

Snoezelen Therapy Reduces Stress and Biomedical Markers in Physiotherapy Students During Examinations

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Purpose: Stress is the body's internal reaction to any external stimulus that is considered harmful. Nowadays, many scientists deal with the issue of stress and coping strategies among students. Among the methods described as a form of relaxation therapy is the Snoezelen method, which is one of the most popular therapeutic methods included in so-called multisensory environments. This study aimed to assess the impact of Snoezelen therapy on stress in physiotherapy students during an examination session.

Methods: Fifty-two randomly selected physiotherapy students qualified to participate in the study. They were divided into two groups: the experimental group (26 people: 18 women and 8 men), which included students who underwent a series of nine 30-minute sessions (for three weeks on Mondays, Wednesdays and Fridays) 30 min each, in the Snoezelen room, and the control group (26 people: 18 women and 8 men), who had no therapeutic intervention. Each person participating in the study completed the authors' survey questionnaire and the Patient Health Questionnaire-9 (PHQ-9) twice, and all people had their resting blood pressure and resting heart rate measured twice, and an electromyographic examination of the trapezius dorsi muscle performed.

Results: Some of the tested indicators improved significantly in the experimental group after therapy, including PHQ-9, blood pressure after session 3 to 9, heart rate after session 2 to 9 and muscular activities (rest, abduction of the upper limb and rest after fatigue phases). Such correlations were observed in the control group only in blood pressure after first and the last measurement.

Conclusions: A series of therapeutic sessions in the Snoezelen room improved the level of relaxation and reduced the level of stress, alleviated the symptoms of depression and lowered the heart rate and blood pressure in the studied students.

Keywords: students, Snoezelen method, heart rate, EMG, biomedical indicators

Introduction

According to the definition proposed by Gallego-Gómez et al.¹ academic stress is a physiological, emotional, cognitive and behavioural reaction to stimuli and it can affect the ability of the students to face the university environment. Nowadays, many scientists deal with the issue of stress and coping strategies among students.² Mental health continues to deteriorate among students around the world, but medical students are most at risk of stress, depression and anxiety.³ Available publications focus most often on the issue of stress among future doctors or nurses.³⁻⁵ However, there are also reports describing stress and its implications for physiotherapy students who are also, like their colleagues, exposed to stress related to participation in activities connected with their studies e.g. hands-on clinical practice or academic workload.⁶⁻¹⁰ Many authors consider the phenomenon of stress in students to be very disturbing, which is why we should constantly look for new strategies to deal with it, especially since many stressed students reach for substances that affect the body negatively, such as alcohol, excessive eating or playing on the computer for long hours.⁶

Among the methods described as a form of relaxation therapy is the Snoezelen room.^{11,12} It constitutes one of the most popular therapeutic methods included in the so-called multisensory environment. It was initiated in the Netherlands in the 1970s and was first dedicated to people with learning

disabilities but over time it was also often used in work with people with intellectual disabilities, among others.^{13,14} It is also the most frequently used method of all polysensory stimulation methods in work with patients with dementia.¹⁴

Nowadays, the Snoezelen room meets the needs of a very diverse range of recipients, both ill and healthy, children and adults.¹⁵ It is believed that the Snoezelen room is a unique therapeutic method, the essence of which is non-directive polysensory stimulation. The Snoezelen room equipment (including fibre-optic cables, aromatherapy, light effects, calming sounds, water columns of different colours and textured balls for tactile stimulation) provides the possibility of stimulating all senses.^{16,17} By appropriately stimulating the senses, the snoezelen room can influence the autonomic nervous system and thus, among other things, reduce stress.¹⁵ Nowadays, Snoezelen rooms are also increasingly used as a tool in various therapies aimed at improving mental health.¹⁸

To the best of the authors' knowledge, there are no reports in the available literature assessing the effectiveness of the Snoezelen room in stress therapy in young and healthy people. Therefore, this study aimed to assess the impact of Snoezelen room on stress in physiotherapy students during an examination session.

Methods

Participants

Fifty-two randomly selected physiotherapy students qualified to participate in the study. They were divided into two groups. The experimental group (26 people: 18 women and 8 men) consisted of students who underwent a series of therapeutic sessions in the World Experience Room (Snoezelen). The control group (26 people: 18 women and 8 men) included people who did not participate in the sessions. Additionally, 26 people from the experimental group were divided randomly into six subgroups and took part in group therapeutic sessions.

The mean age in the experimental group was 21.1 ± 1.6 years, while in the control group it was 20.5 ± 1.5 years. The mean values of the remaining parameters in the experimental group were: body height - 171.6 ± 7.9 cm, body weight - 63.9 ± 7.6 kg, BMI - 21.7 ± 2.1 kg/m², and in the control group: body height - 171.4 ± 7.8 cm, body weight - 64.8 ± 10.8 kg, BMI - 22 ± 2.4 kg/m². The study took place when students had increased stress levels, that is, immediately before and during an examination session. The study participants were informed about the purpose of the study, the methods used, possible side effects and the possibility of resigning from participation in the research project at any time. All students were assigned randomly to individual groups using the toss-coin method.

