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The determination of stress vulnerability by means of self-evaluation using the SSKJ3-8R questionnaire for Czech and Swiss students. A comparative pilot study.

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Abstract

The Level of mental disorders among children and young people in European society is worrying. Comparative studies by UNESCO have concluded that around a fifth of all young people in various European countries have mental problems. Current epidemiological figures even suggest an increasing trend in this regard. In addition to the various personality disorders, bipolar disorders and schizophrenic symptoms, anxiety disorders, depression and social behavior disorders are the most common mental health problems among adolescent.

Some authors are in favor of the theory that chronic stress may impact mental health and at the same time it has been proposed that adolescence is a developmental period of vulnerability to stress leaving adolescent in general even with a higher impact of chronic emotional stress in comparison to adults.

On the other hand, stress vulnerability seems to result from various influencing factors such as genetic disposition, early life experiences, psychological factors, epigenetic modifications, brain function and lifestyle factors.

It can be assumed that school performance and learning success of the adolescent are also influenced by their status of mental health. We found it remarkable, that with this knowledge, current international studies measuring the learning performance concentrate on reproducible learning success in comparisons between different countries without adequately taking into account the general psychological situation of the students and young people. An international comparison of intellectual performance among students and young people should also adequately consider psychological status and stress level of adolescents.

METHODS: We conducted a pilot study comparing the stress vulnerability among two randomly selected groups of pupils from Switzerland and the Czech Republic by using a self-evaluation procedure with the standardized SSKJ3-8R questionnaire.

RESULTS: Czech students showed a significantly higher stress vulnerability (Stress sensitivity) in comparison to Swiss students.

CONCLUSIONS: From our results we conclude that stress in its various forms is a key factor influencing school performance. Stress levels among young people may vary personally. We further hypothesize that stress vulnerability may differ between pupils in different regions depending on their origin and situation, which should be taken into account in future international comparative studies on retrievable learning outcomes. In our pilot study SSKJ 3-8 R questionnaire proved to be valid for assessing stress levels among pupils. Our results need to be verified with larger numbers of participants.

Introduction

Stress is an emotional condition which may contribute to different health effects depending on the ability of stress compensation. Lack of ability to respond to stress adequately triggers an increased stress vulnerability. Stress vulnerability is a paradigm of Clinical Psychology and Health Science. It describes the interactions between disposition and diathesis stress sensitivity. The model is not set to a specific school and connects biological and psychological factors with environmental influences on stress (Taylor *et al.* 2019; Zannas & West 2014).

Chronic stress is considered a potential trigger of various health complaints in adolescents and adults (Mariotti 2015). For adolescents stress can also have a significant influence on physical and psychological development (Esch *et al.* 2002).

Puberty is a developmental stage in which adolescents undergo psychological, hormonal and physical changes that can trigger increased vulnerability to stress (Crestani 2017). The extent to which people can cope with stress is characterized by their individual stress vulnerability, which is influenced by various factors.

It has been described by other authors early that childhood experiences and other life experiences as well as psychosocial factors may dominate stress vulnerability (Auxéméry 2012; Anderson *et al.* 2022). Also, epigenetic as well as neurophysiological aspects may be responsible for different levels of stress vulnerability (McEven &Gianaros 2019; Goh & Agius 2010). Even certain life style factors have been emphasized in the context of stress vulnerability (Herbert 2022). Furthermore, it seems that also socio-economic factors may condition stress vulnerability in puberty. Bonding new partnerships, or preparing for a profession are considered normative everyday stressors. Such stressors occur over a longer period of time even recurrently (Beyer & Lohaus 2007), including problems in the family or in the parental home. Parents are often overwhelmed by their own life situations and give their offspring too little attention, which leads to frustration among young people. Other than that, quarrels between parents, divorce or illness of a family member and sibling conflicts or rivalries between adolescents can be further stressors (Labrague *et al.* 2017).

At school, young people are often subjected to constant performance comparisons, which can lead to a loss of self-confidence and self-esteem in inferior students inferior. In some cases, students become victims of bullying without alternatives from the class community, so that disputes escalate and become a further permanent stressor.

On the physical level, an excess of stress cause obvious symptoms, such as considerable exhaustion, moist hands, restlessness, gastrointestinal complaints, headaches and sleep problems. There may also be other symptoms such as heart palpitations, stomach pressure or sweating. Long-term stress in particular can promote the occurrence of psychological complaints (Balmus *et al.* 2019).

