



ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

The effects of web-based progressive muscle relaxation exercise on perceived stress and anxiety levels of nursing students who were in clinical practice for the first time – a randomized controlled trial

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SUMMARY

Introduction/Objective It is reported that during the education process, uncontrollable long-term stress affects professional identity development and health of nursing students negatively. The effects of web-based progressive muscle relaxation exercises on perceived stress and anxiety levels of nursing students who were in clinical practice for the first time were analyzed in the present study.

Methods The present study used a randomized controlled design. The study was carried out at a state university in Turkey. A total of volunteering 66 nursing students (36 in the control and 30 in the intervention group) in clinical practice for the first time who were studying during the 2021–2022 academic year were included in the sample. Intervention group students performed 36 sessions of progressive muscle relaxation exercise three days a week for 12 weeks. The data were collected by using the Sociodemographic Characteristics Form, State-Trait Anxiety Inventory (STAI), and Perceived Stress Scale (PSS).

Results In comparing post-test mean scores of intervention and control group, PSS and STAI total mean scores of the intervention group were found to be statistically significantly lower than those of the control group ($p < 0.05$).

Conclusion Progressive muscle relaxation exercise was found to reduce perceived stress and anxiety in nursing students who were in clinical practice for the first time.

Keywords: anxiety; nursing student; stress; progressive muscle relaxation; randomized controlled study

INTRODUCTION

Nursing education consists of two complementary parts: theoretical and clinical. Clinical education, an essential component, helps students acquire skills such as effective communication, problem-solving, clinical decision-making, and critical thinking. It also allows students to observe and adapt to the harmonious collaboration of various professionals. It also includes multiple difficulties that may lead to stress and anxiety in students [1]. In clinical education, students may experience anxiety and stress due to unfamiliar environments, the need to communicate with various healthcare professionals, fear of making mistakes and harming patients, lack of practical interpersonal communication skills, self-confidence, information, and skills [2]. Stress and anxiety can be both positive and negative emotions. Moderate levels can motivate students and enhance their performance [3]. High levels of stress and anxiety can negatively impact students' physical and psychological health, as well as their academic, clinical, and overall performance [2, 3]. Literature reports that the first clinical practice is the stage that causes the most stress and anxiety in the clinical education process [4, 5]. It is also stated

that nursing students managing their stress and anxiety more effectively will result in more effective clinical training [6].

Studies in literature have examined the effects of music therapy, progressive muscle relaxation (PMR) exercises, cognitive therapy, emotional freedom technique, breathing exercises, mind-clearing, and aromatherapy methods on decreasing stress and anxiety levels in nursing students [7, 8, 9]. One preferred method for reducing stress and anxiety is PMR exercise because it is easy, inexpensive, reliable, and helps cope with academic stress [10]. Different studies suggest PMR exercises throughout nursing courses to increase student satisfaction, reduce anxiety and stress, and promote positive perspectives [3, 11, 12]. PMR exercises are performed to enable self-relaxation by helping individuals feel the difference between tension and relaxation in their bodies. PMR exercises decrease muscle tension, leading to less stress and anxiety, and provide a feeling of deep rest, refreshment, and rebirth [13].

It is reported that during the education process, uncontrollable long-term stress negatively affects professional identity development and the health of nursing students [14]. Nursing students are affected by numerous academic,

Received • Примљено:

July 2, 2024

Revised • Ревизија:

September 12, 2024

Accepted • Прихваћено:

