

The main factors influencing neuroticism in adolescents

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Abstract

Problem statement: The psychological well-being of adolescents has become a pressing concern in recent years. This study explores the relationship between neuroticism and various factors (including family dynamics, involvement in sports, and overall health) using comprehensive questionnaire data. **Approach:** Employing an exploratory research design, this study aimed to gain deeper insight into the main influencers in adolescents' life such as parent-adolescent relationships, family cohesion, age, and physical activity. Utilizing a cross-sectional study design, we have statistically analyzed data collected from 945 Czech adolescents (387 females and 558 males), aged 16–18 years, representing diverse backgrounds and educational institutions. **Purpose:** The primary objective of this study was to identify the key factors influencing the levels of neuroticism in adolescents and to describe these relationships using a linear model. **Results and Conclusions:** Relationships with parents, mental and physical health, and the frequency of doing sport and physical activity were identified as factors influencing levels of neuroticism. The highest mean of the neuroticism trait was found for respondents related to poor relationships with parents (0.92 standard deviation above the mean), for respondents who feel ill or not at ease (0.85 standard deviation above the mean), and for respondents who do sport only occasionally or not at all (0.48 standard deviation above the mean). It is important for students to participate in physical activities. Such participation has a positive effect on the physical aspect of a person, but also on the social and mental stability. Frequency of weekly sport activities, health, and how the respondent currently feels explain 19.6% and 25.5% of the variability in neuroticism levels for males and females, respectively.

Key words: neuroticism, adolescents, sport, parenting

Introduction

The Period of adolescence lasts from 13 to 19 years. A adolescence is considered to be a crucial and significant period in an individual's life. Psychologically, adolescence is the time when the individual becomes integrated into society. It also includes profound intellectual changes (D'Mello & Monteiro, 2019). Neuroticism, one of the Big Five personality traits, refers to a tendency towards negative emotions such as anxiety, insecurity, and moodiness (Costa & McCrae, 1992). Neuroticism is associated with various aspects of mental and physical health, and predicts the use of alcohol and other addictive substances (Bouhuys et al., 2004).

Family plays a crucial role in shaping an individual's neuroticism levels. Numerous studies have explored the impact of family dynamics, parenting styles, and genetic factors on the development of neuroticism (Jokela, 2012; Kendler, 1992; Kendler et al., 2008; Plomin et al., 2016; Plomin & Daniels, 2011). The results indicate a significant relationship between family connectedness and neuroticism. There were no significant gender differences in the variables among the sample. Regression analysis showed that family connectedness was a strong predictor for neuroticism in a person (Indumathy, 2018). Research has consistently shown that family environment, particularly early experiences, significantly influences neuroticism (Kaniušonytė & Laursen, 2022). Negative family experiences, such as parental conflict, abuse, neglect, or inconsistent parenting, have been linked to higher levels of neuroticism in individuals (Jokela, 2012; Plomin & Daniels, 2011). A longitudinal study confirms the same conclusions which aimed to determine whether there was a connection between neuroticism and negative everyday experiences and interpersonal problems during the adolescence period. The research investigation showed a link between higher levels of neuroticism and negative experiences (Borghuis et al., 2020). On the other hand, a study of identical twins showed that family perception is associated with the level of neuroticism. Adolescents with high neuroticism tend to perceive and evaluate their families more negatively than adolescents with low neuroticism (Millikan et al., 2002). Parenting style also plays a role in shaping neuroticism and it is an important factor in children's socialization. Overly controlling or authoritarian parenting can increase neuroticism levels in children, as it restricts their autonomy and fosters anxiety. Either a punitive parenting style determines high neuroticism (Peng et al., 2022; Zhou et al., 2023). Another result of the research found that affectionless control produced significantly higher levels of neuroticism in young adults than

optimal parenting (Averina et al., 2021). In addition, parental care and protection were also found to be significantly associated with neuroticism. On the other hand, parents who provide emotional support, warmth, and stability tend to have children with lower neuroticism levels (Jokela, 2012; Plomin & Daniels, 2011). The results of research by Kaufling (Kaufling, 2019) indicate a significantly negative correlation between parental warmth and neuroticism in adolescents, as well as a significantly positive correlation between parental control and neuroticism. This finding is accompanied by Seki et al. (Seki et al., 2020) who found that high parental overprotection is associated with high scores in neuroticism.

