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Stress Relief Measurements in Young Adults and Adolescents—A Comparative Pilot Study with Different Relaxation Programs

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Abstract

Background: Chronic stress is a emotional challenge. Constant pressure presents a serious risk of damage to mental and physical health and hence is associated with increased incidence of various diseases. The ability to cope with chronic stress may be a function of psychological resilience including intellectual capacities, but more so of external factors such as life experience and education. Adolescents are more vulnerable to chronic stress than adults. The measures introduced during the COVID-19 pandemic brought up major societal problems. As both children and adolescents lost their life anchors, the prevalence of stress in adolescents increased from 20% to 45%. Chronic psychological stress can impede the normal development of schoolchildren. It may cause anxiety, social withdrawal, interpersonal conflicts and aggression. This applies particularly to those in puberty, with the adolescent already facing unstable social bonds and elevated fear about the future. It is likely that the puberty cohort accounts for the dramatic increase in the prevalence of stress. Since it impacts public health, chronic stress among school-age children is increasingly taking on a socio-political dimension. Non-clinical stress intervention studies can investigate how to achieve stress reduction in school children. **Methods:** In a small pilot study, we analysed the effects of a training program with four different standard interventions, *i.e.* mindfulness training, progressive muscle reflection, autogenic training, and sound meditation. We obtained baseline scores of 10 stress-indicators, and re-tested after the interventions were performed. **Results:** The four applied interventions resulted in a reduction of 8 (out of 10) stress-indicators, such as "feeling stressed" or stress related symptoms (headaches, dizziness, sweating). This positive impact of the interventions significantly reduced "Fears about the future" ($p <$

0.001). None of the offered stress related trainings was particularly preferred. The relaxation using singing bowls was well received by some young people. However, there was a unanimous opinion among the students tested, that stress-related training should be offered on a routine basis in school curriculum. **Discussion:** School children recognise the positive potential of stress reducing training or interventions. Our results provide evidence in support of integrating the training of relaxation techniques in the school curriculum. We propose that a larger study be undertaken to determine which methods would be most effective.

Keywords

Stress in Children and Young Adults, Comparison of Different Stress Relief Interventions in a Cohort of Pupils

1. Introduction

Adolescence is characterized by important psychological and psychosocial changes as the transition to adulthood is characterized by a heightened vulnerability to stress [1]. Adolescents have weaker compensation mechanisms and coping strategies than adults [2] [3]. A growing number of adolescents are entering adult life equipped with maladaptive coping strategies.

Therefore, adolescents face a heightened risk of physical and mental symptoms later in their lives. Coping strategies should be offered as early as possible, ideally during school years [4]-[6].

According to WHO depression, anxiety and behavioural disorders are among the leading causes of illness and disability among adolescents. Globally, it is estimated that one in seven (14%) of 10 - 19-year-olds experience mental health disorder. The 2022 National Healthcare Quality and Disparities Report World revealed that this has been major driver of the increase in the rate of suicide, which now ranks as the fourth leading cause of death among the 15 - 29-year-olds.

The failure to address mental health disorders among adolescents impairs both physical and mental health in adulthood, thus limiting the prospects for a fulfilled adult life. Various authors are unanimous in their opinion, that one reason for mental health problems in young people is increased stress [7]-[9].

Multiple factors have been identified as affecting mental health among adolescents. The more risk factors they are exposed to, the greater the potential impact on their mental health in adult life [10].

Typical factors that contribute to stress during adolescence include exposure to adversity, pressure to conform with peers and exploration of identity Media influence and gender norms can exacerbate the disparity between an adolescent's lived reality and their perceptions or aspirations for the future. Other im-

portant determinants include the quality of their home life and relationships with peers. Violence (especially sexual violence and bullying), harsh parenting and severe and socioeconomic problems are also recognized risks to mental health in this age group [11].

The most common mental illnesses include depression, anxiety disorders, eating disorders and ADHD (attention deficit hyperactivity disorder). Symptoms can range from mood swings, sleep disorders, social isolation to self-harm or suicidal thoughts [12] [13].

Prevention and early intervention are recognized as key strategies for minimizing the impact of any potentially serious health condition. It should be emphasized that this does not necessarily fall within the responsibility of mental health professionals alone. Research evidence suggests that health researchers and professionals such as teachers and youth workers as well as health service institutions and governments should join forces to deliver integrated and multidisciplinary actions in mental health, especially in the early steps of the prevention chain. This should include a common effort to reduce stressful events in school and to implement coping strategies aiming to increase the resilience of adolescents [14]-[16].

