



## Effectiveness of music therapy and progressive muscle relaxation in reducing stress before exams and improving academic performance in Nursing students: A randomized trial



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### ABSTRACT

**Background:** Nursing students experiencing high stress levels before exams could suffer worse academic performance.

**Objective:** We evaluated an intervention combining Progressive Muscle Relaxation (PMR) and music therapy on the decrease of *before exams* stress and the improvement of academic results.

**Design and methods:** Randomized controlled trial including students from the Nursing Degree during the first semester of the 2017–2018 academic year. All participants were randomized to the control (CG) or the experimental group (EG). The CG took the exam as usual whereas in the EG, PMR and music therapy were performed before exams. Blood samples were drawn to investigate variations in biochemical parameters. The academic performance was assessed by the score obtained in the “Clinical Nursing” exam.

**Results:** We included 112 students (75% females, mean age  $24.3 \pm 6.2$  years, 56 students in every group). There were no differences in any parameter during the first measurement. Regarding the second measurement, we observed a reduction in heart rate for the EG and an increase in blood pressure, heart rate, and cortisol for the CG. Indeed, these parameters were significantly higher compared to the EG. The EG had a mean score of  $5.07 \pm 1.59$  in the Clinical Nursing exam, which was significantly higher compared to the CG ( $4.42 \pm 1.58$ ,  $p = 0.033$ ). The proportion of fails in the CG was also higher (62.5% vs. 42.9%,  $p = 0.037$ ).

**Conclusion:** In this study including students from the Nursing degree, the combination of PMR and music therapy was effective for the control and decrease of stress before exams, and also demonstrated improvements in academic results.

### 1. Background

Academic stress, defined as a physiological, emotional, cognitive and behavioral reaction to stimuli, can affect the ability of the students to face the university environment (Dendle et al., 2018; Pozos-Radillo et al., 2018). Indeed, current studies have described high levels of stress in health sciences students such as Nursing, Medicine and Odontology (Crego et al., 2016; Silverstein and Kritz-Silverstein, 2010). Exams and clinical practices, as well as high academic workloads, negative interactions with the personnel and the faculty, financial problems and

changes in their surroundings, social activities, feeding and rest habits, are stress factors that are more commonly found in this population (Quinn and Peters, 2017; Shudifat and Al-Husban, 2015; Silva-Sánchez, 2015). In this sense, recent studies have shown a significant relationship between the high levels of academic stress and psycho-physiological manifestations such as problems in concentration, mental blocks, chronic fatigue, somnolence and depression (Pozos-Radillo et al., 2016). Thus, Nursing students experiencing high levels of stress before exams could be incapable for demonstrating their knowledge (Prato and Yucha, 2013), and therefore, their academic performance could be

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impaired (Dendle et al., 2018).

Some authors consider that Nursing educators could use empirically-proven interventions to reduce stress and improve the abilities of coping (Labrague et al., 2017). In the last years, several studies have investigated the effectiveness of some interventions such as psycho-educational interventions (Labrague et al., 2017; McCarthy et al., 2018), music therapy (Ince and Çevik, 2014; Lee et al., 2016; Shih et al., 2016) and Progressive Muscle Relaxation (PMR) (Hashim and Zainol, 2015; Pal et al., 2014; Prato and Yucha, 2013), to cope with student anxiety or stress before academic exams, tests or evaluations. However, it is still unclear if any of these interventions have a real impact on the stress level of Nursing students.

Given that exams are a natural stressor with the ability to affect health, which can have negative repercussions on memory and test results (Maduka et al., 2015), the aim of this study was to evaluate the effectiveness of a prevention program that combines PMR and music therapy interventions on the decrease of stress during the exam period and the improvement of academic results.

## 2. Design and methods

This is a randomized controlled trial performed in students from the second year of the Nursing Degree that were going to take the Clinical Nursing exam during the first semester of the 2017–2018 academic year (i.e. from October 2017 to February 2018). All the participant students were part of the Nursing Degree from the Catholic University of Murcia.

All the students were considered as there were no specific inclusion or exclusion criteria. However, from the 120 screened students, 8 were excluded, as they did not want to participate in the study. The final sample size was 112 participants (Fig. 1).

### 2.1. Ethical issues

Before starting the study, the students were informed about the purpose of the study and signed an informed consent. This study followed the CONSORT guidelines and was approved by the Ethical Committee from the Catholic University of Murcia. The study was also performed with the ethical standards found in the 1964 Declaration of Helsinki and its later amendments.