September 14, 2024

Online first: September 18, 2024

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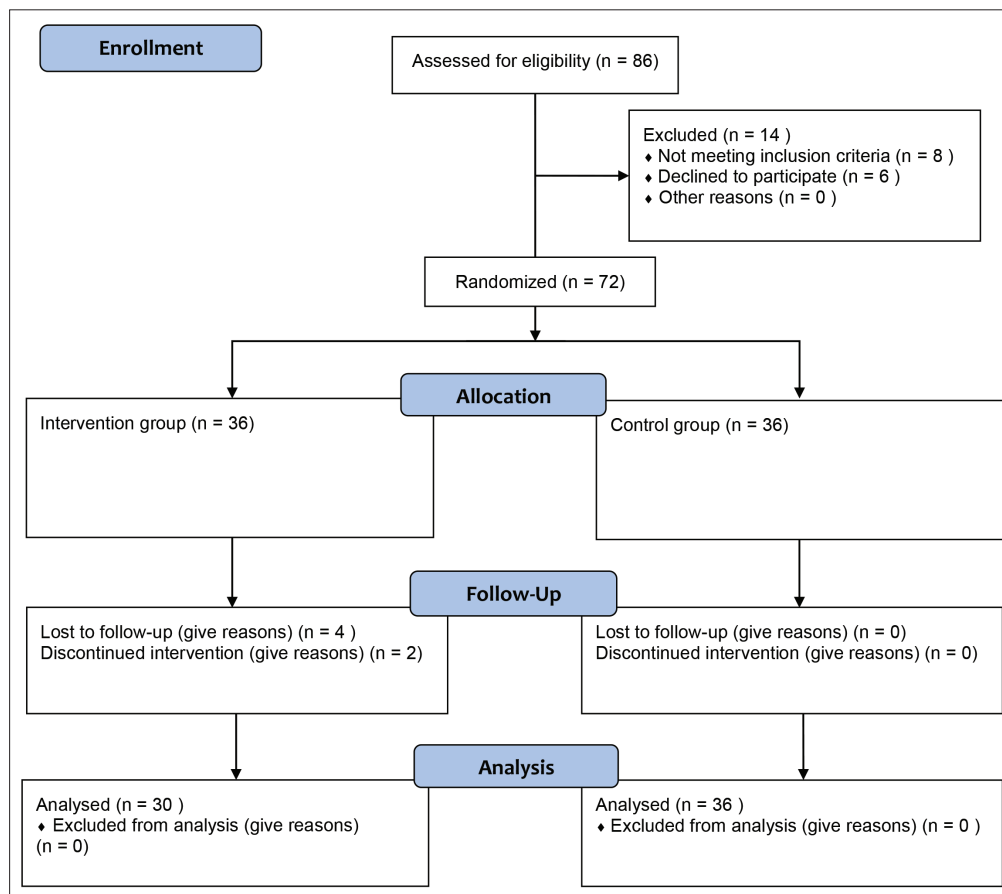


Figure 1. Enrollment process

social, and psychological stressors. Additionally, the pandemic has introduced many new challenges that may have further increased students' stress levels [15, 16]. Students are concerned that they will not be able to develop clinical skills due to problems in nursing education, most of which consist of clinical practice [17].

The stress and anxiety levels of nursing students at the beginning of their educational process, who have limited professional knowledge and skills, should be examined, especially as they transition from online to face-to-face clinical practice due to the COVID-19 pandemic. This study will contribute to understanding students' potential stress and anxiety regarding their first clinical practice, offer solutions to mitigate this stress and raise educators' awareness. It is believed that using relaxation therapy can enhance students' satisfaction with clinical practice, foster a positive perspective, and reduce stress. Therefore, the aim of this study is to analyze the effects of web-based PMR exercises on the perceived stress and anxiety levels of nursing students during their first clinical practice.

Study hypotheses

H_0 – Web-based PMR exercise does not affect the perceived stress and anxiety levels of nursing students who experience clinical practice for the first time.

H_1 – Web-based PMR exercise affects the perceived stress and anxiety levels of nursing students who experience clinical practice for the first time.

METHODS

This study was designed as randomized parallel study with a pre-test, mid-test, and post-test control group. Clinical trial registration was done (ClinicalTrials.gov.:NCT05312749).