Genetics also contribute to neuroticism, and studies have found a heritable component to this trait. Family studies and twin research indicate that genes influence neuroticism, suggesting that individuals may inherit a predisposition for higher or lower levels of neuroticism from their family members (Kendler, 1992; Kendler et al., 2008; Plomin et al., 2016). In addition to these environmental and genetic factors, the interplay between family dynamics and individual differences can shape neuroticism. For instance, individuals with a predisposition for neuroticism may be more sensitive to negative family experiences, making them more vulnerable to developing higher levels of neuroticism (Jokela, 2012; Plomin et al., 2016).

Sport activity might be a good indicator of neuroticism as well. McKelvie et al. (McKelvie et al., 2003) investigated whether there are differences in personality between athletes and non-athletes. Their conclusions confirm that athletes scored significantly lower neuroticism than non-athletes. Other beneficial results were reported from Piepiora et al. (Piepiora et al., 2022), who found that there was a negative correlation between sport experience and neuroticism. In addition, they discovered that the longer the sport experience, the higher scores in extraversion, openness to experience, agreeableness, and conscientiousness, and the lower scores in neuroticism were measured. So the duration of sport experience may have a considerable influence on forming the personality of athletes. Existing research suggests that physical performance and personality traits mutually influence each other, indicating that sport performance and the level of physical activity can be predicted based on personality traits, and vice versa (Allen & Laborde, 2014). Higher frequency of physical exercise positively impacts the emotional stability of children and adolescents; however, the extent of this influence varies according to factors such as place of residence (urban vs. rural areas), age, and gender (Qin et al., 2023; Sedlačík et al., 2023). Additionally, adolescents scoring higher on the neuroticism dimension show a greater inclination towards team sports compared to those participating in individual sports (Madic et al., 2015).

Physical health status usually highly correlates with mental stability as well. Metts et al. (Metts et al., 2021) found that neuroticism increases interpersonal chronic stress and episodic stress in adolescents. Moreover, Neeleman et al. (Neeleman et al., 2002) in their investigation established that neuroticism holds direct links with somatic as well as psychiatric ill-health. In the context of neuroticism, this personality trait can lead to poorer health outcomes through maladaptive behaviors triggered by anxiety. On the other hand, neuroticism could also contribute to improved health due to the vigilance aroused by anxiety (Friedman, 2000). Personality psychologists have long discussed the concept of "healthy neuroticism", which is defined as the interaction between neuroticism and conscientiousness. Neuroticism itself is associated with health-related behaviors in individuals with high conscientiousness, indicating a healthy lifestyle (Graham et al., 2020). In the study by Singh (Singh, 2022) a moderating effect of conscientiousness on neuroticism was found in adolescents. The results revealed that conscientiousness may play a crucial role in mitigating the negative aspects associated with neuroticism and contribute to better coping with risky situations and health care among individuals, especially during adolescence. Individuals with higher conscientiousness are less prone to substance abuse and engage more in physical activity (Graham et al., 2020).

Study design and participants

A total of 948 Czech secondary school students from 15 different schools (560 boys, 388 girls) participated in the study between 2021 and 2022. Almost all regions of the Czech Republic were covered. The age range of participants was 16-18 years. Participants were asked to complete a demographic questionnaire and the five-factor NEO-PI-R personality inventory, Czech version, to measure five main personality traits, including conscientiousness, neuroticism, extraversion, agreeableness, and openness to experience. Responses to questions on this inventory are based on a Likert scale of five options ranging from "strongly disagree = 5" to "strongly agree = 1". In this study, the Cronbach's alpha coefficients for neuroticism (N), extraversion (E), agreeableness (A), conscientiousness (C), and openness to experience (O) were respectively 0.874, 0.810, 0.77, 0.847, and 0.726. The resulting values were standardized and converted to z-scores.