### 2.2. Randomization

At inclusion, the participants were randomly assigned to the control group (CG) or the experimental group (EG) by using a simple randomized sampling. A total of 56 students were assigned to the CG, and another 56 to the EG group, with both groups age and sex-matched. The CG took the exam as usual whereas in the EG, PMR and music therapy interventions were performed before the exam.

### 2.3. Visits, measurements and experimental intervention

For each participant, two visits were scheduled. The first visit was performed in October 2017, during a non-exam period. The participants attended to this first visit fasted. A blood sample was drawn at 9 a.m., and clinical, socio-demographic and vital signs (heart rate, oxygen saturation, and blood pressure) parameters were recorded. The same procedure was performed in the CG and EG.

The second visit was carried out in February 2018, the same day as the exam. The CG was asked to attend at 9 a.m. (i.e. 1 h before the beginning of the exam) in fasting, and a new blood sample was drawn. The EG attended at 8 a.m. (2 h before the exam), in fasting. For 1 h, the experimental intervention was performed and then, a blood sample was also drawn. Before the exam, participants from both groups had enough time to have breakfast.

The experimental intervention consisted on a session of PMR and music therapy before taking the exam. This intervention was carried out

in three classrooms with dimmed illumination, set up with chairs and mattresses for the better performing of the technique. The aim of the technique was to ease the tension and to achieve the relaxation of the main successive muscle groups. During the entire procedure, as well as during the exam, the EG listened to relaxing music. The music was listened using a CD player, without headphones, with an appropriate volume established at 50–60 dB. The intervention was performed by two nurses and a psychologist who had extensive experience with relaxation techniques and music therapy. Once the intervention was finished, a blood sample was drawn. Afterward, the students had breakfast and started the exam.

### 2.4. Analysis of the academic performance

An important part of the experimental intervention was to evaluate if this resulted in an improvement of academic performance. The academic performance was assessed by the score obtained by each student in the exam of the subject “Clinical Nursing”. The score was classified as pass ( $\geq 5$ ) or fail ( $< 5$ ), with values ranging from 0 to 10.

### 2.5. Statistical analysis

For the randomization process, we used a random number generator using the software C4SDP-MAS v. 2.1 (Freeware: Study Design Pack, Glaxo Wellcome Biometry, S. A.). Participants were randomized into two groups with an allocation ratio of 1:1.

Categorical variables were expressed as frequencies and percentages. Continuous variables were presented as median and interquartile range (IQR), or mean  $\pm$  standard deviation (SD) if distribution was normal according to the Kolmogorov-Smirnov test.

The Pearson Chi-squared test was used to compare proportions. Differences between continuous and categorical variables were assessed using Student's *t*-test or Mann-Whitney *U* test, as appropriate, and correlations between continuous variables were assessed by the Pearson's correlation coefficient.

A *p* value  $< 0.05$  was accepted as statistically significant. Statistical analyses were performed using SPSS v. 22.0 (SPSS, Inc., Chicago, IL, USA) for Windows.

## 3. Results

We included 112 students of which most were females (84, 75%), with a mean age of  $24.3 \pm 6.2$  years. Patients were randomized in a 1:1 manner so that the CG was composed of 56 students and the EG was also composed of 56 students. Both groups included 42 (75%) females and the mean age was  $24.53 \pm 6.89$  years and  $24.24 \pm 5.61$  years ( $p = 0.802$ ) for the CG and EG, respectively. Thus, both groups were balanced according to sex and age (Table 1).

We investigated variations in clinical and biochemical parameters in both groups of students as is summarized in Table 2. Of note, there were no differences in any of the parameters between the experimental and the control group during the first measurement. Thus, both groups were homogeneous also from this point of view.

Regarding the second measurement, we observed a significant reduction in the heart rate for the experimental group ( $79.26 \pm 14.77$  bpm to  $72.65 \pm 12.11$  bpm,  $p = 0.001$ ). Compared to the first measurement, the others parameters remained stable in this group. However, in the control group, blood pressure, heart rate, and cortisol levels were significantly increased in the second measurement compared with the first, whereas glucose levels were significantly reduced.

