



## The role of ego-resiliency in patients with keratoconus

### Rola prężności psychicznej u pacjentów z rozpoznaniem stożka rogówki

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#### ABSTRACT

**INTRODUCTION:** Until now, there has been little work on the association of keratoconus with psychiatric disorders. None of these address the role of ego-resiliency, which may prove crucial in coping with chronic illness.

**MATERIAL AND METHODS:** 74 participants with keratoconus and 92 without this diagnosis participated in the study. The respondents were surveyed using a toolkit: the ER-89 questionnaire for ego-resiliency, the State Trait Anxiety Inventory (STAI), the Beck Depression Inventory (BDI), the Hamilton Depression Rating Scale (HDRS) and the Inventory for Personality Disorders according to DSM-IV (IBZO-DSM-IV). Statistical analyses were performed using Statistica 13.3 software.

**RESULTS:** A statistically significant negative regression of optimal regulation (OR) as a component of ego-resiliency (ER) in light of avoidant personality, dependent personality, depression intensity on the HDRS, and both trait and anxiety status was evident in both the study and control groups. No statistically significant differences in ER intensity were evident between the study and control groups.

**CONCLUSIONS:** Ego-resiliency reduces the intensity of anxiety and depression symptoms as well as the intensity of dependent and avoidant personality traits. Patients with keratoconus do not differ in the intensity of ego-resiliency from those without the condition.

#### KEYWORDS

depression, anxiety, keratoconus, personality disorder, ego-resiliency

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## STRESZCZENIE

**WPROWADZENIE:** Dotychczas powstało niewiele prac dotyczących powiązań stożka rogówki z zaburzeniami psychicznymi. Żadna z nich nie dotyczy roli prężności psychicznej, która może okazać się kluczowa w radzeniu sobie z przewlekłą chorobą.

**MATERIAŁ I METODY:** W badaniu wzięły udział 74 osoby ze stożkiem rogówki i 92 bez tego rozpoznania. Uczestnicy zostali przebadani za pomocą zestawu narzędzi: kwestionariusza ER-89 do badania prężności psychicznej, *Inwentarza stanu i cechy lęku* (STAI), *Inwentarza depresji Becka* (BDI), *Skali depresji Hamiltona* (HDRS) oraz *Inwentarza do badania zaburzeń osobowości według DSM-IV* (IBZO-DSM-IV). Analizy statystyczne przeprowadzono za pomocą oprogramowania Statistica 13.3.

**WYNIKI:** W grupach badanej i kontrolnej uwidoczniło istotną statystycznie ujemną regresję optymalnej regulacji (*optimal regulation* – OR), będącej składową prężności psychicznej (*ego-resiliency* – ER) w świetle osobowości unikającej, zależnej, natężenia depresji w HDRS oraz zarówno cechy, jak i stanu lęku. Nie uwidoczniło istotnych statystycznie różnic w natężeniu ER pomiędzy grupą badaną i kontrolną.

**WNIOSKI:** Prężność psychiczna wpływa na zmniejszenie natężenia objawów lęku i depresji oraz natężenia cech osobowości zależnej i unikającej. Pacjenci ze stożkiem rogówki nie różnią się natężeniem prężności psychicznej od osób bez tej choroby.

## SŁOWA KLUCZOWE

depresja, lęk, stożek rogówki, zaburzenia osobowości, prężność psychiczna

## INTRODUCTION

Ego-resiliency (ER) is a personality meta-trait responsible for adapting to new and often difficult situations [1]. It was first introduced as a concept by Block and Kremen [2] in 1996. Nevertheless, it became widespread worldwide quite quickly and the scale to measure it has been adapted in many different countries, including Poland [3]. By examining ER, researchers determine the expression of the personality traits described above, which is a different value than so-called ego-resilience, the role and meaning of which are already much more difficult to formulate [4].

To date, a number of studies have identified how ER influences the experience of a wide variety of stress-related situations, ranging from a high school leaving exam to a prison sentence. In general, in each of these cases, ego-resiliency protected against excessive stress and its associated consequences [5,6]. Furthermore, ER correlates positively with quality of life in alcohol-dependent patients, highlighting its protective properties in a slightly different aspect [7]. The associations of ER with depression, anxiety or suicide attempts are interesting. As an Iranian study shows, ER is a protective factor against all of the above [8]. The Poole et al. [9] study provides robust evidence of how ego-resiliency serves as a protective buffer against depression in individuals with adverse childhood experiences (ACEs). Moreover, ego-resiliency, whether shaped by adversity or other chronic conditions, serves as a general protective factor in diverse populations.

