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Evaluation of Serum Level of Adenosine Deaminase in Patients with Vitiligo

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Abstract
Background: Vitiligo is an epidermal depigmentation condition where melanocytes and melanin disappear, affecting one's appearance and self-esteem. Lymphocytes are only one of several cell types that have the polymorphic enzyme serum adenosine deaminase (ADA) on their surface. It has a crucial role in T lymphocyte development and function. The goal of this study is to examine the levels of adenosine deaminase in the serum of vitiligo patients and compare them to those of healthy individuals. Topics and Techniques: Sixty vitiligo patients and twenty age- and sex-matched healthy volunteers made up the patients' group. The Vitiligo Extent Tensity Index was used to quantify the level of skin discoloration caused by vitiligo. ELISA kits were used to determine the total ADA (tADA) in the serum. There was no statistically significant difference in age or gender between the patients and the control group. The median levels of tADA were drastically different between the patient and control groups. It is likely that serum tADA contributes to the aetiology of vitiligo. New therapy options for vitiligo patients may benefit from the information that this research may give.

Keywords: Vitiligo , Adenosine deaminase, Melanocytes and Melanin

1. Introduction

Vitiligo is a skin condition where melanin and melanocytes stop producing properly, leading to a lack of pigmentation. Vitiligo is the most prevalent genetic condition that causes depigmentation of the skin, hair, and mouth. It is still not entirely apparent what causes vitiligo, although several variables, including genetics, the environment, and the body's own immune system, are all likely contributors. 2 According to the oxidative stress hypothesis of vitiligo, intra-epidermal buildup of reactive oxygen species (ROS), the most infamous of which is hydrogen peroxide (H2O2), whose concentration may reach up to one milimole, is the primary aetiology of vitiligo. Melanocytes undergo apoptosis or cell death and mitochondrial alterations when exposed to this level of H2O2. 3 Adenosine and 2′-deoxyadenosine in the blood are deaminated by adenosine deaminase (ADA) to form inosine and 2'-deoxyinosine, respectively. 4 Increased expression of the microphthalmia-associated transcription factor gene is how adenosine promotes melanogenesis; this is done by activation of the adenosine monophosphate-activated protein kinase pathway. The formation of reactive oxygen species (ROS) and neutrophil adherence to endothelial cells are two of the neutrophil activities that adenosine suppresses. A drug that blocks adenosine deaminase (ADA) totally stopped neutrophils cultured in plasma from producing ROS for an extended period of time. Furthermore, whereas exogenous ADA promoted ROS generation in the neutrophil control, it had no effect on the augmented neutrophil ROS production in plasma. This lends credence to the hypothesis that ADA in the plasma increases ROS generation by neutrophils. 6

2. Subjects and Methods

This Sixty vitiligo patients and twenty age- and sex-matched healthy volunteers were recruited from the Outpatient Clinic of the Dermatology, Venereology, and Andrology Department at Benha University Hospitals for a case-control study.

Method of Sampling: Group A consisted of sixty individuals diagnosed with non-human immunodeficiency virus (NSV) vitiligo. Twenty volunteers of the same age and both sexes served as a control group.

Patients with vitiligo who were at least 18 years old and agreed to take part in the trial met the inclusion criteria.

Exclusion criteria were individuals with segmental vitiligo, a history of topical therapy for vitiligo of less than one month and/or systemic treatment for vitiligo of less than three months previous to the research, active malignancy, or using immunosuppressive medicine.

Methods

The following procedures were performed on every patient:

Personal history, vitiligo history, other autoimmune disease history, and medication history were all taken into account.
Complete physical: ruling out systemic illnesses.
The extent of the vitiligo was evaluated locally using the Vitiligo Extent Tension Index (VETI) scale.
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Research in the Laboratory
Sampling was performed in a completely sterile environment using the conventional venipuncture method. Serum total ADA (tADA) was measured using a tADA ELISA Kit on 5 ml of fasting venous blood from both patients and controls.
The Use of Statistics
SPSS version 25 was used for data administration and statistical analysis (IBM, Armonk, New York, United States). The Kolmogorov-Smirnov test (for cases) and the Shapiro-Wilk test (for controls) as well as direct data visualisation techniques were used to check the normality of the quantitative data (for both). Means, standard deviations, medians, and ranges were used to summarise the numerical data. Numbers and percentages were used to summarise the categorical information. Researchers used a t-test to examine differences in participants' ages and tADA levels across groups. Chi-square analysis was used to compare the sexes. The tADA's ability to distinguish between patients and controls was evaluated using ROC analysis. Diagnostic indices, the optimal cutoff point, and the area under the curve (AUC) were determined. The 95% CI was also determined. Pearson's and Spearman's correlation coefficients were used for the correlation analyses. The serum tADA levels were compared using an independent t-test based on the variables of interest. Vitiligo risk assessment was performed using logistic regression. There were no one-sided statistical analyses. Statistical significance is assumed at the P 0.05 level.