Previous studies have related cognitive performance among pupils with their amount of stress vulnerability in different ways. It was shown that controlled stress (so-called Eu-Stress) may improve the learning process (Maheu 2015), but the quality and intensity of the emotions caused by stress may also impact the learning process. Positive emotions are able to promote optimal learning (Córdova *et al.* 2023), whereas other studies revealed the inhibitory effect on learning under stressful conditions (Smeets *et al.*2007). Stress experienced in an examination situation may foster memory gaps (Shields *et al.* 2017).

So while it is assumed that stress during learning promotes memory formation and contributes to robust memories, stress may also significantly impair the retrieval of memories and harbors the risk of performing worse in exams (Whiting *et al.* 2021).

Current evidence also suggests that stress can hinder the updating of memories confronted with new information and trigger a shift from a flexible, 'cognitive' form of learning to more rigid, 'habitual' behavior. Taken together, these stress-related changes may explain some of the difficulties in learning and remembering under stress (Vogel & Schwabe 2016). High levels of stress can impair cognitive function, attention and memory recall, resulting in difficulty concentrating, processing information and retaining new knowledge. Chronic stress therefore has a negative impact on the physical and mental health of students and hinders educational success (Reeve *et al.* 2013; Goff 2011).

Tab. 1. Distribution of adolescents by gender in the sample

Number of students		Sex		Total
		Male	Female	
Country	CH	16	22	38
	CZ	14	17	31
Total		30	39	69

Tab. 2. Number of participants per age group and country (CZ/CH)

Age Country	Age (years) * Country						Statistics
	12	13	14	15	16	total	Chi-square p
Switzerland	5	13	16	4	0	38	< 0.001
Czech Republic	0	0	15	15	1	31	
Total	5	13	31	19	1	69	

Despite these known correlations, studies in international comparison clearly neglect the mental health and stress levels of pupils in their assessments. In the latest PISA study in 2022, the influence of school closures was reflected, but the emotional stress of pupils was not sufficiently included in the final results (Krueger 2020; Dubey *et al.* 2020; Rigotti *et al.* 2020; Blacburn *et al.* 2020; Janssen *et al.* 2023).

This situation has prompted us to a pilot study with randomly selected Czech and Swiss pupils using a recognized examination procedure (SSKJ3-8R questionnaire) for measuring their stress vulnerability.

Our results indicate different levels of stress vulnerability in the groups analyzed.

It was not the task of this study to analyze the different influencing factors responsible for this observation.

However, the results imply the need to examine the stress vulnerability of pupils on a larger scale and under standardized conditions. If possible, school performance in international comparison should also take into account the mental state of young people.

Material and methods

Participants

A total of N = 69 children (38 children from Switzerland and 31 from the Czech Republic were examined in this analysis. 30 Participants were male (16 from Switzerland and 14 from the Czech Republic) and 39 girls (22 from Switzerland and 17 from the Czech Republic) Tab.1.

Examination method

The self-evaluation was performed by the German version of SSKJ 3-8 R questionnaire, which is the revised edition of the questionnaire for surveying stress and stress management in childhood and adolescence in use since 2018. This self-evaluation with the SSKJ 3-8 R questionnaire was recommended from the third grade for the age group 7 to 16 years (Eschenbeck *et al.* 2006 ; Lohaus *et al.* 2006).

The SSKJ 3-8 R questionnaire was divided into three sections. The first section of the questionnaire assessed vulnerability to potential stressors. In the second section of the questionnaire, the existing potential for coping with stress is assessed in five different items. The third section of the questionnaire measures the physical and psychological symptoms potentially associated with stress). Only the results of the first section of questionnaire, concerning stress vulnerability was considered for this analysis. Stress vulnerability was evaluated on the basis of various items of the student´s everyday life. These included the perception of stress in performance situations (school, homework) as well as in stressful social situations (interactions between peers or parents). Increased stress vulnerability thus indicated a generally increased perception of stress. An increased stress vulnerability thus indicated a generally increased sense of stress.