Inclusion criteria:

- written informed consent to participate in the study
- feeling stressed during the study period;
- aged 18 to 24;
- physiotherapy students;
- body temperature $< 37^{\circ}\text{C}$;
- no infection during the study period;
- no diagnosed genetic disease;
- no diagnosed bacterial or viral infections (up to two weeks before the start of the research project);
- no diagnosed disorders such as depression or neurosis;
- not using stimulants (alcohol, cigarettes, stimulants) at least 48 hours before starting the study and during the research project;
- not engaging in increased physical activity during the study period;
- not pregnant.

Participation in the study was voluntary. Each person willing to participate in the project was informed about its detailed course and the possibility of resigning from the study at any time and providing informed consent for participation. All the requirements of the Declaration of Helsinki for research involving human participants were respected during the study. The research project was approved by the Bioethics Committee.

Research tools

Each person participating in the study (experimental and control groups) had their body height, body weight and body mass index (BMI) measured once. Additionally, both before the series of therapeutic sessions began in the Snoezelen room and after their completion (three weeks), the following tests were carried out:

- original survey questionnaire;
- Patient Health Questionnaire-9 (PHQ-9);
- resting blood pressure measurements;
- resting heart rate measurements;
- electromyographic examination of the trapezius dorsi muscle.

Body height measurement – body height was measured using the Martin-type anthropometer (Seritex, New York, USA) with

an accuracy of 0.1 cm. The patient's height was measured from the top of the head (vertex) in the horizontal plane to the plantar plane of the feet (basis).¹⁹

Body weight measurement – body weight was determined using the Tanita scale (Tanita Corporation, Tokyo, Japan) with an accuracy of .1 kg.¹⁹

Body fat measurement – this test was performed using the BMI, the most popular indicator in the world for assessing body fatness, calculated according to the formula $\text{weight}/\text{height}^2$ (kg/m²).²⁰

The authors' survey questionnaire consisted of three questions. Each question was scored using an 11-point Numerical Rating Scale (NRS) (from 0 to 10 points). The first two questions concerned the subjective assessment of the general mental state and stress level on the day of the examination, and the third question concerned the subjective assessment of the level of relaxation on the day of the examination. In questions 1 and 2, a higher number of points meant a worse mental state and a higher level of stress, while in question 3, a higher score meant a higher level of relaxation.

PHQ-9 – this questionnaire is used to recognise depression included in the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and to assess the severity of its individual symptoms. The questionnaire consists of nine main questions and one additional question. Depending on how often a given symptom occurred in the last two weeks, a respondent can mark the answer on a scale from 0 to 3. The overall result ranges from 0 to 27 points. The higher the score, the greater the risk of depression becoming more severe. A score below 5 points means no depression, from 5 to 10 points – mild depression, from 10 to 14 – moderate depression, from 15 to 19 – moderately severe depression and above 20 points – severe depression. These easy-to-remember thresholds indicate different degrees of depression in practice. If a respondent indicates the presence of symptoms in any of the questions, they must answer an additional question. The person indicates on a four-point scale to what extent these problems made it difficult to perform work, take care of the house or have relationships with other people.²¹

Resting blood pressure was measured using an electronic sphygmomanometer, in a sitting position, with the cuff placed on the left arm approximately 1.5 cm above the elbow joint. Blood pressure was measured only in patients from the experimental group, from the first to the ninth therapeutic session, just before entering and just after leaving the Snoezelen room.

Resting heart rate was measured in a sitting position, using a pulse oximeter on the second (index) finger of the left hand. Heart rate was measured only in patients from the experimental group, from the first to the ninth therapeutic session, just before entering and just after leaving the Snoezelen room.

Electromyography (EMG) was performed on the trapezius dorsi muscle. Stress in particular affects the activity of the trapezius muscle. This muscle is also large and superficial, which, together with its susceptibility to stress, makes it a good candidate for studying the effects of different types of interventions on stress-related physiological outcomes.²² The tests were performed using the EMG Noraxon Myo Trace 400 (Scottsdale, Arizona, USA) device, and the results were read using the application MR – XP. 1/07 MASTER EDITION. Five disposable electrodes were placed on the right and left sides of the body. The study participants sat loosely on a chair without a backrest with their lower limbs adhering freely to the ground. During the measurements, the persons were asked not to talk. The EMG test began with the resting phase and then the examined people

Table 2. Results of the heart rate measurement in the experimental group after subsequent sessions.