A number of research reports describe the effects of stress management programs for schoolchildren and students interacting with teachers/parents, from peer pressure, from school/leisure conflict as well as compulsive behaviours. With respect to resilience, the intervention improved the adolescents' individual skills and resources, relationships with primary caregivers, and the quality of environmental factors all of which facilitated a better sense of belonging [17] [18].

Other interventions aimed at reducing stress and improving health by focusing on relaxation techniques and cognitive-behavioural strategies, which helped to identify and change maladaptive thinking and behaviour [19].

In order to analyse the effectiveness of different relaxation methods in young people, we recruited adolescents and performed different meditation programs (mindfulness training, autogenic training, muscle relaxation according to Jacobson, singing bowl massage). The participants assessed their preference for the respective relaxation method and the overall outcome of the respective mediation program by questionnaire.

2. Materials and Methods

2.1. Participants

The relaxation training was coordinated with the respective school management and the parents' approval was available. In order to guarantee optimal implementation of the relaxation exercises, the number of participants was limited to randomly selected 12 schoolchildren: 11 girls/1 boy (**Table 1**). Each participant went through a series of four interventions: mindfulness training, autogenic training, muscle relaxation according to Jacobson, and sound meditation with ancient Tibetan singing bowls.

Table 1. Description of the participants.

Age	13	14	15	total
Male		1		1
Female	1	4	6	11
Total	1	5	6	12

2.2. Interventions

The stress reducing Interventions were performed as described before. Mindfulness training focused on the pupils' thoughts on the present situation, regulating the own thoughts and their breathing activity [20]. Progressive Muscle Relaxation technique was realized according to the technique of Jacobson which involves consciously tensing and relaxing certain muscle groups in the body in order to reduce muscle tension and reduce stress [21]. Autogenic training was performed by concentrating on specific body sensations and mental images [22]. Sound meditation was applied with the support of ancient Tibetan sound bowls [23]. The school children attended the entire relaxation program which was offered over the week on several days only once and passed their assessment immediately after each session on a questionnaire.

2.3. Questionnaires

Subjective feelings and stress related symptoms were assessed at baseline (before) and after the intervention with 10 items. The subjective preferences or attitude towards each of the four applied technique was assessed with a Likert scale (Table 2).

Table 2. Assessment item assessed per Likert scale.

Item	Assessment Item at baseline and after the intervention
1	Do you feel excited and tense?
2	Do you feel stressed?
3	Are you in a bad mood?
4	Do you have to get angry about something?
5	Do you feel annoyed about something?
6	I feel bad when I think about my school
7	I feel bad when I think about my friends?
8	I have fears about the future
9	I feel nauseous
10	I have a headache, dizziness, sweating wet hands

Finally, the participants provided their views related to stress coping strategies, their general experiences and their ethical background (Table 3 and Table 4).

Table 3. Schoolchildren attitudes towards training methods assessed per Likert scale.

No	Method preferences, Item
1	I appreciate the **mindfulness training** and would like to continue practicing it.
2	I liked **progressive muscle reflection** and would like to learn it.
3	I liked the **autogenic training** and would like to practice it.
4	The **sound meditation** helped me to become calmer.

Table 4. General strategies related to stress copying.

	Strategies related to stress copying
1	I have already practiced relaxation techniques before
2	Relaxation should be practiced in school more often.
3	I am concerned with ethical issues.
4	I consider myself being a Christian.
5	My faith helps me in stressful situations

2.4. Data Analysis

All participants were interviewed by questionnaire twice, before (baseline) and immediately after finishing the interventions. For descriptive or analytical statistical analyses, we used SPSS (IBM Statistics, Version 28). The impact of the intervention was analysed by comparing the scores (baseline/post intervention) by means of the students-t-Test for paired samples.

3. Results

3.1. Participants

A description of the participants is given in Table 1.

There were no dropouts, all recruited scholars provided baseline assessment, attended all interventions, provided the post intervention assessment, and contributed their views on their preferences on the respective intervention method, and provided their reflections on stress coping in general.

3.2. Intervention Assessment

The score differences of the ten questionnaire items between before and after the intervention are summarized in Table (Table 5). After the interventions 8 of 10 items were improved. The improvements were not statistically significant in seven items (Table 5). But the interventions had a highly significant effect on the "Fear about future" ($p < 0.001$, Item 8, Table 5). The improvements were observed in the pupils at the age of 14 and 15 years (Figure 1).

Table 5. Stress relieve after the interventions.