Importantly, we observed differences in several parameters between both groups when we analyzed the second measurement. These were significantly lower for blood pressure (both, systolic [ $115.15 \pm 13.59$  mmHg vs.  $123.22 \pm 16.55$  mmHg,  $p = 0.007$ ] and diastolic [ $68.02 \pm 10.22$  mmHg vs.  $76.67 \pm 11.85$  mmHg,

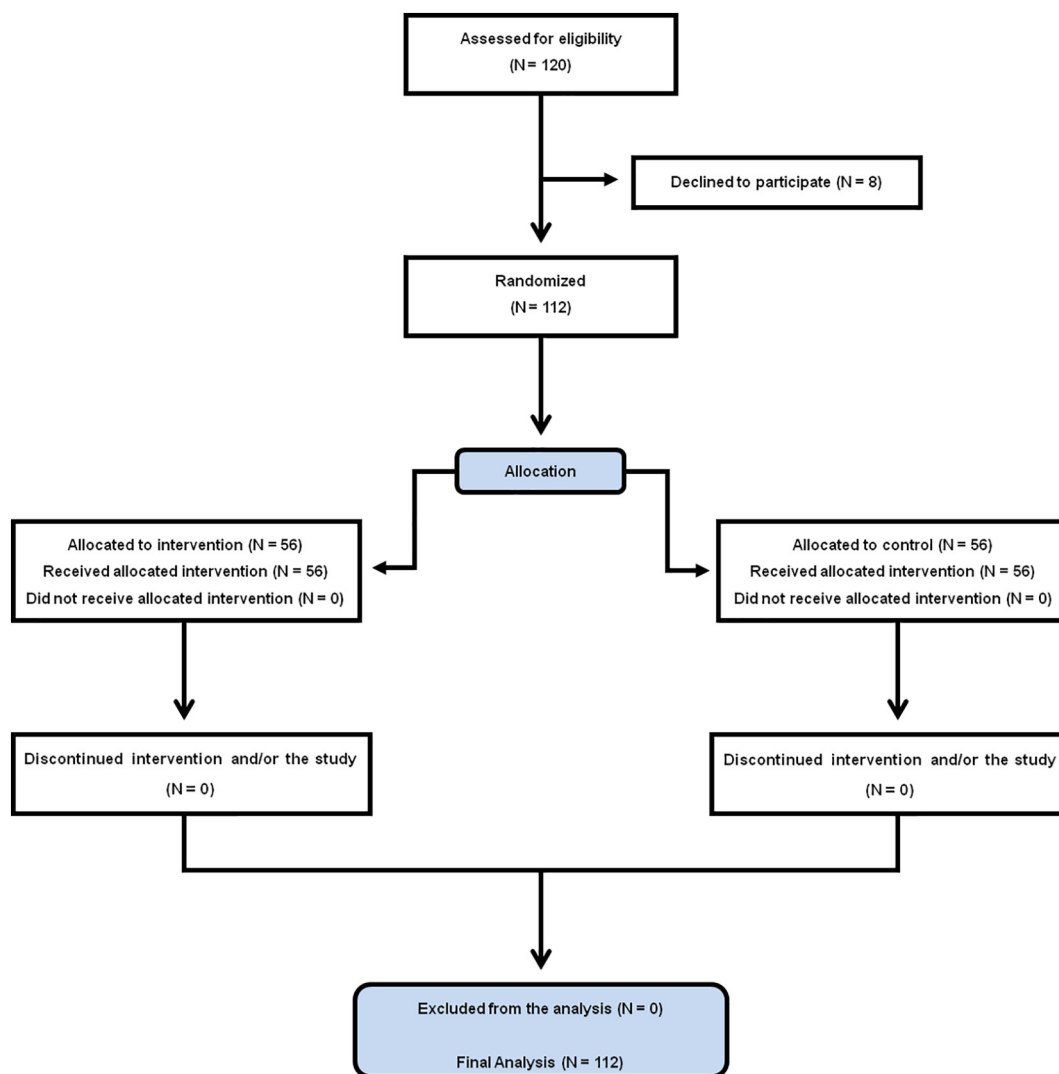


Fig. 1. Flow chart of the study.

Table 1 Sociodemographic data.

	Experimental group N = 56	Control group N = 56	p-Value
Sex, n (%)			
Male	14 (25)	14 (25)	1.000
Female	42 (75)	42 (75)	1.000
Age (years), mean (SD)	24.24 (5.61)	24.53 (6.89)	0.802

SD = standard deviation.

$p < 0.001$ ]), heart rate ( $72.65 \pm 12.11$  bpm vs.  $84.20 \pm 16.80$  bpm,  $p < 0.001$ ) and cortisol levels ( $142.87 \pm 65.81$  ng/mL vs.  $196.70 \pm 79.85$  ng/mL,  $p < 0.001$ ).