Sessions	Group	Systolic blood pressure [mmHg]					Between measurements comparison	Diastolic blood pressure [mmHg]					Between measurements comparison
		$\bar{x}$	Me	Min	Max	SD	<i>P, d, m</i>	$\bar{x}$	Me	Min	Max	SD	<i>P, d, m</i>
1	before	119.65	118.50	95.00	140.00	9.26	<i>P</i> = .094	78.46	78.50	63.00	95.00	8.67	<i>P</i> = .018*
	after	116.54	115.00	99.00	132.00	9.54	<i>d</i> = .233 <i>m</i> = .208	74.62	74.00	64.00	87.00	6.72	<i>d</i> = .350 <i>m</i> = .404
2	before	115.84	115.50	105.00	140.00	8.41	<i>P</i> = .267	75.42	76.00	58.00	97.00	8.32	<i>P</i> = .487
	after	113.15	113.00	93.00	132.00	8.86	<i>d</i> = .220 <i>m</i> = .190	73.69	71.00	53.00	95.00	9.47	<i>d</i> = .137 <i>m</i> = .103
3	before	118.08	116.50	105.00	140.00	9.62	<i>P</i> = .029*	76.31	77.00	58.00	97.00	8.19	<i>P</i> = .163
	after	114.50	113.00	93.00	136.00	10.24	<i>d</i> = .452 <i>m</i> = .601	73.85	71.00	53.00	100.00	10.20	<i>d</i> = .281 <i>m</i> = .281
4	before	118.69	116.50	102.00	136.00	9.97	<i>P</i> = .005*	72.92	73.00	60.00	84.00	6.30	<i>P</i> = .220
	after	113.23	113.50	103.00	133.00	8.09	<i>d</i> = .601 <i>m</i> = .838	70.88	70.50	47.00	88.00	9.28	<i>d</i> = .247 <i>m</i> = .228
5	before	118.35	118.00	99.00	140.00	9.03	<i>P</i> = .896	73.65	74.00	56.00	86.00	6.51	<i>P</i> = .877
	after	118.08	119.00	97.00	134.00	9.40	<i>d</i> = .026 <i>m</i> = .052	73.92	76.00	51.00	87.00	8.68	<i>d</i> = .031 <i>m</i> = .053
6	before	118.77	118.00	99.00	140.00	9.91	<i>P</i> < .001*	73.88	74.50	61.00	90.00	7.42	<i>P</i> = .241
	after	113.54	115.00	97.00	134.00	9.61	<i>d</i> = .790 <i>m</i> = .972	71.77	72.00	50.00	84.00	7.94	<i>d</i> = .236 <i>m</i> = .212
7	before	117.88	115.00	93.00	139.00	10.27	<i>P</i> = .001*	73.27	73.00	59.00	87.00	7.48	<i>P</i> = .321
	after	111.62	108.50	96.00	133.00	9.36	<i>d</i> = .596 <i>m</i> = .832	71.81	72.50	54.00	83.00	7.06	<i>d</i> = .198 <i>m</i> = .163
8	before	119.96	118.00	101.00	138.00	10.57	<i>P</i> = .001*	75.04	75.00	62.00	98.00	8.84	<i>P</i> = .078
	after	112.77	113.00	97.00	125.00	7.88	<i>d</i> = .509 <i>m</i> = .704	72.38	70.50	62.00	95.00	8.43	<i>d</i> = .360 <i>m</i> = .423
9	before	117.81	116.50	95.00	140.00	12.24	<i>P</i> = .003*	74.46	74.00	58.00	92.00	8.71	<i>P</i> = .004*
	after	111.04	109.50	95.00	132.00	8.85	<i>d</i> = .650 <i>m</i> = .890	70.73	71.00	61.00	83.00	7.02	<i>d</i> = .614 <i>m</i> = .853

$\bar{x}$ – arithmetic mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; *P* – level of significance of differences, * – statistically significant differences (*P*< .05), Cohen's *d* (effect size): *d* = .2 – small effect, *d* = .5 – medium effect, *d* = .8 – large effect, *m* – power test (not less than .8, the closer to 1, the better the result)

freely raised their shoulders and then abducted their upper limbs. This was followed by a fatigue phase, i.e. lifting the shoulders with resistance. Finally, the resting phase after fatigue was read. Electromyography was performed just before entering the Snoezelen room (first session) and just after leaving the Snoezelen room (ninth session – last one) in the experimental group. In control group this measurement was performed twice in a three-week interval.

A series of therapeutic sessions in the Snoezelen room

The study was conducted in the white Snoezelen room. The series of therapeutic sessions included only people qualified for the experimental group, excluding the control group. The entire series of tests included nine therapeutic sessions. The sessions were held for three weeks on Mondays, Wednesdays and Fridays. A single therapeutic session in the Snoezelen room lasted about 30 minutes. The participants were dressed in loose sports clothing, without shoes. Conversations between participants and the use of mobile phones in the room were prohibited. All sessions were informal, which means that participants had no session plan. This session methodology is completely consistent with the Snoezelen idea. Each session was supervised by a qualified therapist (first author). After entering the Snoezelen room, the study participants' task was to calm down and relax as much as possible. During the therapeutic sessions, they had at their disposal: interactive water columns, optical fibres – ropes, curtains, a waterbed, a projector with a disk with liquid images, mirrors, tactile elements – bags with materials, a musical chair, poufs, an armchair, pillows and a blanket. During each session, delicate, warm and pastel colours dominated (blue, green, yellow and purple) and a musical composition *Traumreise und Meer* by Martin Buntrock was played.

