (211.29±7.4 Iu/mg) respectively also there is a significant reduction in ADA activity value in individuals with cataract (147.86 ± 2.4) Iu/mg comparing with those with glaucoma (164.06 ± 2.5) Iu/mg that refer the effect of cataract on ADA activity is more than the glaucoma .

تقييم فعالية أنظيم الأدينوسين دي أمينيز عند الأشخاص المصابين بالماء الأبيض والماء الأسود

المستخلص

تم قياس فعالية أنظيم ADA لمصل 40 شخصاً (15 مصاب بالماء الابيض و15 مصاب بالماء الاسود و10 اشخاص اصحاء طبيعيين والذين يمثلون مجموعة السيطرة). أظهرت النتائج وجود إنخفاض معنوي في فعالية الأنظيم عند الأشخاص المصابين بالماء الأبيض والماء الأسود مقارنة بالسيطرة والتي بلغت فيها فعالية الأنظيم 211.29±7.4. كما وجد إن هناك إنخفاضاً معنوياً في فعالية الأنظيم عند الأشخاص المصابين بالماء الأبيض (147.86 ± 2.4) مقارنة مع الأشخاص المصابين بالماء الأسود (164.06 ± 2.5) مما يشير إلى تأثير الماء الأبيض على فعالية الأنظيم أكثر من تأثير الماء الأسود.

Introduction

Many enzymes are involved in the biosynthesis, interconversion and degradation of purine compound. These enzymes seem to play important roles in purine metabolism [1] .One of these enzymes is a adenosine deaminase (ADA) which is an important deamination enzyme , convert adenosine and 20-deoxy adenosine to inosine and 20-deoxyinosine, respectively.The genomic sequence of ADA gene spans 32k on the long arm of chromosome 20 [2] .

ADA is present in all tissues in mammals. the high activity of ADA enzyme was seen in thymes , spleen and duodenum while low activity was seen in blood , brain , muscles and pancreas [3], beside that ADA enzyme occur in other organ like liver , kidney , lung and in digestive tract that prove its role to clear the adenosine which enter the body from digestive tract .ADA enzyme also work in lung to clear the adenosine from the blood before its entrance to the heart .In serology , they measure its level in pleura fluid to detect Tuberculosis. Toxic levels of purine metabolites (adenosine, adenosine deoxyribonucleotides, due to deficiency of ADA which can cause hepatic, skeletal, neurologic and behavioral alteration [1], and sensorineural deafness [4] . A deficit of ADA enzyme causes cellular stress due to the unbalance of dNTPs leading to the inhibition of DNA replication and repair [5].After the deficit of ADA enzyme , the adenosine level is rising , linkage with its specific receptors ,singling transport is results according to this linkage , therefore there is increasing in the activity of AdeneylylCyclase enzyme which causes elevation in the level of cAmp inside the cells and enhance cell death mechanism through activation of endonucleases enzyme on Ca^{++} dependant [6].In similar way , when there is increasing in the level of deoxyadenosine , that enhance programmed death mechanism which activate Apo-1/fas mechanism which mediated cell death [7]. Therefore ADA deficiency is distinguished from other types of immunodeficiencies because it is metabolic disease causing immune dysfunction which failure to thrine impaired immunoresponses and recurrent infections [8,9]. Gene therapy is effective in patients with (SCID) like used mature hematopoietic stem cells engraftment in supporting the differential expansion of gene-Corrected cells especially in lymphoid lineages [10].

Many people sever from main eye diseases, like cataract and glaucoma, especially those people in older ages. A cataract is clouding in the lens that blocks some of the light and causes loss of vision [11] . Cataract formation is believed to involve damage to lens protein by free radicals, causing the lens to lose its transparency [12], while glaucoma is a group of diseases that damage the eye's optic nerve and can result in vision loss and blindness [13]. Several large studies have shown the elevated of intraocular pressure [eye pressure) is a major risk factor for optic nerve damage [14].

The people who suffer from age-related diseases, they have decline in the activity of many enzymes and proteins, therefore the purpose of this study to determine the impact the activity of ADA enzyme in people with cataract and glaucoma.

Materials and Methods

The serum of (40) individuals at age of (45 – 65) years old (male and female) were used in this research to evaluate ADA enzyme activity according to Giusti [15]. The sera were collected from Ibn-Al-Haitham hospital for eye diseases.

The individuals were divided into three group first group (15) individuals with cataract, second group (15) individuals with glaucoma , and third group (10) as control . At first total protein was estimated for each specimen according to Biuret kit (Randox , UK), then volume activity for ADA enzyme was evaluated for each specimen according to Giusti [15]. To estimate specific activity for ADA enzyme was used this formula:

$$\text{Specific activity (unit/mg protein)} = \frac{\text{Volume activity}}{\text{Total protein}}$$

The percentage from control value was estimated by this formula:

$$\frac{\text{The ADA activity in cataract or glaucoma}}{\text{The ADA activity in control}} \times 100$$

Statistical significances of differences between the groups were tested with two-tailed t test.