We also investigated the percentage of students that increased or reduced the values of the parameters from the first to the second measurement. Hence, most students of the experimental group suffered a reduction of the heart rate in the second measurement without significantly different increase or reduction in any of the other parameters. On contrary, a higher proportion of students from the control group increased the systolic and diastolic blood pressures, heart rate and cortisol levels in the second measurement. As expected, glucose decreased in most students from both groups (Table 3).

Finally, the academic performance was evaluated after having the scores of the exam. The experimental group had a mean score of

$5.07 \pm 1.59$  points, which was significantly higher compared with the mean score of the control group ( $4.42 \pm 1.58$  points,  $p = 0.033$ ). By categorizing the exam score as pass or fail, the proportion of fails in the control group was higher than in the experimental group (35 [62.5%] vs. 24 [42.9%],  $p = 0.037$ ).

#### 4. Discussion

In the present study, the combined intervention of PMR and music therapy has demonstrated to avoid the increase in blood pressure, heart rate and cortisol levels, which are strongly associated with higher stress. This intervention also improved the academic results in university students from the Nursing degree.

Stress is a “physiological and/or psychological reaction to an event that is perceived as threatening or burdensome” (Riggio, 2015). The levels of stress in Nursing students vary from moderate to high, and several studies have pointed to exams as the main source of academic stress (Shukla et al., 2013; Yamashita et al., 2012), together with the relationship with professors (Bagcivan et al., 2015), heavy workloads (Suresh et al., 2013) and the academic sphere per se.

For these reasons, it is important to help Nursing students with appropriate and specific interventions that result in positive outcomes. With this regard, numerous studies have analyzed the effectiveness of diverse techniques for coping with the stress before exams. To date,

**Table 2**  
Values of the variables measured before and after the intervention: between both groups and intra-group variability.

	Experimental group	Control group	p-Value (inter-group)
<b>Systolic blood pressure (mmHg), mean (SD)</b>			
1st measurement	113.84 ± 14.77	112.59 ± 16.15	0.530
2nd measurement	115.15 ± 13.59	123.22 ± 16.55	0.007
p-Value (intra-group)	0.289	< 0.001	
<b>Diastolic blood pressure (mmHg), mean (SD)</b>			
1st measurement	70.19 ± 9.79	66.09 ± 13.27	0.591
2nd measurement	68.02 ± 10.22	76.67 ± 11.85	< 0.001
p-Value (intra-group)	0.235	< 0.001	
<b>Heart rate (beats per minute), mean (SD)</b>			
1st measurement	79.26 ± 14.77	77.45 ± 16.15	0.060
2nd measurement	72.65 ± 12.11	84.20 ± 16.80	< 0.001
p-Value (intra-group)	0.001	< 0.001	
<b>Oxygen saturation (%), mean (SD)</b>			
1st measurement	98.04 ± 1.80	98.05 ± 2.50	0.442
2nd measurement	98.12 ± 1.62	98.33 ± 1.15	0.442
p-Value (intra-group)	0.822	0.496	
<b>Cortisol (ng/mL), mean (SD)</b>			
1st measurement	148.60 ± 66.46	152.22 ± 77.03	0.787
2nd measurement	142.87 ± 65.81	196.70 ± 79.85	< 0.001
p-Value (intra-group)	0.508	< 0.001	
<b>Glucose (mg/dL), mean (SD)</b>			
1st measurement	83.34 ± 17.85	80.30 ± 8.13	0.241
2nd measurement	78.23 ± 21.93	76.90 ± 5.97	0.670
p-Value (intra-group)	0.056	0.002	

SD = standard deviation.

most of them that studied the sources of stress and coping strategies used by Nursing students were cross-sectional and used self-administered tools that were very different in their quantity of elements, contents and even structure (Bagcivan et al., 2015; Graham et al., 2016; Khajehei et al., 2011), which may hinder the comparison and validation of the results. In addition, the results we present here include the serum cortisol and glucose levels. This is important since adrenaline, blood glucose, the lipid profile and particularly cortisol, have been previously related with stress in students before the exam period (Maduka et al.,

**Table 3**  
Experimental group: direction of the changes before (first measure) and after (second measure) the intervention.