Despite so many aspects of ER being studied, no study was found on its role among patients with ocular disease. In this context, special attention should be paid to keratoconus, which is progressive and most often develops and progresses in the second and third

decades of life [10]. It is a bilateral and asymmetrical disease that involves convexity of the central and paracentral parts of the cornea of the eye and progressive thinning of the cornea, which lead to irregular astigmatism. Thinning of the corneal parenchyma is caused by an increase in the activity of proteolytic enzymes, accompanied by a reduction in the activity of their inhibitors. This condition impairs the biomechanical stability of the cornea. The changes lead to the deterioration of visual acuity reported by patients on ophthalmic examination. On average, keratoconus is diagnosed in about 50 cases per 100,000 people, occurring with equal frequency in men and women. A family history, eye rubbing, the presence of eczema, atopy and bronchial asthma have been found to be risk factors for the development of this condition. The aetiology of the disease is unknown, most likely caused by multiple factors. Significantly, although the development of the disease involves complex interactions between environmental and genetic factors, their relative contribution to causing and influencing the disease is currently unknown and appears to be individually variable. Histologically, the cornea shows a reduction in the number of keratocytes and a decrease in the amount of collagen lamellae in the stroma, accompanied by the destruction of fibroblasts located in the cornea. The severity of the cone can be classified according to the parameters of the cornea (its morphological features) and the progression of the disease. The treatment of keratoconus depends on its severity. Mild cases require the selection of appropriate spectacle correction; intermediate cases require the selection of contact lenses, sometimes a corneal collagen fibre cross-linking procedure is performed for rapidly progressing cones, and in cases of advanced stages, a corneal transplant is performed [11].

To date, more than a dozen reports have been published on the association of personality traits or depressive-



-anxiety disorders in this group of patients. However, the results of the conducted studies remain inconclusive [12].

The aim of this study is to determine the role of ER among patients with keratoconus in relation to the severity of depression, anxiety and personality disorders, and in comparison to a control group.

## MATERIAL AND METHODS

The study included 74 patients with a diagnosis of keratoconus (study group) and 92 without this diagnosis (control group). The study group consisted of 22 women (29.73%) and 52 men (70.27%) with a mean age of 31.67 years ( $\pm$  11.71 years). In contrast, the control group consisted of 38 (41.30%) women and 54 (58.70%) men. The mean age in the control group was 28.77 years ( $\pm$  9.26 years). The inclusion criteria were common to both groups: informed consent to participate in the study and completion of 18 years of age. The common exclusion criteria included cognitive impairment making it difficult or impossible to complete the questionnaires and a previous or current diagnosis of mental retardation (F70–F79), dementia and other organic disorders (F00–F09), schizophrenia and related disorders (F20–F29) and bipolar disorder (F30, F31) according to ICD-10 (International Classification of Diseases 10<sup>th</sup> Revision) criteria [13]. A diagnosis of keratoconus was an inclusion criterion for the study group and an exclusion criterion for the control group.

The present study was conducted with the approval of the Bioethics Committee of the Medical University of Silesia in Katowice. Before participating in the study, each participant was made aware in detail of the rules of participation in the study, including the possibility of resigning at any stage of the study. After agreeing to participate, each participant was tested with a set of standardised psychometric tools.

ER-89-R12 is a self-report instrument used to measure ER intensity. This scale consists of 12 questions to which the respondent answers on a 4-point Likert scale. An overall score is obtained by simply adding up the individual scores. With this scale, scores on two ER subscales – optimal regulation (OR) and openness to life experiences (OL) [3] – can also be determined.

Two tools were used to assess depressive intensity – the Hamilton Depression Rating Scale (HDRS) and the Beck Depression Inventory (BDI). The former involves an examiner assessing individual symptoms of depression. A specific number of points can be

assigned to each symptom, while the total score is obtained by simply adding up all the points [14]. The BDI, on the other hand, is a self-report scale in which the respondent indicates the severity of the listed 21 depressive symptoms on a 4-point Likert scale [15]. Anxiety intensity was examined using the State Trait Anxiety Inventory (STAI), which consists of subscales of anxiety as a state (X-1) and as a trait (X-2). It is a self-report scale containing 40 items to which the patient provides a response on a 4-point Likert scale. The score is obtained by adding up the scores for each subscale separately, with some questions having reverse point scale responses [16].