Population and sample of the study

The study included 300 second-year nursing students at a state university in Turkey during 2021–2022. In total, 86 students were reached, and 72 (36 intervention, 36 control) were sampled. The study was completed with 66 students (36 control, 30 intervention), as six did not participate regularly. Inclusion criteria: aged over 18, second-year student, no psychiatric history. Exclusion criteria: first-, third-, or fourth-year student, prior clinical practice, relaxation exercises. Post hoc power analysis with G-Power 3.1.9.4 showed an effect size of 0.156 and a power of 0.88 at a 95% confidence interval, indicating sufficient sample size.

Randomization

Students were randomly assigned student numbers during university enrollment. For this study, odd-numbered students were in the intervention group, and even-numbered students were in the control group, ensuring equal numbers (1:1 ratio). In total, 72 students were distributed accordingly (Figure 1).

Data collection tools

The study collected data using the Sociodemographic Characteristics Form, State-Trait Anxiety Inventory (STAI), and Perceived Stress Scale (PSS).

Sociodemographic Characteristics Form: The form included questions about students' demographics, feelings about clinical practice, willingness to choose nursing, love for the profession, and previous hospital experience.

STAI: Öner and Le Compte [18] adapted the STAI for Turkish, ensuring its validity and reliability. The STAI has two parts: the State Anxiety Inventory (SAI) and the Trait Anxiety Inventory, each with 20 items. This study used the SAI, which measures state anxiety at a specific time. Scores range from 20 to 80, with higher scores indicating higher anxiety. The Cronbach α level for the SAI was 0.94–0.96. This study's pre-test and post-test Cronbach α values were 0.918–0.941.

PSS: Eskin et al. [19] validated the Turkish version of the PSS-14. This 14-item scale has two factors: "insufficient self-efficacy" and "perceived stress," with a five-Likert-type range. Scores range from 0 to 56, with higher scores indicating higher stress levels. Scores between 0–35 are normal, while 35–56 indicate high stress. The original Cronbach α was 0.84; in this study, it ranged from 0.765 to 0.842.

Pre-application

Five students tested the survey questions for clarity, finding all questions clear and sufficient. Their data should have been included in the research.

Progressive muscle relaxation exercise CD

The "Relaxation Exercises CD" by the Turkish Psychologists Association, featuring a 30-minute session with instructions and river sounds, was used [3, 20]. PMR exercises were performed three times a week for 12 weeks (36 sessions total) to reduce anxiety and stress in nursing students during their first clinical practice.

WhatsApp group

A WhatsApp group was created to share information and manage the study. The CD was converted to a WhatsApp-compatible format and shared as a voice recording.

Progressive Relaxation Exercise Application Record Chart

This chart was created for students to record their sessions and for researchers to track them, covering seven days a week for 12 weeks.

Application of progressive relaxation exercise

Before starting the exercise training, an online Zoom meeting was held. A researcher explained the exercises' definition, aim, benefits, and techniques. Steps were

demonstrated, practiced, and checked for correctness. Following the audio recording commands, students were instructed to perform the exercises for 30 minutes in the evening three days a week for 12 weeks. Daily reminders were sent at 8 p.m. through WhatsApp. Students shared confirmation messages in the group about their practice. Weekly calls checked for any problems.

Fundamentals of nursing course

The university offers theoretical courses and lab applications in the first year, preparing students for clinical practice. In the second year's first semester, students take the "Fundamentals of Nursing" course that lasts for 28 hours (two hours per week for 14 weeks) with about 100 students. Students engage in 112 lab and clinical practices (eight hours per week) alongside theoretical courses to apply their knowledge. Active learning methods like group discussions, reflection, problem-based learning, and case analysis are used in the course.

Clinical practice

The laboratory application lasted four weeks, and the clinical application lasted eight weeks, totaling 12 weeks for the PMR exercise. Initially, students practiced nursing skills in the laboratory, focusing on infection control, drug administration, nutrition, and urinary interventions on simulation models. In the fifth week, students started clinical practice. The lecturer explained the responsibilities at the clinic, and students met the clinic team, adapted, and informed patients. Students were at the clinic from 8:00 a.m. to 4:00 p.m. once a week for eight weeks, participating in patient care and treatment practices.