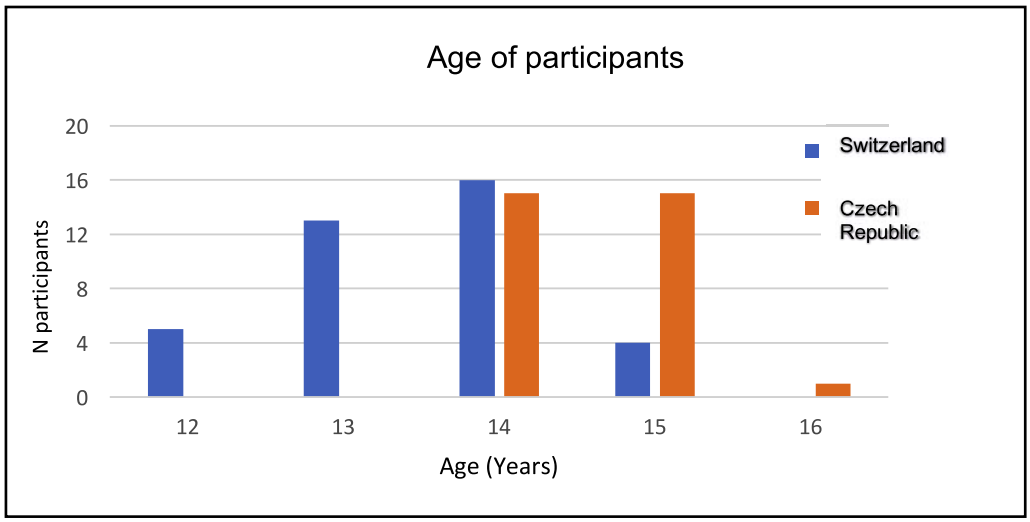

Fig. 1. Age distribution of young people recruited for the sample

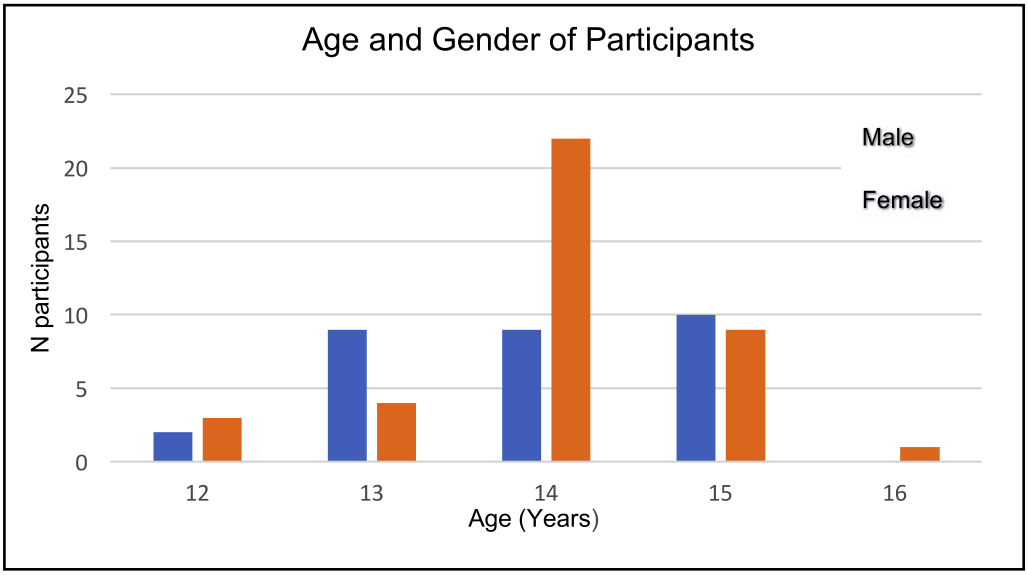

Fig. 2. Age and gender distribution of the adolescents in the sample

The questionnaires were handed out to the pupils during school lessons.

Czech students were selected randomly from schools in Prague with German as the first-degree foreign language. The participants had no time limit to fill out the questionnaire and a German teacher assisted pupils to answer comprehension questions.

Results

Age sex distribution oc Czech and Swiss participants

Most of the participants (n = 50; 72%) were 14-15 years old (Tab. 2 and Fig. 1).

The **age distribution** between countries differed highly significantly ($p < 0.001$) (Tab.1).

The group of 14-year-old Czech and Swiss pupils was matched at similar size, which allowed us to compare both nationalities. In the Czech Republic, 14- and 15-year-olds were evenly distributed which allowed us to compare age group this age group.

However, the participants were unevenly distributed across age groups. There were no participants at the age of 12-13 from Switzerland and at the age of 16 there was only one participant from the Czech Republic.