The last tool used in the study was the Inventory for Personality Disorders according to DSM-IV (*Inwentarz do badania zaburzeń osobowości według DSM-IV – IBZO-DSM-IV*). It consists of 100 statements on which the respondent should state whether they fit or not. It is acceptable to answer ‘some fit and some not’, but, according to the instructions, it is recommended to mark this answer as rarely as possible. Scores are obtained by adding up the scores on each of the 10 subscales corresponding to specific personality disorders [17]. The scores of each tool described above were recalculated and interpreted by an experienced clinical psychologist participating in this project.

All the results were statistically analysed using Statistica 13.3 (licence provided by the Medical University of Silesia in Katowice). The normality of distributions was checked using the Shapiro-Wilk test. Correlations separately within the study and control groups were performed by means of Spearman’s rank test for variables without a normal distribution and Student’s t-test for variables having a normal distribution. For comparisons between the study and control groups, the Mann-Whitney U test and Student’s t-test were used, respectively. Finally, linear regression models were designed with caveats, which are discussed in the limitations section of the paper at the end of the Discussion section. All the statistical considerations were conducted at a significance level of  $\alpha \leq 0.05$ .

## RESULTS

The correlation analysis of ER and its components with the other study variables within the study group highlighted statistically significant negative correlations of ER with HDRS, both STAI subscales in addition to avoidant and dependent personality, as shown in Table I.



**Table I.** Spearman's rank correlations within study group ( $p < 0.05$ )

Variable	ER	OR	OL
HDRS	-0.346*	-0.334*	-0.236*
BDI	-0.205	-0.201	-0.147
STAI X-1	-0.391*	-0.422*	-0.222
STAI X-2	-0.522*	-0.554*	-0.305*
Paranoid personality	-0.225	-0.210	-0.180
Schizoid personality	-0.314*	-0.340*	-0.192
Schizotypal personality	-0.094	-0.079	-0.124
Antisocial personality	0.019	0.050	-0.041
Borderline personality	-0.237*	-0.223	-0.202
Histrionic personality	-0.134	-0.100	-0.147
Narcissistic personality	-0.079	-0.016	-0.165
Avoidant personality	-0.451*	-0.428*	-0.354*
Dependent personality	-0.474*	-0.455*	-0.341*
Obsessive-compulsive personality	-0.023	0.007	-0.065

\* statistically significant at  $p < 0.05$ ; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.

The correlation results by gender are slightly different, as shown for women in Table II and for men in Table III respectively.

**Table II.** Spearman's rank correlations among women in study group ( $p < 0.05$ )

Variable	ER	OR	OL
HDRS	-0.462*	-0.471*	-0.341
BDI	-0.462*	-0.431*	-0.428*
STAI X-1	-0.546*	-0.567*	-0.435*
STAI X-2	-0.548*	-0.502*	-0.489*
Paranoid personality	-0.380	-0.307	-0.562*
Schizoid personality	-0.245	-0.227	-0.345
Schizotypal personality	0.182	0.217	-0.146
Antisocial personality	0.355	0.417	-0.028
Borderline personality	-0.239	-0.176	-0.376
Histrionic personality	-0.164	-0.127	-0.191
Narcissistic personality	0.145	0.181	-0.066
Avoidant personality	-0.570*	-0.562*	-0.459*
Dependent personality	-0.324	-0.238	-0.424*
Obsessive-compulsive personality	0.156	0.163	0.030

\* statistically significant at  $p < 0.05$ ; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.