Statistical analysis

Statistical analysis of the gathered data was performed using Statistica 10.0 (StatSoft, Palo Alto, California, USA). The following parameters were used: mean, median, minimum and maximum values and standard deviation. Normal values were verified with the Shapiro–Wilk test. In each case, two groups or two measurements were compared, therefore the t-test for dependent or independent samples (or their nonparametric equivalents, the Wilcoxon signed-rank test or the Mann-Whitney U test) was used, and the effect sizes were determined for these tests (Cohen's d or nonparametric equivalent, the rank-biserial correlation coefficient). The power of the test was determined using the GPower 3.1 program (Dusseldorf, Germany). In all the tests, the level of significance was set as $P < .05$. The Cohen's d coefficient value was interpreted as $d = .2$ – small effect (the

observed difference is small and may have limited clinical significance), $d = .5$ – medium effect (the observed difference is noticeable and may have moderate clinical significance), $d = .8$ – large effect (the observed difference is significant and probably has a significant impact on clinical practice).

Results

The first analysed correlation was between the level of stress, mental state, relaxation and the therapeutic method used. In the experimental group, before the therapy, the values for individual indicators were (mean and SD): stress - 4.69 ± 2.41 a.u., mental state - 6.85 ± 2.09 a.u., relaxation - 4.85 ± 1.74 a.u.. However, after the therapy: stress - 2.50 ± 1.82 a.u., mental state - 7.73 ± 1.15 a.u., relaxation - 6.65 ± 1.38 a.u.. In the experimental group, all assessed indicators improved significantly after the therapy (stress $P = .001$, mental state $P = .013$, relaxation $P = .001$). In the control group the values for individual indicators were: stress - 4.38 ± 2.50 a.u., mental state - 7.96 ± 0.96 a.u., relaxation - 5.15 ± 1.67 a.u.. Whereas after three weeks: stress - 3.27 ± 2.18 a.u., mental state - 7.85 ± 1.57 a.u., relaxation - 6.04 ± 2.18 a.u.. No statistically significant changes were observed in the control group (stress $P = .052$, mental state $P = .711$, relaxation $P = .076$). In intergroup comparisons, no statistically significant differences were observed between groups in any of the assessed indicators (stress $P = .173$, mental state $P = .763$, relaxation $P = .230$).

Another assessed correlation was between the results of the PHQ-9 and the therapeutic method used. Before therapy in the experimental group, the PHQ-9 results were (mean and SD): 8.04 ± 4.60 a.u., while after therapy: 5.69 ± 2.63 a.u.. The results of this questionnaire also improved significantly after the therapy only in the experimental group ($P = .012$). In the control group the PHQ-9 results were: 7.42 ± 4.59 a.u., and after three weeks: 6.35 ± 3.38 a.u.. No statistically significant changes were observed in the control group ($P = .171$). In the intergroup comparison, no statistically significant difference was observed between the assessed groups ($P = .410$).

Another assessed correlation was between resting blood pressure and the therapeutic method used, after subsequent therapeutic sessions. While systolic pressure was reduced significantly after sessions 3, 4, 6, 7, 8 and 9, diastolic pressure decreased significantly after sessions 1 and 9 (see Table 1).

Another assessed relationship was between the resting heart rate and the therapeutic method used, after subsequent therapeutic sessions. A statistically significant reduction in heart rate was observed after sessions 2 to 9 (see Table 2).

Table 2. Results of the heart rate measurement in the experimental group after subsequent sessions.

Sessions	Group	Heart rate [number of heart beats per minute]					Between measurements comparison
		$\bar{x}$	Me	Min	Max	SD	P, d, m
1	before	79.42	77.50	60.00	105.00	12.74	$P = .056$
	after	74.38	71.50	56.00	111.00	13.41	$d = .272$ $m = .266$
2	before	84.68	79.00	62.00	127.00	18.33	$P = .053$
	after	76.00	75.00	56.00	105.00	11.91	$d = .379$ $m = .459$
3	before	84.96	77.50	62.00	127.00	19.22	$P = .004^*$
	after	76.46	75.00	56.00	108.00	12.35	$d = .617$ $m = .856$

4	before	81.27	79.50	63.00	118.00	13.46	$P = .001^*$ $d = .808$ $m = .977$
	after	73.62	73.50	56.00	98.00	10.10	
5	before	83.73	79.50	59.00	117.00	13.65	$P < .001^*$ $d = .920$ $m = .995$
	after	75.15	73.50	58.00	93.00	8.59	
6	before	84.46	82.50	65.00	110.00	14.05	$P < .001^*$ $d = .810$ $m = .978$
	after	75.96	79.50	60.00	96.00	9.76	
7	before	82.65	79.50	63.00	115.00	14.46	$P < .001^*$ $d = .923$ $m = .995$
	after	73.88	70.50	63.00	105.00	11.12	
8	before	90.08	90.00	60.00	119.00	13.53	$P < .001^*$ $d = 1.409$ $m = .998$
	after	76.81	76.00	61.00	105.00	10.25	
9	before	83.46	80.50	56.00	112.00	14.31	$P = .001^*$ $d = .771$ $m = .965$
	after	74.69	72.50	54.00	97.00	11.04	