Results and Discussion

There are many mechanisms like oxidation and reduction have special importance in the eye damage which can result in a number of molecular changes that contribute to the development of glaucoma , cataract and other eye diseases [16,17] . Many studies about eye's diseases used plasma to measure many factors, because it was not possible to measure the status of factors in the eye itself [18], therefore we used

serum to measure the ADA activity in this study. The results of this research showed a significant reduction ($P<0.001$) in the percentage value of ADA activity in individual with cataract and glaucoma comparing with control. The percentage value of reduction in individuals with cataract was 70 .14 % while the percentage value of reduction in individuals with glaucoma was 76.78 % comparing with control which ADA activity value was 211.29 ± 7.4 Iu/mg (Fig. 1) The reduction in ADA enzyme activity in cataract and glaucoma groups is associated with age – related morbidit because there is a general consensus that cumulative oxidative and toxic damage is responsible for aging [19] and there is an age related rise in systemic oxidant which may be affected on the activity of ADA like the decreased in the activity of other enzymes (catalase , superoxide dismutase , peroxidase) which associated with cataract and glaucoma [4,20].

When we compared the results of ADA activity value between the individuals with cataract and other with glaucoma, we showed significant reduction ($P < 0.001$), the reduction value was presented in individuals with cataract 147.86 ± 2.4 Iu/mg comparing in individuals with glaucoma 164.06 ± 2.5 Iu/mg (fig.2).

The activity of ADA enzyme of the cataract group in this study was significantly decreased compared with its activity in individuals with glaucoma , like this result observed in the many studies about the activity value of antioxidant enzymes which was decreased in cataract group compared with glaucoma group which showed increased in the activity value of these enzymes [21] . That may be refer the effect of cataract on ADA activity is more thane the glaucoma . Any stress lead to accumulate the second messengers like diacylglycerol (DAG), Inositol triphosphate (IP_3) and the increasing of Ca^{++} concentration in the cell which effected on the biosynthesis and activity of different proteins and enzymes like ADA , this effect may be happen at molecular level and gene expression [22].

The results in this research showed that people with cataract and glaucoma appeared to have reduction in the activity of ADA which gives an indication of declined activity of immune system.

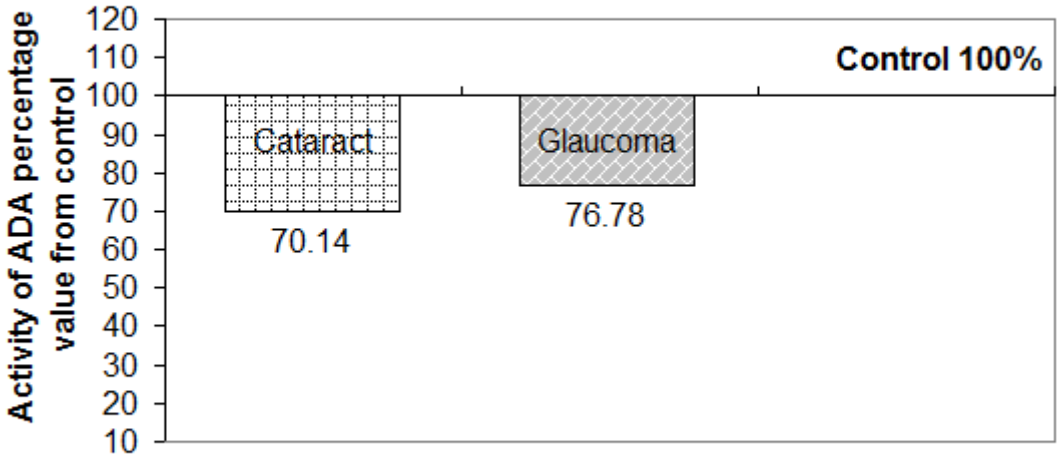

Fig.(1) The Activity of ADA enzyme in indivatulas with cataract and glaucoma comparing with control

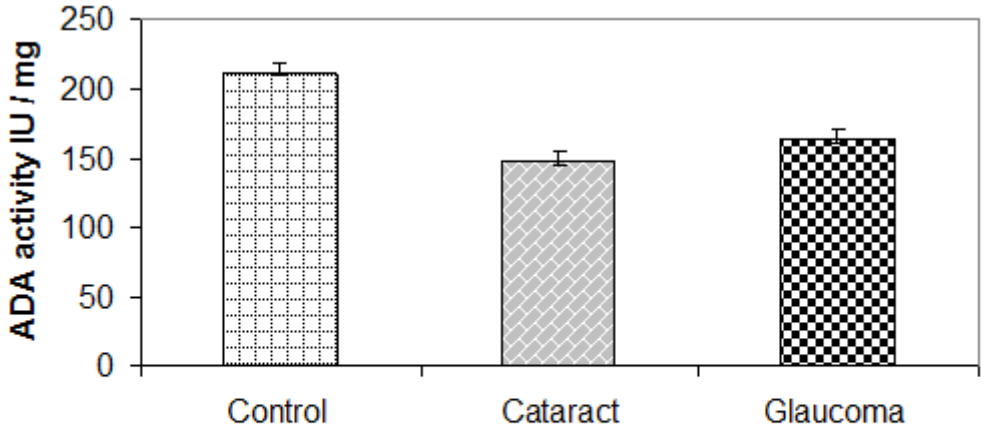

Fig.(2) Activity of ADA in cataract is lower than in glaucoma

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