**Table III.** Spearman's rank correlations among men in study group ( $p < 0.05$ )

Variable	ER	OR	OL
HDRS	-0.312*	-0.297*	-0.196
BDI	-0.143	-0.150	-0.062
STAI X-1	-0.355*	-0.398*	-0.160
STAI X-2	-0.526*	-0.591*	-0.254
Paranoid personality	-0.161	-0.160	-0.091
Schizoid personality	-0.367*	-0.416	-0.159
Schizotypal personality	-0.198	-0.201	-0.138
Antisocial personality	-0.126	-0.129	-0.063
Borderline personality	-0.232	-0.232	-0.161
Histrionic personality	-0.117	-0.084	-0.148
Narcissistic personality	-0.138	-0.077	-0.191
Avoidant personality	-0.389*	-0.358*	-0.307*
Dependent personality	-0.529*	-0.528*	-0.354*
Obsessive-compulsive personality	-0.087	-0.055	-0.100

\* statistically significant at  $p < 0.05$ ; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.

Corresponding analyses were carried out in the control group obtaining broadly similar results to those presented above, as presented in Tables IV–VI.

**Table IV.** Spearman's rank correlations within control group ( $p < 0.05$ )

Variable	ER	OR	OL
HDRS	-0.312*	-0.398*	-0.037
BDI	-0.413*	-0.424*	-0.211*
STAI X-1	-0.376*	-0.468*	-0.035
STAI X-2	-0.552*	-0.588*	-0.217*
Paranoid personality	-0.322*	-0.369*	-0.116
Schizoid personality	-0.261*	-0.268*	-0.110
Schizotypal personality	-0.248*	-0.273*	-0.093
Antisocial personality	0.251*	0.230*	0.176
Borderline personality	-0.361*	-0.438*	-0.052
Histrionic personality	-0.036	-0.038	-0.011
Narcissistic personality	0.113	0.080	0.117
Avoidant personality	-0.388*	-0.422*	-0.125
Dependent personality	-0.333*	-0.359*	-0.116
Obsessive-compulsive personality	-0.104	-0.121	-0.027

\* statistically significant at  $p < 0.05$ ; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.



**Table V.** Spearman's rank correlations among women in control group (p < 0.05)

Variable	ER	OR	OL
HDRS	-0.347*	-0.431*	-0.160
BDI	-0.490*	-0.450	-0.373*
STAI X-1	-0.411*	-0.510*	-0.092
STAI X-2	-0.587*	-0.575*	-0.336*
Paranoid personality	-0.334*	-0.459*	-0.143
Schizoid personality	-0.506*	-0.372*	-0.370*
Schizotypal personality	-0.377*	-0.352*	-0.273
Antisocial personality	0.317	0.364*	0.002
Borderline personality	-0.316	-0.316	-0.159
Histrionic personality	-0.173	-0.241	-0.101
Narcissistic personality	-0.050	-0.137	0.011
Avoidant personality	-0.499*	-0.467*	-0.296
Dependent personality	-0.315	-0.336*	-0.099
Obsessive-compulsive personality	-0.247	-0.233	-0.099

\* statistically significant at p < 0.05; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.

In the performed comparative analyses, no statistically significant differences in ER intensity and its components were evident between the study and control groups. Subsequently, within statistically signi-

**Table VI.** Spearman's rank correlations among men in control group (p < 0.05)

Variable	ER	OR	OL
HDRS	-0.254	-0.356*	-0.070
BDI	-0.291*	-0.313*	-0.097
STAI X-1	-0.336*	-0.441*	-0.001
STAI X-2	-0.520*	-0.575*	-0.152
Paranoid personality	-0.283*	-0.320*	-0.072
Schizoid personality	-0.170	-0.242	0.059
Schizotypal personality	-0.119	-0.179	0.045
Antisocial personality	0.198	0.121	0.310*
Borderline personality	-0.386*	-0.515*	0.012
Histrionic personality	0.055	0.094	0.025
Narcissistic personality	0.219	0.220	0.183
Avoidant personality	-0.266	-0.357*	0.008
Dependent personality	-0.346*	-0.389*	-0.096
Obsessive-compulsive personality	0.022	-0.022	0.067

\* statistically significant at p < 0.05; HDRS – Hamilton Depression Rating Scale; BDI – Beck Depression Inventory; STAI X-1 – State Trait Anxiety Inventory – state anxiety subscale; STAI X-2 – State Trait Anxiety Inventory – trait anxiety subscale; ER – ego-resiliency; OR – optimal regulation; OL – openness to life experiences.

ficant OR and OL correlations, regression analyses were performed to determine the effect of ER on the study characteristics, as shown for the study and control groups in Table VII and VIII, respectively.