All of the questionnaires were filled out on computers in a typical classroom of a maximum of 20 persons at one time. The classroom was quiet and participants were supervised by at least 3 people including one psychologist so they were concentrated solely on the task. Detailed explanations on how to complete the questionnaires were provided by the researchers, and the participants were requested to ask for more clarification in case of encountered problems filling out the questionnaires. The respondents had no time limit. Individuals participated in this study voluntarily and signed an informed consent form if they were 18 years old. For the minors, the consent was signed by their legal representative. They were also assured of the confidentiality of the information contained in the questionnaires. Finally, the questionnaires were collected and the obtained data were analyzed.

Methods

The analysis was performed using the independent samples t-test or nonparametric Mann-Whitney test, analysis of variance and regression analysis. The level of confidence was set at 0.05, and all tests were two-sided. The assumptions of normality and homogeneity of variance were verified. The software applied was IBM SPSS Statistics, version 26. Demographic variables included age group, gender, parents' education (low – both parents have a high school diploma or lower level of education, high – both parents have a higher vocational, college, or university education), weekly sport activity (no sports at all or only occasionally = 1, once a week = 2, three or more times a week = 3), if the respondent lives in a complete or incomplete family, information about the relationship with the parents and information about how the respondent feels. Relationship with parents was measured on a 10-point ordinal scale. For the purpose of analysis, we divided the relationship with parents into three groups: poor (score 0-6 = 1), good (score 7-8 = 2), and excellent (score 9-10 = 3).

Results

Statistically significant differences in mean neuroticism scores were found for groups of adolescents in this demographic variables:

1. Intensity of sport activity, which explained 4.3% of the variability in neuroticism levels for males and 7.6% of the variability for females. Tukey's HSD test for multiple comparisons found that mean neuroticism score is statistically significantly higher for respondents who do not play sports at all or only occasionally than for the group that plays sports three or more times per week, for both male ($p < 0.001$, 95% CI = [0.305, 0.886]) and female ($p < 0.001$, 95% CI = [0.408, 0.997]) respondents.

2. Relationships with parents explaining 6.9% of the variability in the neuroticism variable for males and 5.4% of the variability for females. According to Tukey's HSD test, the mean neuroticism score for adolescents with poor relationships with parents is statistically significantly higher than the mean neuroticism score for adolescents with excellent relationships with parents for both males ($p < 0.001$, 95% CI = [0.265, 1.168]) and females ($p < 0.001$, 95% CI = [0.208, 0.807]). In addition, for males, the group with excellent relationships differed from the group with good relationships ($p < 0.001$, 95% CI = [0.631, 1.43]).

3. The current state of mind of the respondents.

Respondents who feel ill or not at ease have statistically significantly higher neuroticism scores than respondents who are healthy and at ease for both males and females.

The survey found no statistically significant differences in levels of neuroticism between groups of respondents differing in age, parental education, or between respondents living in complete or incomplete families. Descriptive characteristics and test results for all groups are shown in Table 1. Box plots for groups with statistically significantly different levels of neuroticism are shown in Figure 1 and Figure 2 for males and females, respectively.

Table 1: Descriptive characteristics and results of analysis of variance and independent-sample t test or their non-parametric variants for selected groups of respondents. The null hypothesis: The means of the populations are the same, the alternative hypothesis: The means of the populations are not the same.