$\bar{x}$ – arithmetic mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; P – level of significance of differences, * – statistically significant differences ($P < .05$), Cohen's d (effect size): $d = .2$ – small effect, $d = .5$ – medium effect, $d = .8$ – large effect, m – power test (not less than .8, the closer to 1, the better the result)

The last assessed relationship was between the results of EMG measurement performed on the trapezius dorsi muscle and the therapeutic method used. Statistically significant reductions in muscle tension were observed only in the experimental group, in three phases: rest, upper limb abduction and rest after fatigue. In the resting phase, these relationships concerned the left side of the body, and in the other two phases, both sides of the body. In the intergroup comparison, no statistically significant difference was observed between the assessed groups (see Table 3).

Table 3. Results of EMG measurement on the trapezius dorsi muscle in the experimental and control groups.

Phases – mean values [%]	Body side	Group	Before therapy			After therapy			Intergroup comparison
			$\bar{x}$	SD	Me	$\bar{x}$	SD	Me	
Rest	Right	Experimental	8.57	7.69	5.96	6.32	4.06	5.10	$P= .260$
		Control	6.61	7.83	4.44	7.17	6.91	4.23	$d= .183$ $m= .095$
	Left	Experimental	10.15	12.21	7.12	6.07	3.83	5.29	$P= .564$
		Control	9.80	9.79	6.72	7.35	5.94	5.52	$d= .093$ $m= .061$
	Between measurements comparison (P)			Right experimental $P= .166, d= .346, m= .380$ Right control $P= .713, d= .056, m= .058$ Left experimental $P= .037^*, d= .383, m=0.$ Left control $P= .228, d= .212, m= .174$					
Free shoulder raise	Right	Experimental	48.77	20.92	48.40	44.93	13.58	44.10	$P= .812$
		Control	47.30	31.99	37.30	41.07	14.19	42.22	$d= .092$ $m= .061$
	Left	Experimental	46.01	28.13	40.95	45.32	12.67	42.20	$P= .475$
		Control	49.62	32.51	43.10	39.91	13.11	40.05	$d= .157$ $m= .083$
	Between measurements comparison (P)			Right experimental $P= .316, d= .185, m= .143$ Right control $P= .770, d= .193, m= .152$ Left experimental $P= .798, d= .026, m= .052$ Left control $P= .269, d= .257, m= .233$					
Abduction of the upper limb	Right	Experimental	71.99	41.12	54.95	43.47	19.07	40.55	$P= .066$
		Control	58.57	37.53	47.10	46.42	25.25	40.80	$d= .299$ $m= .173$
	Left	Experimental	70.06	55.27	63.95	46.30	17.48	40.45	$P= .297$
		Control	60.11	32.88	50.40	48.65	23.30	46.40	$d= .170$ $m= .089$

Between measurements comparison (<i>P</i>)			Right experimental <i>P</i> = .001*, d= .671, m= .894						
			Right control <i>P</i> = .066, d= .327, m= .346						
			Left experimental <i>P</i> = .020*, d= .453, m= .582						
			Left control <i>P</i> = .144, d= .290, m= .284						
Shoulder raise with resistance	Right	Experimental	42.86	76.05	27.05	17.13	52.04	9.62	<i>P</i> = .805
		Control	55.69	95.56	31.95	27.58	61.92	21.15	d= .041 m= .052
	Left	Experimental	48.28	81.48	35.75	26.86	68.91	15.83	<i>P</i> = .337
		Control	59.55	93.52	40.90	79.56	164.82	40.85	d= .269 m= .149
Between measurements comparison (<i>P</i>)			Right experimental <i>P</i> = .316, d= .245, m= .216						
			Right control <i>P</i> = .209, d= .280, m= .268						
			Left experimental <i>P</i> = .361, d= .183, m= .141						
			Left control <i>P</i> = .337, d= .109, m= .082						
Rest after fatigue	Right	Experimental	14.11	12.61	8.97	7.01	4.68	6.68	<i>P</i> = .084
		Control	9.80	13.06	4.76	7.62	6.80	4.25	d= .269 m= .149
	Left	Experimental	13.80	10.87	11.75	7.20	6.20	4.68	<i>P</i> = .151
		Control	13.70	16.48	6.67	9.01	6.67	6.22	d= .234 m= .124
Between measurements comparison (<i>P</i>)			Right experimental <i>P</i> = .011*, d= .593, m= .809						
			Right control <i>P</i> = .859, d= .164, m= .123						
			Left experimental <i>P</i> = .002*, d= .698, m= .915						
			Left control <i>P</i> = .269, d= .281, m= .269						

$\bar{x}$ – arithmetic mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; P – level of significance of differences, * – statistically significant differences ($P < .05$), Cohen's d (effect size): $d = .2$ – small effect, $d = .5$ – medium effect, $d = .8$ – large effect, m – power test (not less than .8, the closer to 1, the better the result).