**Table VII.** Regressions of HDRS, STAI X-1, STAI X-2 in light of OR and avoidant and dependent personality in light of OR and OL in study group (p < 0.05)

Variable	b	b SE	β	β SE	t	p	Features of the model
<b>HDRS</b>							
constant	11.931	2.581	–	–	6.622	< 0.001*	Correct. R <sup>2</sup> = 0.106, F(1.72) = 9.632, p < 0.01, SEE = 4.051
OR	-0.333	0.107	-0.343	0.111	-3.103	< 0.01*	
<b>STAI X-1</b>							
constant	10.52	1.114	–	–	9.022	< 0.001*	Correct. R <sup>2</sup> = 0.227, F(1.72) = 22.422, p < 0.001, SEE = 1.748
OR	-0.219	0.046	-0.487	0.103	-4.735	< 0.001*	
<b>STAI X-2</b>							
constant	11.334	1.212	–	–	9.351	< 0.001*	Correct. R <sup>2</sup> = 0.321, F(1.72) = 35.536, p < 0.001, SEE = 1.902
OR	-0.575	0.050	-0.575	0.096	-5.962	< 0.001*	
<b>Avoidant personality</b>							
constant	10.500	1.442	–	–	7.282	< 0.001*	Correct. R <sup>2</sup> = 0.166, F(2.71) = 8.267, p < 0.001, SEE = 2.127
OR	-0.193	0.069	-0.367	0.131	-2.798	< 0.01*	
OL	-0.097	0.123	-0.103	0.131	-0.787	0.434	
<b>Dependent personality</b>							
constant	11.923	1.498	–	–	7.957	< 0.001*	Correct. R <sup>2</sup> = 0.213, F(2.71) = 10.875, p < 0.001, SEE = 2.210
OR	-0.255	0.072	-0.453	0.127	-3.556	< 0.001*	
OL	-0.052	0.128	-0.051	0.127	-0.402	0.689	

OR – optimal regulation; OL – openness to life experiences; HDRS – Hamilton Depression Rating Scale; STAI X-1 – state anxiety subscale for the State Trait Anxiety Inventory; STAI X-2 – trait anxiety subscale for the State Trait Anxiety Inventory; SEE – standard error of estimate.

**Table VIII.** Regressions of HDRS, STAI X-1, STAI X-2 in light of OR and avoidant and dependent personality in light of OR and OL in control group ( $p < 0.05$ )

Variable	b	b SE	$\beta$	$\beta$ SE	t	p	Features of the model
HDRS							
constant	13.914	2.582	–	–	5.390	< 0.001*	Correct. $R^2 = 0.149$ , $F(1.90) = 16.875$ , $p < 0.001$ , SEE = 4.406
OR	-0.397	0.106	-0.397	0.097	-4.108	< 0.001*	
STAI X-1							
constant	10.822	1.098	–	–	9.860	< 0.001*	Correct. $R^2 = 0.228$ , $F(1.90) = 27.875$ , $p < 0.001$ , SEE = 1.873
OR	-0.239	0.045	-0.486	0.092	-5.280	< 0.001*	
STAI X-2							
constant	12.885	1.118	–	–	11.530	< 0.001*	Correct. $R^2 = 0.380$ , $F(1.90) = 56.790$ , $p < 0.001$ , SEE = 1.908
OR	-0.347	0.046	-0.622	0.083	-7.536	< 0.001*	
Avoidant personality							
constant	10.803	1.339	–	–	8.070	< 0.001*	Correct. $R^2 = 0.192$ , $F(2.89) = 11.783$ , $p < 0.001$ , SEE = 1.983
OR	-0.219	0.053	-0.432	0.105	-4.131	< 0.001*	
OL	-0.050	0.098	-0.053	0.105	-0.507	0.613	
Dependent personality							
constant	9.417	1.312	–	–	8.179	< 0.001*	Correct. $R^2 = 0.130$ , $F(2.89) = 7.799$ , $p < 0.001$ , SEE = 1.943
OR	-0.186	0.052	-0.387	0.109	-3.571	< 0.001*	
OL	0.003	0.096	-0.003	0.109	0.028	0.977	

OR – optimal regulation; OL – openness to life experiences; HDRS – Hamilton Depression Rating Scale; STAI X-1 – state anxiety subscale for the State Trait Anxiety Inventory; STAI X-2 – trait anxiety subscale for the State Trait Anxiety Inventory; SEE – standard error of estimate.