3. Results

The patients and control groups showed a non-significant difference as regards age and gender. Serum tADA was significantly higher in patients than controls. All data were shown in **Table 1**.

Table (1) Demographic characteristics of patients and control groups

		Patients (n = 60)	**Controls (n = 20)**	***Test* (*t*)**	***P***
Age (years)	**Mean ±SD**	33 ±13	38 ±11	$t = 1.485$	0.142
Gender	**Males n (%)**	**29 (48.3%)**	**9 (45%)**	$X^2 = 0.067$	0.796
	Females n (%)	**31 (51.7%)**	**11 (55%)**		

The average beginning of vitiligo occurred in the 25th year of life. Vitiligo may last anywhere from ten months to thirty years, with five and a half years being the norm. About fifty percent of patients had localised vitiligo, whereas the other fifty percent had widespread vitiligo. A VETI score may vary from 0 to 31.8, with 10.5 being the median. There was a 50/50 split between individuals with stable and unstable vitiligo. More than half of patients (53.3% of all patients) reported a successful treatment history, but only 11.7% of patients had a good vitiligo family history. Table 2 displays all data.

Table (2) Clinical characteristics of patients group

Clinical characteristics		
Age of disease onset (years)	Mean ±SD	25 ±10
Disease duration (years)	Median (range)	5.5 (0.83 - 30)
Vitiligo type	Focal n (%)	30 (50%)
	Generalized n (%)	30 (50%)
VETI score	Median (range)	10.5 (0.5 - 31.8)
Vitiligo stability	Stable n (%)	30 (50%)
	Unstable n (%)	30 (50%)
History of treatment	n (%)	32 (53.3%)
Family history of vitiligo	n (%)	7 (11.7%)

Patients had increased serum tADA levels compared to controls.
A positive association was found between serum tADA and VETI score, but no significant correlations were found with patient age, illness beginning age, or disease duration.

4. Discussion

The Autoimmunity, oxidative stress, metabolic poisons, and genetic factors are all considered potential causes of vitiligo. 8 The abnormal stress response, neo-antigenicity, and vulnerability of melanocytes to immunological assault and death in vitiligo may be related to the elevated oxidative stress in the disease. 9

Because of its central role in the pathophysiology of some metabolic illnesses, ADA increase has been linked to a variety of ROS-mediated metabolic syndromes. In addition to amplifying the production of harmful oxygen radicals, increased ADA activity in the serum activates neutrophils and promotes their release of ROS10. 11

The average onset age in this research was 25. Consistent with the findings of Zhang et al.12, the prevalence of vitiligo decreased with age. Mahmmod and Ismael13 found that the average age of onset for vitiligo patients was 24.24 12.28 years. According to research by Pugliese et al.14, the average age of vitiligo onset is 25.9 16.6 years. In contrast to the present research, Huang et al.15 found that the mean age of onset for vitiligo patients was 55 years.

Vitiligo was shown to have a range of 10 months to 30 years in the present research, with a median length of 5.5 years. While Atwa et al.16 and Demirbaş and Eker17 reported a mean vitiligo duration of 27.2 20.18 months and 8.72 8.17 years, respectively, our findings contradicted both of those estimates. Patients were selected differently in the present research compared to the aforementioned trials, which may explain the discrepancy in results.

In this analysis, males and females seem to be similarly impacted. This result was consistent with Bergqvist and Ezzedine's18 finding that both sexes experience the same level of distress, with the exception that women are more likely to seek professional help owing to the potentially more severe negative social consequences they may face.

Patients with vitiligo often report a favourable family history, since the condition is polygenetic. The present research found that 11.7% of vitiligo patients had a family history of the condition. This was consistent with the findings of Mohammed et al.19, who found that between 6.25 and 38 percent of their vitiligo patients had a family history of the condition. It is possible that underlying genetic factors and particular HLA haplotypes contribute to the greater severity of vitiligo seen in families, as shown by the work of Abdullahi et al.20.

The mean VETI score in this analysis was 10.5, and the range was 0.5-21.8. This corresponded with the findings of Ahmed Abdel-Rahman et al.21, who found a similar range of VETI scores, from 0.5 to 26.5. Demirbaş and Eker22 reported a VETI score of 3.51 3.60, which contradicts the findings of the present research.

Our search of Medline did not turn up any further research that looked at whether or not there was a connection between tADA serum level and vitiligo. We looked for causes for the higher serum tADA levels in vitiligo patients compared to controls.

5. Conclusion

The increased serum tADA levels seen in vitiligo patients compared to controls suggest a potential involvement for this protein in the aetiology of this condition. New therapy options for vitiligo patients may benefit from the information that this research may give.

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