Discussion

In people living under extended or chronic stress, the body's ability to produce a strong immune response is impaired, which may consequently increase morbidity.²³ It is therefore most important to use effective strategies to combat this burden. The literature shows that the Snoezelen room is increasingly used in coping with stress symptoms in both ill and healthy people.^{17,18,24-26} However, there are no reports on the effectiveness of this method in combating stress in healthy people who are particularly exposed to it.

Hudon et al.²⁷ reviewed the literature dealing with the use of Snoezelen rooms, among others, in the therapy of psychiatric patients. They showed that all publications discussing the impact of the Snoezelen room on the level of stress and anger in such patients indicated that Snoezelen therapy effectively reduced the values of both indicators. Novakovic et al.¹⁸ examined 40 people aged 15 to 35 with autism spectrum disorder, who were assigned to the experimental and control groups. The therapeutic intervention lasted 30 minutes each session, three times a week for three months. To assess the effects of therapy, researchers used the Childhood Autism Rating Scale (CARS) and showed that therapy in the Snoezelen room helped calm patients down, reducing the intensity of autism symptoms. Maseda et al.¹⁶ examined the impact of the Snoezelen room on mood, behaviour and biomedical parameters in patients with dementia. They examined 30 people, ten of whom participated in individual Snoezelen sessions, another 10 received individual activation therapy, and 10 people constituted the control group. The Snoezelen room sessions lasted 30 minutes, twice a week for 16 weeks. The authors showed that therapy in the Snoezelen room relaxed the studied patients effectively, although the

strength of its impact was like individual activation therapy. The authors also emphasised that, in their opinion, individual contact between the patient and the therapist was an extremely important element of the treatment. Also, in their subsequent study, Maseda et al.¹⁷ compared the impact of the Snoezelen therapy and music therapy. This study involved 21 people aged over 65 and diagnosed with severe dementia. The patients took part in a 12-week programme, and classes for both groups took place twice a week and lasted about 30 minutes. The authors of this project assessed the impact of two therapies on mood and behaviour, as well as on biomedical parameters such as heart rate and oxygen saturation. The research results showed that the Snoezelen room had a more effective relaxing effect on patients with severe dementia than music therapy. The available literature also includes several systematic reviews that analyse publications dealing with the relationship between the Snoezelen therapy and dementia. Based on 14 articles analysed, Carvalho et al.²⁸ reported that the Snoezelen room had a positive effect on alleviating all symptoms associated with dementia. Similar conclusions were also drawn by Helbling et al.²⁹, who analysed 36 reports in the discussed field. Their analysis confirmed the positive impact of the Snoezelen room on patients with dementia, particularly in terms of anger, depression and hyperarousal. Also, in the study conducted by Lehrer et al.²⁶, heart rate and blood pressure were reduced after five sessions in the Snoezelen room in patients with brain injuries and dementia. Koller et al.¹² conducted a pilot study that involved five children and teenagers (aged 6 to 17 years) hospitalised for a long time (eight months to five years) due to brain injuries, epilepsy or genetic diseases, among others. The patients were subjected to individual therapy in the Snoezelen room using three elements of the room (fibre-optic light spray set, massage tube, and interactive bubble tube), which lasted two weeks. The measurements of blood pressure,

electrodermal activity, temperature and respiration showed that the stay in the Snoezelen room reduced the values of these indicators. Our study involved 52 physiotherapy students, 26 of whom underwent therapy in the Snoezelen room and 26 constituted the control group. All students were in a state of increased stress resulting from the ongoing examination session, in addition to participating in clinical exercises. The stress level before and after the therapy was examined using survey questions and the PHQ-9 as well as objective measurements of selected biomedical indicators: heart rate, blood pressure and EMG of the trapezius dorsi muscle. The obtained results showed that all indicators improved significantly in the second measurement only in the experimental group; in the control group, no such change was noted in any of the assessed indicators.

The ability to cope with stress is a very important skill, especially for people who are particularly exposed to stress. Both stressed people and scientists look constantly for new strategies that could help fight stress effectively, and the chosen methods may vary depending not only on the type of studies but also on the country where the studies are conducted.³⁰ According to Ayed and Amoudi,⁹ techniques that help physiotherapy students cope with stress include primarily trying to solve problems, motivating themselves to act and trying to avoid stressful situations. The students they surveyed (83 people) also indicated defining priorities, ensuring a sufficiently long sleeping time and taking care of their health as methods of combating stress. A study by Brook et al.⁶ conducted on 38 physiotherapy students showed that the most common methods of coping with stress were practising sports, baking cakes, listening to music and socialising. Unfortunately, these authors also pointed out that physiotherapy students tried to cope with stress by reaching for stimulants, eating or spending long periods of time playing games on the computer. Also, Onieva-Zafra et al.⁵ noted that nursing students coped with stress with the support of friends, cognitive restructuring, expressing emotions and wishful thinking. Huberty et al.³¹ examined 88 students using the meditation app 'Calm Mobile'. Students were asked to use the app for a minimum of ten minutes every day but could extend this time when necessary. Their study showed that the application reduced stress and improved concentration and self-perception in stressed students.