## DISCUSSION

The correlation analyses of ER and OR with the other parameters examined within both groups presented above clearly indicate a negative association with the HDRS scores and both STAI subscales. Importantly, this association appears to be inconclusive for the BDI scores, which may be due to a reduced subjective sense of depressive symptoms in some subjects. The discussed differences between the HDRS and BDI correlations are particularly evident when the study group is divided by gender. In the male group, the BDI does not correlate with ER, while the HDRS is different. This may indicate a reduced subjective sense of depressive symptoms among men in the study group. The protective effect of OR on the intensity of depression and anxiety is evident from the regression analyses in Table VII and VIII. It should be noted that in both the study and control group, OR has a statistically significant effect on lowering scores on the HDRS and both STAI subscales. As studies conducted to date indicate, such an effect of ER is present in the whole population [18]. Moreover, as has been shown in several publications, this was a very important function of ER during the COVID-19 pandemic, as people with higher ER were better able to cope with its mental health consequences [19,20]. In the present study, however, it is important to look specifically at the potentially protective role of ER in relation to the mental state of people with keratoconus. According to a review of the literature, these individuals may be characterised by an increased intensity of depressive and anxiety symptoms [12].

In view of the above, the protective properties of ER, which were also confirmed in this study, seem to be of great importance among people with keratoconus.

Of equal interest appear to be the correlations of ER and its components with individual personality disorders, the results of which were obtained using IBZO-DSM-IV. In the literature, one can find studies indicating correlations of ER with the results of questionnaires for individual personality traits. One of these is an article by Pyszkowska [21], which used a shortened version of the HEXACO questionnaire. This study showed statistically significant negative correlations of ER with honesty, modesty and emotionality and its subscales. Positive ER correlations were significant for extraversion and its subscales with the exception of vitality, agreeableness (along with forgiveness and patience), diligence and perfectionism, and openness to experience (with all its subscales). In the light of the above data, the correlation results obtained in the present study presented in Tables I–VI seem justified. It is worth noting that another study by Israeli scholars also identified a positive correlation between ER and extraversion and openness to experience and a negative correlation between ER and neuroticism, which seems to confirm the universality of the described correlations [22].

Owing to the presence of relatively strong correlations between ER and its components and the intensity of avoidant and dependent personality traits, it was decided to perform regression analysis for the aforementioned variables in order to determine the impact of individual ER components on the aforementioned personality disorders. As was shown, among both test and control subjects OR has



a statistically significant effect on reducing the intensity of the traits of both personality disorders. In the study cited above, ER regression analyses were also conducted, which showed no effect of ER on either anxiety intensity or correlations in terms of personality traits. Nonetheless, it should be noted that this study included a slightly smaller group of individuals [21]. Given that an increased experience of anxiety is present in both individuals with avoidant and dependent personality, the relationship between ER and anxiety should be looked at more closely [23,24]. As research shows, ER has a protective effect on the intensity of experiencing anxiety [18,19]. Therefore, it seems reasonable to assume that the same relationship would become apparent between ER intensity and the personality disorders in question, as shown in Tables VII–VIII.

In the conducted study, no statistically significant differences between the intensity of ER and its components were evident in the study or control groups. No similar comparisons were found in previously published studies on the association between ER and somatic diseases. This is probably due to the nature of ER, which is part of one's personality and therefore should not change under the influence of external factors [2]. Although our study focuses on keratoconus, the mechanisms of resilience are similar in different contexts, including those associated with ACEs [9], highlighting the universality of ego-resiliency as a psychological construct. Nevertheless, it should be noted that, in the case of keratoconus, a number of studies have shown associations of the underlying disease with specific personality traits [25,26,27]. In this context, it is important to note that ER intensity is not different in this patient group, so that keratoconus sufferers are able to regulate anxiety and depressive intensity in the same way as those without the disease. Furthermore, behavioural-cognitive therapy can be helpful as it has been shown among people with diabetes that ER can be statistically

significantly increased [28]. Moreover, the Poole et al. [9] study also suggests that immune-building interventions may be beneficial, and so their validity among keratoconus patients should be considered. However, in the field of keratoconus, further research is needed to demonstrate this potential relationship.