Question about Subjective feelings		Prae/post Difference				t-Test paired	
		Mean	STD	N	Effect	p	Significance
1	Tensed?	0.667	1.371	12	Decrease	0.120	n.s.

Continued

2	Stressed?	0.583	1.084	12	Decrease	0.089	Trend
3	Bad mood?	−0.083	0.515	12	Increase	0.586	n.s.
4	Have to be angry about something?	−0.250	0.866	12	Increase	0.339	n.s.
5	Is something annoying you?	0.167	1.030	12	Decrease	0.586	n.s.
6	Feel bad about school?	0.417	0.900	12	Decrease	0.137	n.s.
7	Feel bad about friends?	0.167	1.850	12	Decrease	0.761	n.s.
8	Fears about the future?	1.583	0.793	12	Decrease	**<0.001**	Significant
9	Nauseous?	0.417	1.621	12	Decrease	0.392	n.s
10	Headaches. dizziness, etc, (stress symptoms)?	1.000	1.809	12	Decrease	0.082	Trend

Statistical results comparing the scores of items before and after the intervention. Positive delta between the score after and before intervention reveled a decrease in the intensity of the item (T-Test pared random sample).

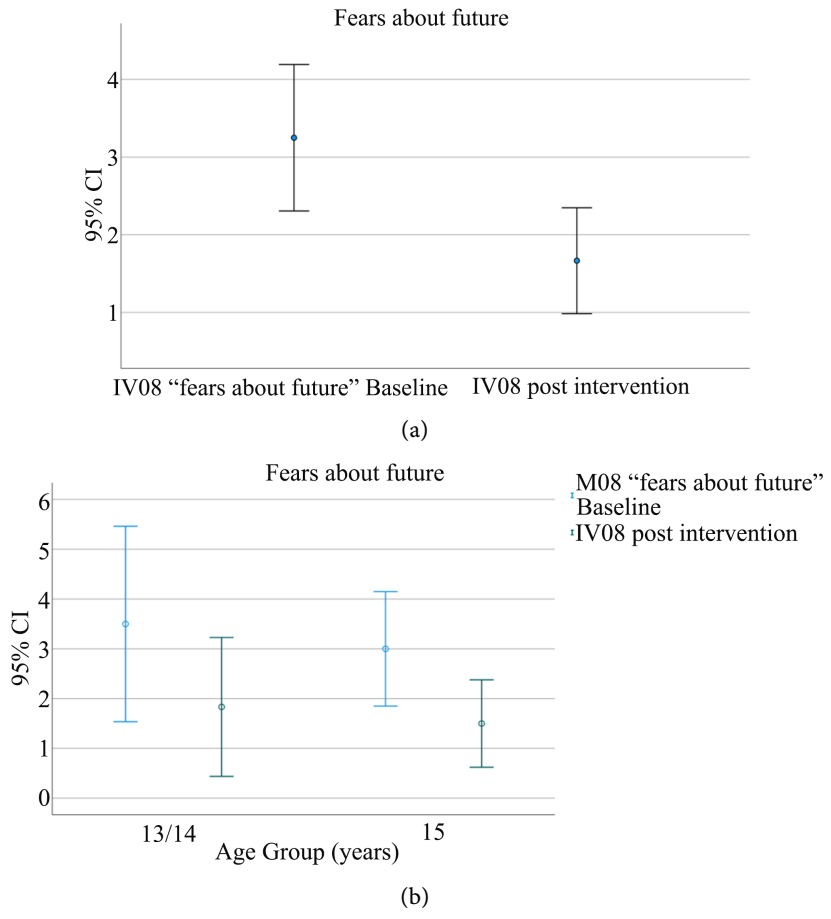

Figure 1. (a) Item 08 "Fears about future" before intervention; (b) Item 08 "Fears about future" after intervention. Mean ± 95% CI (confidence interval); n = 12. The interventions resulted in a change of perspectives on "Fears about future" Table 5 (p = 0.001). The interventions highly significantly decreased the item despite the test group was small, indicating a huge effect size.

3.3. School Children's Reflections and Preferences

The Interventions had a relaxing effect in both age groups (Figure 1). There was no favorite relaxation technique as the pupils assessed and rated the four applied interventions as almost equally positive (Figure 2). Only a few pupils had had any prior experience with relaxation techniques, however, the majority expressed their preference towards more relaxation training at school (Figure 3).