Control group

After collecting the pre-test data, no interventions were given to these students. The same forms were distributed online as mid-test, and post-test surveys.

Data collection

After collecting pre-test data using the Sociodemographic Characteristics Form, STAI, and PSS forms, the intervention group was taught PMR exercises. These were performed three days a week for four weeks alongside laboratory practices. In the fifth week, students started clinical practice and continued the exercises. Both groups filled out mid-test forms before clinical practice in the fifth week and post-test forms in week 12. Forms had to be completed within five minutes; otherwise, they were deemed invalid.

Data assessment

Socio-demographic characteristics were summarized with frequency and percentage. Group homogeneity was analyzed using the χ^2 test. The independent t-test compared the groups' mean ages. Intragroup comparisons of STAI

Table 1. Sociodemographic characteristics of students (n = 66)

Variables		Groups				Test value and significance
		Intervention		Control		
		N	%	n	(%)	
Gender	Female	23	76.7	26	72.2	$\chi^2 = 0.169$ p = 0.681
	Male	7	23.3	10	27.8	
Type of family	Nuclear	22	73.3	32	88.9	$\chi^2 = 2.662$ p = 0.103
	Extended	8	26.7	4	11.1	
Place of living	Dormitory	23	76.7	29	80.6	$\chi^2 = 0.576$ p = 0.750
	Family home	6	20	5	13.9	
	Peer home	1	3.3	2	5.6	
Feeling fearful about clinical practice	Yes	26	86.7	26	72.2	$\chi^2 = 2.043$ p = 0.153
	No	4	13.3	10	27.8	
Feeling nervous about clinical practice	Yes	26	86.7	34	94.4	$\chi^2 = 1.198$ p = 0.274
	No	4	13.3	2	5.6	
Feeling curious about clinical practice	Yes	20	66.7	25	69.4	$\chi^2 = 0.058$ p = 0.809
	No	10	33.3	11	30.6	
The state of choosing nursing department willingly	Yes	20	66.7	25	69.4	$\chi^2 = 0.058$ p = 0.809
	No	10	33.3	11	30.6	
The state of loving nursing profession	Yes	27	90	34	94.4	$\chi^2 = 0.462$ p = 0.497
	No	3	10	2	5.6	
Previous hospital experience (hospital attendant, patient, etc.)	Yes	19	63.3	21	58.3	$\chi^2 = 0.171$ p = 0.679
	No	11	36.7	15	41.7	
Feeling ready for clinical practice	Yes	7	23.3	15	41.7	$\chi^2 = 2.475$ p = 0.116
	No	23	76.7	21	58.3	
Sufficiency of theoretical knowledge	Yes	5	16.7	5	13.9	$\chi^2 = 0.098$ p = 0.754
	No	25	83.3	31	86.1	
Continuous variables		X ± SD	Min–max	X ± SD	Min–max	
Age		19.93 ± 0.944	18–22	19.75 ± 1.42	18–23	t = 0.775 p = 0.441

and PSS scores used repeated measurements ANOVA for normal distributions and the Friedman test for non-normal distributions. The dependent t-test analyzed normally distributed groups, while the Wilcoxon test analyzed non-normal groups. Between-group comparisons used the independent t-test for normal distributions and the Mann–Whitney U test for non-normal distributions. Multiple linear regression analyzed the effect of progressive relaxation exercises on stress and anxiety.

Ethical considerations

The university's ethics committee approved the study on September 16, 2021 (2021/09-45). The study followed the Declaration of Helsinki principles and obtained written consent. After data collection, PMR exercises were taught to three willing control group students, and the CD was shared with them for ethical equality.