This study is the first attempt to assess ER intensity among patients with keratoconus. For this reason, its results should be confirmed in subsequent projects that also include other questionnaires for personality disorders. It should be noted that the limitations of the study may be due to the disparity in the groups between genders, which result from the characteristics of the keratoconus group. It should be noted that in terms of both the study of people with keratoconus and ER, this is one of the larger studies conducted to date. Another limitation of the study is the creation of linear regression models for the effect of ER components on the analysed parameters. In principle, one of the assumptions of linear regression is a linear distribution of the data under study. Nonetheless, according to the literature, this analysis is resistant to violations of this assumption [29]. For this reason, the regression analyses presented in this paper should be treated as exploratory analyses that need to be verified in subsequent studies.

## CONCLUSIONS

1. High mental toughness results in lower levels of anxiety and depression symptoms and lower levels of dependent and avoidant personality traits.
2. Patients with keratoconus do not differ in the intensity of ego-resiliency from those without the condition.
3. Among patients with keratoconus, the effect of ego-resiliency on mental health is unaffected relative to healthy individuals.

## REFERENCES

1. Farkas D., Orosz G. Ego-resiliency reloaded: a three-component model of general resiliency. *PLoS One* 2015; 10(3): e0120883, doi: 10.1371/journal.pone.0120883.
2. Block J., Kremen A.M. IQ and ego-resiliency: conceptual and empirical connections and separateness. *J. Pers. Soc. Psychol.* 1996; 70(2): 349–361, doi: 10.1037//0022-3514.70.2.349.
3. Kołodziej-Zaleska A., Przybyła-Basista H. *Ego-resiliency* as a personal resource – an assessment instrument and its use in interdisciplinary research. [Article in Polish]. *Czas. Psychol. –Psychol. J.* 2018; 24(1): 159–170, doi: 10.14691/CPPJ.24.1.159.
4. Szwajca K. Resilience and responses to the experience of trauma – a fascinating but difficult study area. [Article in Polish]. *Psychiatr. Pol.* 2014; 48(3): 563–572.
5. Ogińska-Bulik N., Zadworna-Cieślak M. The role of resiliency in coping with stress related to the matriculation examination. [Article in Polish]. *Educ. Stud. Rev.* 2015; 19(2): 7–24, doi: 10.12775/PBE.2014.019.
6. Sygit-Kowalkowska E., Szrajda J., Weber-Rajek M., Porazyński K., Ziółkowski M. Resilience as a predictor of mental health of incarcerated women. *Psychiatr. Pol.* 2017; 51(3): 549–560, doi: 10.12740/PP/OnlineFirst/62617.
7. Dębski P.G. Ego-resiliency and life satisfaction in individuals with alcohol dependence. *Psychiatr. Psychol. Klin.* 2021; 21(2): 110–120, doi: 10.15557/PIPK.2021.0012.
8. Izadnia N., Amiri M., Jahromi R., Hamidi S. A study of relationship between suicidal ideas, depression, anxiety, resiliency, daily stresses and mental health among Tehran university students. *Procedia Soc. Behav. Sci.* 2010; 5: 1615–1619, doi: 10.1016/j.sbspro.2010.07.335.
9. Poole J.C., Dobson K.S., Pusch D. Childhood adversity and adult depression: The protective role of psychological resilience. *Child Abuse Negl.* 2017; 64: 89–100, doi: 10.1016/j.chiabu.2016.12.012.
10. Das A.V., Deshmukh R.S., Reddy J.C., Joshi V.P., Singh V.M., Gogri P.Y. et al. Keratoconus in India: Clinical presentation and demographic distribution based on big data analytics. *Indian J. Ophthalmol.* 2024; 72(1): 105–110, doi: 10.4103/IJO.IJO\_1190\_23.
11. Rabinowitz Y.S. Keratoconus. *Surv. Ophthalmol.* 1998; 42(4): 297–319, doi: 10.1016/s0039-6257(97)00119-7.
12. Florek S., Pudło R., Gościńiewicz P., Mrukwa-Kominek E. Mental disorders in people with keratoconus. *Curr. Probl. Psychiatr.* 2023; 24: 33–39, doi: 10.12923/2353-8627/2023-0003.