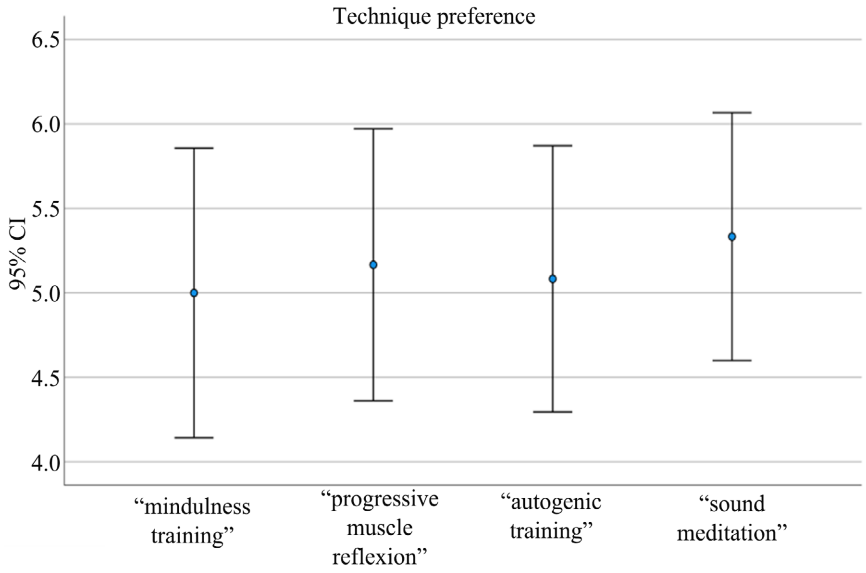

Figure 2. Schoolchildren attitudes towards a specific stress coping method. Assessment per Likert scale from 1 (low) to 6 (high agreement). Generally, there was no particular preference towards any specific method.

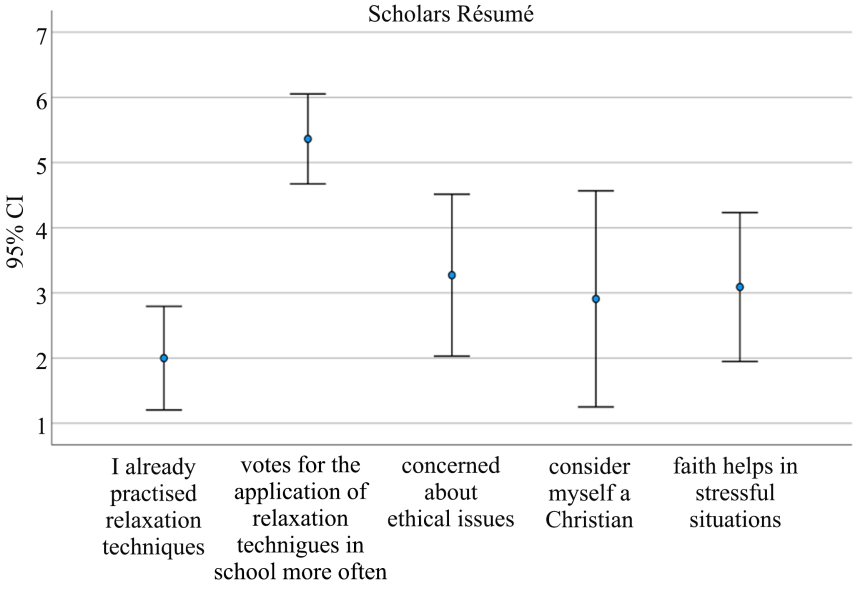

Figure 3. Résumé of the pupils after the intervention. Assessment per Likert scale from 1 (low) to 6 (high agreement). While only few of the scholars had had experiences with relaxation techniques before, there was a strong wish of the scholars to increase stress coping training or exercise in the school routine.

4. Discussion

We aimed to test various forms of relaxation methods offered to schoolchildren in order to investigate their effects. According to UNICEF, analysis based on estimates from the IHME, Global Burden of Disease Study, 2019 average prevalence of psychological distress among young people amounts to 15% - 20% in different European Countries. Experts interpret the occurrence of psychological disorders as the cause of increased chronic stress among young people. Some authors have pointed to intensified demands of everyday school life, the social pressure to which young people are exposed in a performance-oriented society and to family circumstances as a possible source of this problem [24].

The isolation of adolescents in the Corona crisis during school shut-downs may also have intensified stress among adolescents, creating a feeling of uncertainty and fear about the future [25].

While mental illnesses among adolescents are subject to a clear medical definition, the recognition of their continuous stress level as a possible precursor is difficult to calculate and measure. Given this background, the provision of successful stress relaxation programs to adolescents is a major challenge.