Clinical trial registration was done (ClinicalTrials.gov.: NCT05312749). The CONSolidated Standards Of Reporting Trials checklist for randomised controlled trials was used in this study.

RESULTS

In the intervention group, 76.7% were female, 73.3% had a nuclear family, 76.7% lived in a dormitory, 86.7% had fears

about clinical practice, 86.7% felt nervous, and 66.7% felt curious. Additionally, 66.7% chose nursing willingly, 90% loved nursing, 63.3% had hospital experience, 76.7% did not feel ready for clinical practice, 83.3% lacked theoretical information, and the mean age was 19.93 ± 0.944. In the control group, 72.2% were female, 88.9% had a nuclear family, 80.6% lived in a dormitory, 72.2% had fears about clinical practice, 94.4% felt nervous, and 69.4% felt curious. Furthermore, 69.4% chose nursing willingly, 94.4% loved nursing, 58.3% had hospital experience, 58.3% did not feel ready for clinical practice, 86.1% lacked theoretical information, and the mean age was 19.75 ± 1.42. Both groups are homogeneous in sociodemographic characteristics (Table 1).

In the intervention group, statistically significant differences were found in PSS and STAI pre-test, mid-test, and post-test scores (p < 0.05). Differences in insufficient self-efficacy perception were between pre-test and post-test scores (p < 0.05). Differences in perceived stress were between pre-test, mid-test, and post-test scores (p < 0.05). SAI differed between pre-test, mid-test, and post-test scores (p < 0.05). No statistically significant differences were found in the control group in the PSS factors pre-test, mid-test, and post-test scores. Statistically significant differences were found between both groups in post-test insufficient self-efficacy perception, pre-test stress perception, pre-test and post-test PSS, and post-test SAI scores (p < 0.05) (Table 2).

Table 2. Comparison of intragroup and between groups of perceived stress scale and factors and state anxiety inventory scores of nursing students

Perceived stress scale factors		Groups		Test value and significance between groups
		Intervention X ± SD	Control X ± SD	
Insufficient self-efficacy perception	Pre-test ¹	13.47 ± 5.09	12.92 ± 3.73	t = 0.492 p = 0.625
	Mid-test ²	11.73 ± 4.82	11.39 ± 5.09	t = 0.280 p = 0.780
	Post-test ³	9.43 ± 5.03	12.72 ± 3.07	t = -3.054 p = 0.003
	Difference	1 > 3 ^x	None	
Intragroup test value and significance		F = 6.072 p = 0.004	Friedman = 4.491 p = 0.106	
Stress perception	Pre-test ¹	17.07 ± 5.47	13.72 ± 5.34	t = 2.506 p = 0.015
	Mid-test ²	14.50 ± 4.22	14.64 ± 4.70	U = 481.50 p = 0.448
	Post-test ³	12.83 ± 4.97	13.83 ± 4.29	U = 475.50 p = 0.402
	Difference	1 > 2, 1 > 3 ^x	None	
Intragroup test value and significance		F = 8.296 p = 0.001	Friedman = 0.645 p = 0.724	
Total Perceived Stress Scale	Pre-test ¹	30.53 ± 8.02	26.64 ± 5.90	t = 2.270 p = 0.027
	Mid-test ²	26.23 ± 7.72	26.03 ± 7.04	U = 510.50 p = 0.703
	Post-test ³	22.26 ± 8.99	26.56 ± 6.04	U = 293.00 p = 0.001
	Difference	1 > 2, 1 > 3, 2 > 3 ^y	None	
Intragroup test value and significance		Friedman = 23.248 p = 0.001	Friedman = 1.206 p = 0.547	
State Anxiety Inventory	Pre-test ¹	47.23 ± 9.88	41.11 ± 8.96	t = 2.638 p = 0.010
	Mid-test ²	40.63 ± 8.84	41.92 ± 7.45	t = -0.640 p = 0.524
	Post-test ³	38.73 ± 8.19	45.50 ± 9.03	t = -3.160 p = 0.002
	Difference	1 > 2, 1 > 3 ^y	3 > 1 ^y	
Intragroup test value and significance		Friedman = 16.167 p = 0.001	Friedman = 6.048 p = 0.049	