The age distribution among 14-year-olds was balanced between Switzerland and the Czech Republic. In Switzerland, the number of 13- and 14-year-olds was similarly distributed and therefore more comparable in terms of age differences. Among Czech participants 14- and 15-year-olds were homogeneously distributed and therefore this age group were comparable within the Czech participants

Age differences for 13- and 14-year-olds were only analyzed among the Swiss group, and for 14–15-year-olds only among the Czech group Fig, 2).

Since the distribution of **gender** was not statistically significant (Tab. 3), further analyzes were carried out with pooled data.

For statistical comparisons, the significance levels were defined as follows (Tab. 4.).

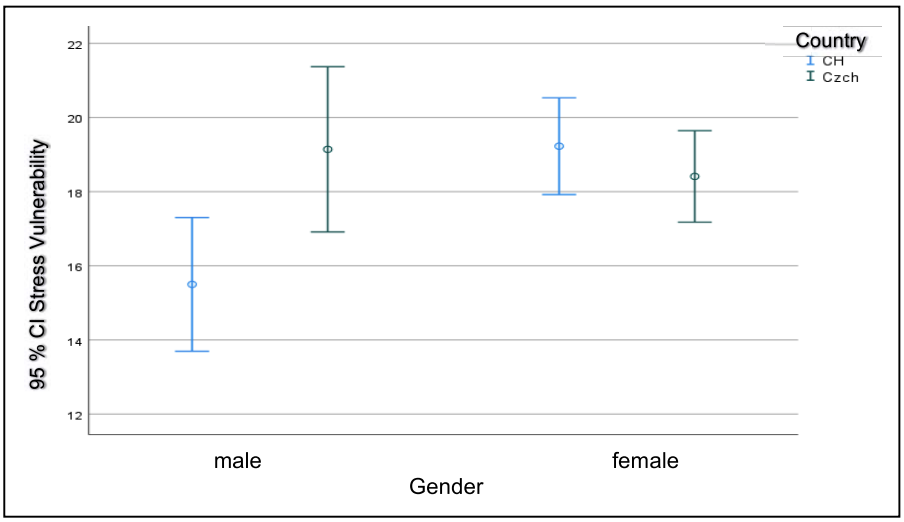

Fig. 3. Result of the comparative study of stress vulnerability in the sample in boys (m) and girls (f) from Switzerland (CH), Czech Republic (Cz).

Tab. 3. Number of participants, age distribution and gender

Age M/F	Age (years) * Gender						Statistics
	12	13	14	15	16	total	Chi-square p
Male	2	9	9	10	0	30	0,108
Female	3	4	22	9	1	39	
Total (M,F)	5	13	31	19	1	69	

Tab. 4. Significance level

Two-sided *p*-value	Assessment
> 0.1	Not significantly different from a random distribution
0.1 > *p* > 0.05	Statistical trend
< 0.05	Statistically significant
< 0.001	Statistically highly significant

Results of the stress analysis of adolescents from Switzerland and the Czech Republic

We used the SSKJ 3-8R to determine the average stress vulnerability of randomly selected students from Prague (CZ) and Kreuzlingen (CH). A high stress vulnerability was reflected in the fact that the students reported a high potential sense of stress in various stressful situations.

In our pilot study, boys from the Czech Republic had significantly higher stress indices. For girls, there was no significant difference between the countries (CH and CZ) in this regard. Viewed in isolation, the boys from Switzerland (N = 16) and the Czech Republic (N = 14) showed a significant difference in stress vulnerability. The vulnerability score was higher for Czech boys than for Swiss boys (Fig. 3).

The stress vulnerability of the Czech students (N = 31; green) was higher compared to the Swiss students (N = 38; blue). which was due to the different stress vulnerability of the Czech boys (M, green) in comparison to Swiss boys (m, blue).

In comparison Czech and Swiss boys and girls (M/F) did not show any significant difference regarding stress vulnerability (Tab. 5, 6. p = 0,069). Also, there were no significant differences between the genders in this regard (Tab. 5,6. p = 0,055). However, a significant difference emerged when the group of young people (girls and boys combined) were compared across countries (Tab 5,6; p = 0,005). This comparison revealed a significantly higher vulnerability to stress among young people from the Czech Republic compared to young people from Switzerland.