We studied the stress relaxation in a random sample design with students (11 female and 1 male) from two schools in Kreuzlingen (Thurgau Switzerland) at the pubertal age of 13 - 15 years (**Table 1**). In general students at this school level are particularly exposed to school stress.

We used a questionnaire for the self-assessment to quantify the participants' perception and interpretation in 10 items (**Table 2**), while being aware of the fact that this may have led to subjective assessments. When conducting the intervention programs, we were not able to rule out influencing the students. In order to minimise the feedback influencing, the evaluation was performed anonymously. Despite that we cannot rule out possible weakening of our results. Still, this remains well within accepted practice of other authors, who also used self-surveys to obtain relevant data in this area of research [26].

The assessments differed between the age groups only in the two items "excitement and tension" and "feeling of stress". Here older participants showed stronger effects. This suggests that stress management should be applied early in puberty and should not be reserved for half-adult adolescents. In this regard, we proved our hypothesis, that even young people at this age are amenable to relaxation exercises. In most categories of the relaxation program participants reported a feeling of relief afterwards. Although these effects were not statistically significant ($p > 0.05$) we saw a positive trend after the relaxation in the items "feelings of stress" and related symptoms it "headache, vertigo and sweating". It is noteworthy that the item "fears for (or about?) the future" had a significant effect. The relaxation exercises were obviously able to influence the participants' perspectives regarding the future in the long term positively (**Table 2**; **Figure 2**; $p < 0.001$).

The power of the four relaxation programs offered was demonstrably equal.

However, the relaxation with ancient sound bowls was rated with the best score in the cohort (**Figure 2**).

Results from investigations with adults cannot be directly transferred to younger age groups However, our results are consistent with reported achievements in adult groups [27].

We could show that stressed schoolchildren benefit from relaxation exercises (**Table 5**). In particular, since our research indicates that relaxation exercises can ameliorate stress, we have established that there are readily available effective methods of avoiding the long-term damage of ongoing stress in adolescents.

Besides the use of the singing bowls, our relaxation measurements were implemented without any special hardware. Evidently, it is unlikely that the success of these interventions was tied to the intellectual abilities of the young people. It has been shown that relaxation exercises modifies the neurovegetative functions.

Under parasympathetic control, sympathetic stress symptoms such as increased blood pressure, faster pulse, etc. can be ameliorated [28]**.** Adolescents are generally susceptible to sound and tones. The perception of sounds and active muscle tension influences the minds vegetatively and can trigger relaxation reactions [29].

To a certain extent, we observed the same effect also in cognitively focused methods such as mindfulness exercises and autogenic training. For the implementation in everyday routine, we hypothesize that the selection of relaxation methods should primarily depend on the setting and the needs of the young people individually as there may be individual preferences for different methods.

We assume that the implementation of relaxation methods in daily school life routine can reduce stress tension among schoolchildren. However, to increase success, the relaxation program should be offered regularly, as it is unlikely to have any particular side effects.

The pedagogical educational mission must also accompany the successful transition of young people into adulthood and ensure the psychological health of those who mature. A previous study with adolescents had shown that perceived social support may buffer the effects of academic stress on psychological wellbeing [30] [31].

Young people suffering from mental health problems during early adolescence may be too psychologically impaired to positively contribute to social life as adults, as they carry their problems from youth to adulthood. It follows, that the problems of today's youth can easily become problems of tomorrow's society [32].

The rise in the prevalence of mental disorders among young people in Europe is an alarming signal. Health policy aspects must therefore be incorporated into educational policy of European countries.

Finally, we are in agreement with other authors who have identified stress management techniques for children and adolescents as an important tool for improving social skills and reducing anxiety, as well as preventing from depressive symptoms.

5. Conclusions

The use of relaxation techniques in this small pilot study was successful in terms of stress reduction in a small group of schoolchildren The application success of four different relaxation methods constitutes evidence in support of the integration of stress coping training in the school curriculum. In our cohort the application of Tibetan sound bowls was slightly preferred (Figure 2).

Incorporating stress interventions into everyday school life may reduce school stress but also stress related to external factors. This suggests that teachers and relevant authorities should consider the integration of relaxation techniques into the school curriculum on a routine basis.

6. Study Limitations

The present study's limitation is the low number of participants (n = 12). To determine whether or not a specific intervention method is more practicable than the others, further studies with more statistical power are required.

The questionnaires were completed anonymously, but since the relaxation intervention could not applied anonymously, unconscious influence on the children's reaction cannot be ruled out.

Conflicts of Interest

The study was carried out with no financial support. The relaxation program was offered free of charge. The Authors have no conflict of interest to declare.

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