*p < 0.05

x – dependent groups t test; y – Wilcoxon test

Multiple linear regression analysis showed a significant positive effect of PMR on insufficient self-efficacy perception ($\beta = -0.357$, $p < 0.003$), perceived stress ($\beta = -0.277$, $p < 0.024$), and state of anxiety ($\beta = -0.367$, $p < 0.002$) (Table 3).

DISCUSSION

Clinical teaching environments are crucial for nursing students to develop professional knowledge and skills, but they also create significant anxiety and stress. This study analyzed the effects of PMR exercises on nursing students' perceived stress and anxiety levels before their first clinical practice. Unlike previous studies, this research examined the additional stress and anxiety caused by the COVID-19 pandemic, such as close contact with patients and infection risk, alongside the usual anxiety of first clinical practice. The results showed that PMR exercises significantly

decreased stress and anxiety levels. Therefore, hypothesis 1 was accepted, indicating that these exercises effectively reduce stress and anxiety in nursing students.

Nursing students experience various stress levels during clinical practices [21, 22]. This study found high rates of fear, nervousness, and curiosity about clinical practice, with moderate stress and anxiety levels before starting clinical practice. Bahçecioglu Turan et al. [5] also found moderate anxiety among nursing students during the COVID-19 pandemic. These findings align with existing literature, indicating that moderate anxiety and stress reflect students' need for support. Recognizing and addressing students' anxiety before clinical practice can help create a less traumatic experience and a positive learning environment. Hamadi et al. [23] reported increased stress among nursing students during the COVID-19 pandemic, leading to more use of stress-coping strategies. This study supports PMR exercises as an effective, cost-free coping method. The study's timing during the COVID-19 pandemic is significant. The pandemic likely influenced the finding that perceived stress levels remained the same while anxiety levels decreased in the intervention group. This highlights the importance of PMR exercises in reducing stress and anxiety among nursing students during challenging times.

This study found a significant decrease in anxiety levels of intervention group nursing students. It is essential to provide intervention strategies to manage nursing students' stress and anxiety levels before the first clinical practice. In the literature, it is recommended to try different methods as intervention programs so that during clinical practices nursing students can manage their stress and anxiety [24]. In this study, PMR exercises were applied as an intervention program because they are the most efficient and effective therapy for psychosomatic disorders like anxiety and stress [25]. This is because, in a relaxed state, the body generates natural chemicals to repair damage and eliminate toxins. Additionally, relaxation nurtures internal abilities, increases capacity to think and innovate, and empowers psychological and mental strength, increasing useful output and self-confidence [26].

Various studies have demonstrated the effectiveness of PMR exercises in reducing anxiety levels among nursing students. For instance, research by İnangil et al. [3], Korkut et al. [27] and Pelit-Aksu et al. [20] reported significant reductions in anxiety and stress levels both before and during clinical practice. Similarly, Ayed [11], Toqan et al. [28] and Torabizadeh et al. [9] highlighted the effectiveness of PMR exercises, particularly in managing anxiety within psychiatric and intensive care settings. These findings align

Table 3. Regression analysis results regarding the effects of progressive muscle relaxation exercise on anxiety and perceived stress levels