Discussion

In this sample, the test subjects were selected randomly from two schools in the Czech Republic (Prague) and Switzerland (Keuzlingen) with similar requirements and performance profiles (secondary school students with similar subjects). The test was performed under similar conditions with German speaking pupils by means of the SSKJ 3-8 R (standardized) questionnaire.

The country comparison between Czech and Swiss students was not statistically significant (Tab. 6;

Tab. 6. Statitcs of stess vunerability

Statistical comparison	ANOVA p
Country comparison (CH, CZ)	0.069
Gender (m, f)	0.055
Country * Gender	0.005

Tab. 5. Stress vulnerability, country and gender comparison, statistical assessment

Country	Sex	Stress vulnerability		N
		Mean	Standard deviation	
Switzerland	M	15.50	3.386	16
	F	19.23	2.943	22
	Total	17.66	3.611	38
Czech Republic	M	19.14	3.860	14
	F	18.41	2.399	17
	Total	18.74	3.109	31
Total	M	17.20	4.003	30
	F	18.87	2.716	39
	Total	18.14	3.414	69

p = 0.069). When comparing the genders, there was already a trend towards the distribution of stress vulnerability (Tab. 6; p = 0.055). Compiling the data from girls and boys together, there was a significantly higher stress vulnerability among young people from the Czech Republic compared to adolescents from Switzerland. This significant difference can essentially be attributed to the stress vulnerability of the boys in our sample. In a country comparison, boys from the Czech Republic (n = 14) were more vulnerable to stress than the comparison group of boys in Switzerland (n = 16). In other studies, a higher stress vulnerability in the group of girls was observed (Beck *et al.* 2016), while others found fewer vegetative stress symptoms in girls (Fiol-Veny *et al.* 2020).

If these small numbers of our pilot study allow us any conclusions at all, our overall result suggests a higher average stress vulnerability among Czech pupils and, as a result, a higher level of stress resilience among the Swiss young people in our sample.

Our results thus confirm the assumption, that stress is experienced individually and may bear different health impact according to the underlying stress vulnerability. Comparing to different populations may reveal differences of stress vulnerability. Since stress exposure and stress vulnerability have a variable impact on learning capacity and reproducibility, we conclude that emotional stability and stress vulnerability should be taken into account in studies on reproducible learning efficiency (Bevelaqua & Muss 2024).

It may be significant that the Czech students, in contrast to the Swiss students, did not receive any ethics or religious instruction. It is possible that the Swiss students were able to develop greater resilience on the basis of ethics or religious education. Some authors had previously pointed out the coherence and resilience-increasing effect of ethics and religion education (Delgado 2007; Stangl 2017; Mueller 2020; Howard-Snyder & McKaughan 2022). However, we assume that socioeconomic reasons are primarily important for the different stress vulnerabilities in the examined groups between Czech and Swiss students (Reiss *et al.* 2019). However, it was outside the scope of this pilot study to differentiate between such factors influencing stress vulnerability in our cohort.

Since various studies have pointed to the potential of behavioral and/or cognitive interventions, relaxation and nutritional or food interventions including social support and spirituality, this pilot study may also provide an opportunity for further international studies on the topic of stress management in adolescents (Esch & Stefano 2010).

Conclusion

In our pilot study, the analyzes of stress vulnerability showed significant differences between the groups of Czech and Swiss students, but further studies with larger numbers of participants under standardized conditions would be necessary to draw further conclusions. Such a study on stress and resilience among young people between individual countries would be helpful, among other things, to analyze the psychological stress on students in the individual European school systems. The studies carried out so far on learning efficiency between countries only cover psychological stress to a limited extent and therefore do not allow this comparison. The declared goal of European education policy in the future should be to promote the mental health of young people in addition to imparting knowledge.

Study limitatios

The present study is limited by the small number of participants and the restriction to pupils from two schools in Prague (CH) and Kreuzlingen (CZ). We were not able to differentiate any socio-economic impact factors. Since the students were only invited to the test once, we do not overlook long termed tendencies with regards to stress vulnerability in our cohort. Despite the fact that the Czech students were trained in the German language, answering the German questionnaire may have been more strenuous to them.

Conflict of interest

The study was carried out without financial support. We had the permission of the Hogrefe Verlag to hand out copies of the SSKJ3-8R questionnaires to all the participants, as well as the consent from the involved schools and parents of all pupils to perform this survey. The authors declare that there are no conflicts of interest.

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