Neuroticism		Males				Females			
		N	Mean	SD	ANOVA/t-test	N	Mean	SD	ANOVA/t-test
Age	16 ^a	197	0.058	0.992	$R^2 = 0.002$ $F = 0.538$ $p = 0.584$	118	0.016	1.056	$R^2 < 0.001$ $F = 0.023$ $p = 0.978$
	17 ^b	218	-0.016	0.985		177	-0.006	0.959	
	18 ^c	143	-0.051	1.038		92	-0.009	1.013	
edu	low	278	0.033	0.957	$t = 0.796$ $p = 0.426$	259	-0.058	1.044	$Z = -1.348$ $p = 0.178$
	high	280	-0.034	1.043		128	0.117	0.897	
Family	incomplete	186	-0.016	0.956	$t = -0.288$ $p = 0.773$	107	0.153	0.957	$t = 1.875$ $p = 0.062$
	full	372	0.010	1.023		279	-0.059	1.013	
Sport	3 or more times a week ^a	396	-0.115	0.981	$R^2 = 0.043$ $F = 12.352$ $p < 0.001$	215	-0.183	1.220	$R^2 = 0.076$ $F = 15.85$ $p < 0.001$
	once a week ^b	87	0.117	1.041		89	-0.037	0.946	
	occasionally or not at all ^c	75	0.481	0.902		82	0.520	0.819	
Relationship with parents	excellent ^a	431	-0.115	0.950	$R^2 = 0.069$ $F = 20.675$ $p < 0.001$	265	-0.144	0.934	$R^2 = 0.054$ $F = 10.85$ $p < 0.001$
	good ^b	92	0.199	0.965		82	0.200	1.106	
	poor ^c	35	0.915	1.167		39	0.553	0.972	
I feel	healthy and at ease ^a	450	-0.204	0.894	$t = -10.855$ $p < 0.001$	285	-0.275	0.927	$Z = -0.922$ $p < 0.001$
	ill or not at ease ^b	108	0.854	0.971		101	0.774	0.774	

^{a, b, c} These symbols identify the groups in Figure 1 and Figure 2

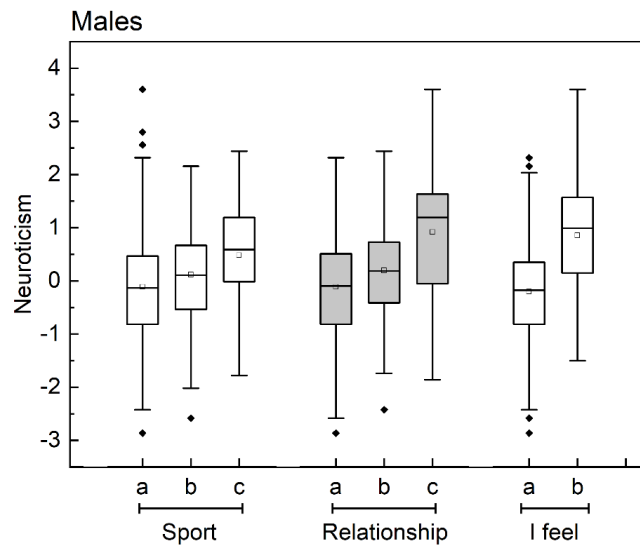


Figure 1: Box plots (Range within 1.5IQR, Median Line, Mean, Outliers) of neuroticism for males

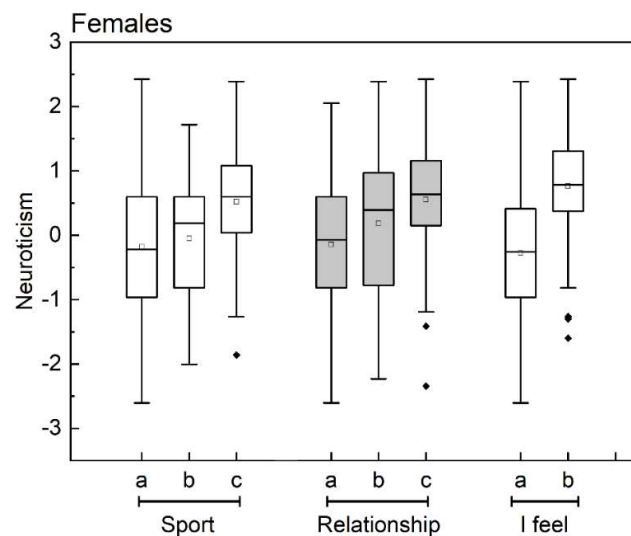


Figure 2: Box plots (Range within 1.5IQR, Median Line, Mean, Outliers) of neuroticism for females

A linear model was constructed from the domains that influence neuroticism. Estimates of the marginal means of neuroticism for both males and females were calculated. The predicted neuroticism scores in terms of the model coefficients are shown in Table 2. An additive model including how the respondent feels and the intensity of sport activity describes 19.6% of the variability in the neuroticism variable for males and 25.5% of the variability in the neuroticism variable for females.