13. World Health Organization. The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research. World Health Organization. Geneva 1993.
14. Hamilton M. A rating scale for depression. *J. Neurol. Neurosurg. Psychiatry* 1960; 23(1): 56–62, doi: 10.1136/jnnp.23.1.56.
15. Beck A.T., Ward C.H., Mendelson M., Mock J., Erbaugh J. An inventory for measuring depression. *Arch. Gen. Psychiatry* 1961; 4: 561–571, doi: 10.1001/archpsyc.1961.01710120031004.
16. Spielberger C.D. *State-Trait Anxiety Inventory: Bibliography*. 2nd ed. Palo Alto, CA: Consulting Psychologists Press, 1989.
17. Stanik J. Inwentarz do badania zaburzeń osobowości według DSM-IV; IBZO-DSM-IV: (M. Radochońskiego i J.M. Stanika). In: J. Stanik [ed.], *Zastosowanie wybranych technik diagnostycznych w psychologicznej praktyce klinicznej i sądowej*. Podręczniki i Skrypty Uniwersytetu Śląskiego w Katowicach, nr 72. Wyd. Uniwersytetu Śląskiego. Katowice 2006, p. 17–50.
18. Seo E.H., Yang H.J., Kim S.G., Yoon H.J. Ego-resiliency moderates the risk of depression and social anxiety symptoms on suicidal ideation in medical students. *Ann. Gen. Psychiatry* 2022; 21(1): 19, doi: 10.1186/s12991-022-00399-x.
19. Goryczka A., Dębski P., Gogola A.M., Goryczyca P., Pięga M. Depressive and anxiety symptoms and their relationships with ego-resiliency and life satisfaction among well-educated, young Polish citizens during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 2022; 19(16): 10364, doi: 10.3390/ijerph191610364.
20. Kubo T., Sugawara D., Masuyama A. The effect of ego-resiliency and COVID-19-related stress on mental health among the Japanese population. *Pers. Individ. Dif.* 2021; 175: 110702, doi: 10.1016/j.paid.2021.110702.
21. Pyszowska A. Personality predictors of self-compassion, ego-resiliency and psychological flexibility in the context of quality of life. *Pers. Individ. Dif.* 2020; 161: 109932, doi: 10.1016/j.paid.2020.109932.
22. Cohen-Louck K., Zvi L. A model for predicting post-traumatic stress disorder due to exposure to chronic political violence: big five personality traits, ego-resiliency, and coping. *J. Interpers. Violence* 2022; 37(23–24): NP23241–NP23261, doi: 10.1177/08862605221080144.
23. Lampe L. Avoidant personality disorder as a social anxiety phenotype: risk factors, associations and treatment. *Curr. Opin. Psychiatry* 2016; 29(1): 64–69, doi: 10.1097/YCO.0000000000000211.
24. Mroczkowski M.M., Goes F.S., Riddle M.A., Grados M.A., Bienvenu O.J., Greenberg B.D. et al. Dependent personality, separation anxiety disorder and other anxiety disorders in OCD. *Personal. Ment. Health* 2016; 10(1): 22–28, doi: 10.1002/pmh.1321.
25. Mannis M.J., Morrison T.L., Zadnik K., Holland E.J., Krachmer J.H. Personality trends in keratoconus. An analysis. *Arch. Ophthalmol.* 1987; 105(6): 798–800, doi: 10.1001/archoph.1987.01060060084038.
26. Mannis M.J., Ling J.J., Kyrillos R., Barnett M. Keratoconus and personality – A review. *Cornea* 2018; 37(3): 400–404, doi: 10.1097/ICO.0000000000001479.
27. Cooke C.A., Cooper C., Dowds E., Frazer D.G., Jackson A.J. Keratoconus, myopia, and personality. *Cornea* 2003; 22(3): 239–242, doi: 10.1097/00003226-200304000-00011.
28. Shegarf Nakhaei M.R., Akbari Oryani T., Bayazi M.H., Shomoossi N., Hoseini B.L. Influence of cognitive behavioral therapy on psychological wellbeing and ego-resiliency in type 2 diabetes patients in Sabzevar. *Iran. J. Diabetes Obes.* 2021; 13(2): 88–94, doi: 10.18502/ijdo.v13i2.6477.
29. Stanisław A. *Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. T. 2. Modele liniowe i nieliniowe*. StatSoft Polska. Kraków 2007.