Dependent variable	Model	Variables	B	S.Error	β	t	p
Insufficient self-efficacy perception	1	Fixed	9.433	0.795		11.860	0.001*
		Progressive muscle relaxation exercise - intervention	3.289	1.077	-0.357	3.054	0.003*
	R = 0.357, R² = 0.127						
	F = 9.327, p = 0.003*						
Stress Perception	1	Fixed	12.833	0,841		15.253	0.001*
		Progressive muscle relaxation exercise - intervention	1.000	1.139	-0.109	0.878	0.383
	R = 0.109, R² = 0.012						
	F = 0.771, p = 0.383						
Perceived Stress Scale	1	Fixed	22.267	1.373		16.215	0.001*
		Progressive muscle relaxation exercise - intervention	4.289	1.859	-0.277	2.307	0.024*
	R = 0.277, R² = 0.077						
	F = 5.320, p = 0.024*						
State Anxiety Inventory	1	Fixed	38.733	1.581		24.495	0.001*
		Progressive muscle relaxation exercise - intervention	6.767	2.141	-0.367	3.160	0.002*
	R = 0.367, R² = 0.135						
	F = 9.988, p = 0.002*						

with our study, supporting the notion that PMR exercises can help reduce pre-clinical practice anxiety, thereby fostering a more positive learning environment. Given the heightened stress and anxiety during the COVID-19 pandemic, the use of these exercises emerged as an economical and effective intervention. The present study aligns with other studies, showing that intervention group students used relaxation techniques more and integrated them into their lives. PMR helped students learn to stretch and relax muscle groups, reducing stress and anxiety by alleviating muscle tension. This study contributes to the literature by enhancing nursing students' psychological health with an economical, web-based method, avoiding pharmacological approaches.

Limitations of the study

The leakage of information from students with previous clinical experiences and from intervention groups to control groups may have influenced the study results. Other limitations include conducting the study in a single school and not comparing it with different education curricula.

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Additionally, PMR exercises were not applied to the control group after completing the study.

CONCLUSION

PMR exercises significantly decreased perceived stress and anxiety in nursing students. These results suggest PMR can reduce stress and anxiety during clinical practice. It is recommended to assess students for anxiety, identify those at risk, and implement measures to reduce anxiety before clinical practice. This method is crucial for nurses, especially during disasters like COVID-19 pandemic, to healthily cope with anxiety.

PMR can be recommended as a supportive treatment for nursing students in clinical practice. It can serve as a stress management tool. Future studies should include more students and be conducted in universities with different curricula. A qualitative study could also better understand nursing students' experiences with interventions to reduce stress.

Conflict of interest: None declared.

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Ефекти прогресивне релаксације мишића путем интернета на перципирани стрес и нивое анксиозности код студената сестринства током првог искуства у клиничкој пракси – рандомизована контролисана студија

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САЖЕТАК

Увод/Циљ Пријављено је да током образовног процеса не-контролисани дуготрајни стрес негативно утиче на здравље и развој професионалног идентитета студената на студијама сестринства. У овој студији анализирани су ефекти онлајн вежби прогресивне релаксације мишића на нивое перципираног стреса и анксиозности код студената Факултета медицинских сестара који су први пут били у клиничкој пракси. **Метод** Ова студија је користила рандомизовани контролисани дизајн. Спроведена је на државном универзитету у Турској. У узорак је укључено укупно 66 студената сестринства (36 у контролној и 30 у студијској групи) који су први пут били на клиничкој пракси, а студирали су током школске 2021–2022. Студенти у студијској групи одрадили су 36 сесија вежби прогресивног опуштања мишића три пута недеље-

но током 12 недеља. Подаци су прикупљени коришћењем Обрасца социодемографских карактеристика, Инвентара анксиозности као стања и особина и Скале перципираног стреса.

Резултати Поређењем средњих резултата после теста студијске и контролне групе, укупни средњи резултати Скале перципираног стреса и Инвентара анксиозности као стања и особина у студијској групи били су статистички значајно нижи од оних у контролној групи ($p < 0,05$).

Закључак Утврђено је да вежбе прогресивног опуштања мишића смањују перципирани стрес и анксиозност код студената сестринства који су први пут били у клиничкој пракси.

Кључне речи: анксиозност; студенти сестринства; стрес; прогресивна релаксација мишића; рандомизована контролисана студија