Study limitation

This study is not without limitations. In further research, the sample size could also be increased to include more people in each group to increase the power of statistical calculations. The second limitation is lack of a placebo control. A sham intervention or alternative relaxation activity could have controlled for non-specific effects of attention or group participation. Increasing the duration of training is also a limitation, because longer time of intervention could further highlight the impact of therapy on the studied indicators. We are also aware that the obtained results, including the lack of differences between groups, could have been influenced by the effect of natural stress reduction in the control group.

Practical Applications

Our study has shown that a series of therapeutic sessions in the Snoezelen room for physiotherapy students under the influence of stress contributes to its reduction, as well as to relaxation and calmness. This allows us to believe that this method can be recommended to combat stress in physiotherapy students, but research in this area should certainly be continued and expanded to confirm intergroup differences and long-term effects.

Conclusions

1. A series of nine therapeutic sessions in the Snoezelen room statistically significant improved self-reported relaxation levels and reduced examination stress among tested physiotherapy students from experimental group, but no intergroup differences were observed.
2. A series of nine therapeutic sessions also statistically significant alleviated symptoms of depression among tested physiotherapy students from experimental group, but no intergroup differences were observed.
3. Each session from two to nine lowered heart rate and occasionally reduced blood pressure among tested physiotherapy students.
4. A series of nine therapeutic sessions in the Snoezelen room reduced the trapezius dorsi muscle tension (EMG measurement) among tested physiotherapy students from experimental group. Statistically significant changes concerned only some indicators, but no differences between groups were observed.

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Ethical Committee approval

Local Bioethics Committee at the Regional Medical Chamber, Nr 211/KBL/OIL/2018, Komisja Bioetyczna, Krakov, Poland.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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Author-s contribution