		Experimental group		Control group	
		N (%)	p-Value	N (%)	p-Value
Systolic blood pressure	Reduction from the first measure	21 (37.49)	0.369	12 (21.42)	< 0.001
	Increase from the first measure	31 (54.35)		44 (78.57)	
	Same as the first measure	4 (7.14)		0 (0.0%)	
Diastolic blood pressure	Reduction from the first measure	28 (49.99)	0.242	13 (23.21)	< 0.001
	Increase from the first measure	24 (42.85)		41 (73.21)	
	Same as the first measure	4 (7.14)		2 (3.57)	
Heart rate	Reduction from the first measure	37 (66.07)	0.003	14 (25.0)	< 0.001
	Increase from the first measure	17 (30.35)		42 (74.99)	
	Same as the first measure	2 (3.57)		0 (0.0)	
Oxygen saturation	Reduction from the first measure	19 (33.92)	0.883	20 (35.71)	0.984
	Increase from the first measure	23 (41.07)		20 (35.71)	
	Same as the first measure	14 (24.99)		16 (28.57)	
Cortisol	Reduction from the first measure	29 (51.78)	0.642	11 (19.64)	< 0.001
	Increase from the first measure	27 (48.21)		44 (78.56)	
	Same as the first measure	0 (0.0)		1 (1.78)	
Glucose	Reduction from the first measure	41 (73.21)	0.001	40 (71.42)	0.002
	Increase from the first measure	15 (26.78)		16 (28.57)	
	Same as the first measure	0 (0.0)		0 (0.0)	

2015). These objective parameters avoid the possible bias of subjective answers in self-administered questionnaire or scales to assess the level of stress.

To the best of our knowledge, this is the first study combining PMR and music therapy as a method for the control of academic stress. There are studies that have analyzed the efficacy of music therapy or relaxation therapy separately (Lee et al., 2016; Pal et al., 2014; Shih et al., 2016), and others analyzed the effects of this combined therapy, but in different contexts and populations. Thus, Zhou et al. showed the effects of two combined therapies on depression, anxiety and the duration of the hospital stay, on women with breast cancer after a radical mastectomy (Zhou et al., 2015). The results in this context were also positive. There are also studies on the effects of music on the brain, and more specifically on aspects such as cognition, emotional processing, anxiety, and stress. Menon and Levitin, and later Salimpoor et al. (Menon and Levitin, 2005; Salimpoor et al., 2011), studied young subjects showing that listening to music had an influence on the physiological responses controlled by the autonomous nervous system. All of these results allow us to consolidate the hypothesis that music therapy is an excellent, easy-to-use, useful and accessible tool without negative secondary effects, applicable to various contexts and effective in the treatment of various psychiatric disorders in teenagers and youths, so it is deemed a safe and economic alternative treatment (Burrari et al., 2014; Melo et al., 2018; Mohammadi et al., 2014; Yinger and Gooding, 2015). A systematic review and meta-analysis has also corroborated the efficacy of music interventions on the treatment of hypertension (Kuhlmann et al., 2016), which also has been confirmed in our study, given that the control group had a significant increase in their blood pressure whereas it remain stabilized in the experimental group.

On the other hand, the efficacy of PMR therapy for the decrease of the student's exam stress has been proven as well (Pal et al., 2014; Prato and Yucha, 2013).

Taking the above information into account, we have proved that the combination of two interventions included in the Nursing taxonomy (Butcher et al., 2017), PMR and music therapy, was effective for the control and decrease of stress before exams. While several parameters increased in the control group from the first to the second measurement, with our intervention, we were able to maintain constant all of these in the 56 students from experimental group. Thus, the level of stress was lower in this group and importantly, the academic results were better. This is in agreement with some authors who stated that academic stress negatively affects the student's performance (Crego

et al., 2016; Labrague et al., 2017; Maduka et al., 2015). These results seem to evidence the need to establish strategies to prevent the occurrence of stress among the Nursing students before an exam or when facing other stressful situations from the discipline itself, such as oral exams, clinical practices and the performing of invasive techniques.

## 5. Limitations

There are some limitations to acknowledge. First, this research included only students in their second year of Degree. We recognize that to include students of different years would enhance the generability of the study, and this is an issue that we will take in mind in the future. Second, this study was conducted only in Nursing students, and therefore our results must be prospectively validated in University students from a larger variety of academic sectors and involving other Universities.

## 6. Conclusion

In this study including university students from the Nursing degree, the combination of PMR and music therapy was effective for the control and decrease of stress before exams. This intervention also demonstrated to improve academic results in this population of students.

## Funding source

None declared.

## Ethical approval

Ethical Committee from the Catholic University of Murcia (UCAM).

## Declaration of competing interest

The authors declare that they have not conflicts of interest.

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