Table 2: Estimates of conditional means of neuroticism for males and females

Neuroticism		Males				Females			
I feel	Sport	Mean	SE	CI		Mean	Std. Error	CI	
healthy and at ease	3 or more times a week	-0.28	0.048	-0.374	-0.185	-0.387	0.063	-0.511	-0.264
	once a week	-0.079	0.098	-0.272	0.114	-0.300	0.096	-0.489	-0.111
	occasionally or not at all	0.133	0.109	-0.082	0.347	0.139	0.104	-0.064	0.343
Ill or not at ease	3 or more times a week	0.724	0.093	0.54	0.907	0.587	0.100	0.390	0.783
	once a week	0.924	0.124	0.68	1.169	0.674	0.118	0.441	0.907
	occasionally or not at all	1.136	0.122	0.897	1.375	1.114	0.114	0.889	1.338

Discussion

First, our research investigation revealed that the personality trait of neuroticism is significantly related to playing or not playing sports. The statistically significantly higher mean of neuroticism trait was found in respondents who do not play sports at all or only occasionally (males: $M=0.481$, $p<0.001$; females: $M=0.819$, $p<0.001$). Table 1 shows that adolescents who exercise three or more times a week have slightly below average levels of neuroticism, whereas adolescents who exercise only occasionally or not at all are about half a standard deviation above the overall average level of neuroticism. Our findings correlate with earlier research.

Our other findings have shown that the relationship with parents plays a big role in the level of neuroticism. If adolescents have a poor relationship with their parents, their mean neuroticism levels have proven to be significantly higher than individuals who have an excellent relationship. Students with a poor relationship with their parents, as shown in Table 1, have a higher mean value of neuroticism by approximately one standard deviation compared to the mean. Our conclusions are in line with the published research.

Finally, our research demonstrates an evidential link between the current state of mind of the respondents and neuroticism. Table 1 shows that people who feel healthy and at ease have levels of neuroticism about 0.2 SD below the mean and people who feel ill and uncomfortable about 0.85 SD above the mean.

It is important to note that these data have methodological limitations including self-report data. Respondents were asked to complete two slightly long questionnaires so fatigue might play a role. Further, respondents had to participate in demanding physical tests before or after our data collection, which could also affect their concentration level. It should also be noted that the influence of the family on neuroticism is complex and multifaceted, with various interacting factors at play. Future research will continue to explore these relationships, shedding more light on the specific mechanisms through which the family influences neuroticism.

The summary results of our research have demonstrated the important impact of sport on neuroticism levels, the importance of relationships with parents, and as the latest the relevance of low levels of neuroticism in the case of healthy feelings and being at ease in adolescence. Statistically significant differences related to neuroticism stemming from age, parent's education, or incomplete family were not found.

Conclusions

Above-average values of neuroticism were measured in adolescents who have poor relationships with their parents, do not play sports regularly, and feel ill or unwell. Conversely, adolescents who have good relationships with their parents, are engaged in regular sport activity, are healthy, and are mentally well have below-average values of neuroticism. It is important for students to participate in organised physical activities or to be a member of a sport club. Such participation has a positive effect on the physical aspect of a person, but also on the social and mental stability. That is why it is essential to lead children to sport activities from their early period of life. Our study confirmed the results of already conducted studies and showed the importance of the role of family as an influential factor in neuroticism rates. The family environment has a significant effect on the child's everyday life and if the parenting style is not caring enough or abusive, the child is at risk of increasing neuroticism. The physical health is also reflected in higher scores of neuroticism. Adolescents who reported that they are feeling ill or not at ease showed significantly higher scores of neuroticism than the others referring that they are healthy and at ease. This study found no statistically significant differences in levels of neuroticism between groups of respondents differing in other factors like age, parental education, or between respondents living in complete or incomplete families.

Conflicts of interest The Authors declare that there is no conflict of interest.

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