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References

- Gallego-Gómez JI, Balanza S, Leal-Llopis J, et al. Effectiveness of music therapy and progressive muscle relaxation in reducing stress before exams and improving academic performance in nursing students: A randomized trial. *Nurse Educ. Today* 2019; 84(1):104217. doi:10.1016/j.nedt.2019.104217
- Gardani M, Bradford DRR, Russell K, et al. A systematic review and meta-analysis of poor sleep, insomnia symptoms and stress in undergraduate students. *Sleep Med Rev.* 2022;61:101565. doi:10.1016/j.smrv. 2021.101565
- Saravanan C, Wilks R. Medical students' experience of and reaction to stress: the role of depression and anxiety. *Sci. World J.* 2014;29:737382. doi:10.1155/2014 /737382
- Weurlander M, Lönn A, Seeberger A, Broberger E, Hult H, Wernerson A. How do medical and nursing students experience emotional challenges during clinical placements? *Int J Med Educ.* 2018;27(9):74-82. doi:10.5116/ijme.5a88.1f80
- Onieva-Zafra MD, Fernández-Muñoz JJ, Fernández-Martínez E, García-Sánchez FJ, Abreu-Sánchez A, Parra-Fernández ML. Anxiety, perceived stress and coping strategies in nursing students: a cross-sectional, correlational, descriptive study. *BMC Med Educ.* 2020;20(1):370. doi:10.1186/s12909-020-02294-z
- Brooke T, Brown M, Orr R, Gough S. Stress and burnout: exploring postgraduate physiotherapy students' experiences and coping strategies. *BMC Med Educ.* 2020;20(1):433. doi:10.1186/s12909-020-02360-6
- Romo-Barrientos C, Criado-Álvarez JJ, González-González J, et al. Anxiety levels among health sciences students during their first visit to the dissection room. *BMC Med Educ.* 2020;20(1):109. doi:10.1186/s12909-020-02027-2
- Ferreira ÉMR, Pinto RZ, Arantes PMM, et al. Stress, anxiety, self-efficacy, and the meanings that physical therapy students attribute to their experience with an objective structured clinical examination. *BMC Med Educ.* 2020;20(1):296. doi:10.1186/s12909-020-02202-5
- Ayed A, Amoudi M. Stress Sources of Physical Therapy Students' and Behaviors of Coping in Clinical Practice: A Palestinian Perspective. *Inquiry* 2020;57: 46958020944642. doi:10.1177/0046958020944642
- Molina-Torres G, Sandoval-Hernández I, Roperio-Padilla C, Rodriguez-Arrastia M, Martínez-Cal J, Gonzalez-Sanchez M. Escape Room vs. Traditional Assessment in Physiotherapy Students' Anxiety, Stress and Gaming Experience: A Comparative Study. *Int J Environ Res Public Health* 2021;18(23):12778. doi:10.3390/ijerph182312778
- Fava L, Strauss K. Multi-sensory rooms: comparing effects of the Snoezelen and the Stimulus Preference environment on the behavior of adults with profound mental retardation. *Res Dev Disabil.* 2010;31(1):160-71. doi:10.1016/j.ridd.2009.08.006
- Koller D, McPherson AC, Lockwood I, Blain-Moraes S, Nolan J. The impact of Snoezelen in pediatric complex continuing care: A pilot study. *J Pediatr Rehabil Med.* 2018;11(1):31-41. doi:10.3233/PRM-150373
- Maseda A, Sánchez A, Marante MP, González-Abraldes I, de Labra C, Millán-Calenti JC. Multisensory stimulation on mood, behavior, and biomedical parameters in people with dementia: is it more effective than conventional one-to-one stimulation? *Am J Alzheimers Dis Other Demen.* 2014;29(7):637-47. doi:10.1177/1533317514532823
- Pinto JO, Dore AR, Geraldo A, Peixoto B, Barbosa F. Sensory stimulation programs in dementia: a systematic review of methods and effectiveness. *Expert Rev Neurother.* 2020;20(12):1229-1247. doi:10.1080/14737175.2020.1825942
- Smrokowska-Reichmann A. *Snoezelen – Sala Doświadczenia Świata. Kompendium opiekuna i terapię.* Wrocław, Fundacja Rosa; 2013.
- Goto S, Kamal N, Puzio H, Kobylarz F, Herrup K. Differential responses of individuals with late-stage dementia to two novel environments: a multimedia room and an interior garden. *J Alzheimers Dis.* 2014;42(3):985-98. doi:10.3233/JAD-131379
- Maseda A, Cibeira N, Lorenzo-López L, et al. Multisensory Stimulation and Individualized Music Sessions on Older Adults with Severe Dementia: Effects on Mood, Behavior, and Biomedical Parameters. *J Alzheimers Dis.* 2018;63(4):1415-1425. doi:10.3233/JAD-180109
- Novakovic N, Milovancevic MP, Dejanovic SD, Aleksic B. Effects of Snoezelen-Multisensory environment on CARS scale in adolescents and adults with autism spectrum disorder. *Res Dev Disabil.* 2019;89:51-58. doi:10.1016/j.ridd.2019.03.007
- Woźniacka R, Bac A, Kowal M, Matusik S. Differences in the prevalence of overweight and obesity in 5- to 14-year-old children in Krakow, Poland, using three national BMI cut-offs. *J Biosoc Sci.* 2018;50(3):365-379. doi:10.1017/S0021932017000426
- Kowal M, Woźniacka R, Bac A, Żarow R. Prevalence of underweight in children and adolescents (aged 3-18 years) from Kraków (Poland) in 1983 and 2010. *Public Health Nutr.* 2019;22(12):2210-2219. doi:10.1017/S1368980019001319
- Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606-13. doi:10.1046/j.1525-1497.2001.016009606.x
- Luijckx R, Vossen CJ, Roggeveen S, Os J, Hermens HJ, Lousberg R. Impact of early life adversity on EMG stress reactivity of the trapezius muscle. *Medicine (Baltimore)* 2016;95(39):e4745. doi: 10.1097/MD.0000000000004745
- Noushad S, Ahmed S, Ansari B, Mustafa UH, Saleem Y, Hazrat H. Physiological biomarkers of chronic stress: A systematic review. *Int J Health Sci (Qassim)* 2021;15(5):46-59.
- Nielsen JH, Overgaard C. Healing architecture and Snoezelen in delivery room design: a qualitative study of women's birth experiences and patient-centeredness of care. *BMC Pregnancy Childb.* 2020;20(1):283. doi:10.1186/s12884-020-02983-z
- Sigal A, Sigal M. The Multisensory/Snoezelen Environment to Optimize the Dental Care Patient Experience. *Dent Clin North Am.* 2022;66(2):209-228. doi:10.1016/j.cden.2021.12.001
- Lehrer H, Dayan I, Elkayam K, et al. Responses to stimuli in the 'snoezelen' room in unresponsive wakefulness or in minimally responsive state. *Brain Inj.* 2022;36(9):1167-1175. doi:10.1080/02699052.2022.2110286
- Hudon A, Rosca MA, La Charité-Harbec O, Allard JM, Borduas Pagé S. The Use of Alternative Rooms in Forensic and Regular Psychiatric Units: A Scoping Review. *Healthcare (Basel)* 2023;11(17):2432. doi:10.3390/healthcare11172432
- Carvalho SC, Martins FS, Martins AN, Barbosa RC, Vicente SG. Effectiveness of Snoezelen in older adults with

- neurocognitive and other pathologies: A systematic review of the literature. *J Neuropsychol.* 2023;21. doi:10.1111/jnp.12346
29. Helbling M, Grandjean ML, Srinivasan M. Effects of multisensory environment/stimulation therapy on adults with cognitive impairment and/or special needs: A systematic review and meta-analysis. *Spec Care Dentist.* 2023;44(6). doi: 10.1111/scd.12906
30. Labrague LJ, McEnroe-Petitte DM, Papathanasiou IV, et al. Stress and coping strategies among nursing students: an international study. *J Ment Health* 2018;27(5):402-408. doi:10.1080/09638237.2017.1417552
31. Huberty J, Green J, Glissmann C, Larkey L, Puzia M, Lee C. Efficacy of the Mindfulness Meditation Mobile App "Calm" to Reduce Stress Among College Students: Randomized Controlled Trial. *JMIR Mhealth Uhealth* 2019;7(6): e14273. doi:10.2196/14273

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