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The Effect of Anxiety on Heart Rate and Blood Pressure among PT Students Prior and Post-AcademicExams.

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Abstract

Background: Anxiety generally impacts all the body's systems, including the cardiovascular, pulmonary, nervous, muscular, and reproductive systems.

Aim: To address how anxiety levels among physical therapy students of various study years relate to changes in heart rate and blood pressure throughout various exams, depending on the difficulty of the subject and whether this influences their level of worry.

Subjects and methods: This was a longitudinal study looking at how PT students' blood pressure and heart rates are affected by their anxiety before and after exams in varied materials based on the difficulty level.The subjects were healthy physical therapy students attending Kuwait University, and their age range was between 18 and 24 years. The sample included 60 students. 20 students were selected from each academic year of study.

Results: There were significant differences in systolic blood pressure before and after difficult and easy exams $p<0.05$, with the third-year group having the highest differences. However, there were no significant differences in heart rate changes before or after exams $p>0.05$. There were no significant differences in heart rate changes between the three student groups, regardless of exam difficulty level or year of study $p>0.05$.

Conclusion: Readjusting the curriculum to minimize the overload on the students, create a relaxed examination environment, and teach the students better ways to cope with stress prior to each exam. Mentor the students' psychological and mental health by having an adviser office that they can reach out for.

Keywords: Anxiety, Heart rate, Blood pressure, PT students, Exams

Introduction

Among all psychological disorders, anxiety disorders are one of the most prevalent disorders globally, which can be described as feelings of worry, nervousness, and fear **(1)**. During early life, Psychotic disorders are likely to begin as a result of stressful or traumatic encounters where both environmental and genetic components may contribute to the development of anxiety disorders **(1)**.

This, in terms, will have an influence on a wide range of people, typically students, from various age groups, gender variances, and environments. Due to anxiety, many aspects of students' lives will be disturbed. Their study findings have shown that anxiety disorders have a great effect on students' academic performance, social interaction, and personal development **(2)**. Students being subjected to distressing everyday occurrences are highly correlated with both an increase in physical and psychological negative signs. Anxiety psychological symptoms are linked to low concentration, memory loss, and cognitive dysfunction, which can lead to academic failure and poor educational performance, both of which can result in severe anxiety that can progress into mental disorders **(3)**. While stress can trigger physical signs such as increased heart rate, shortness of breath, rapid breathing, dizziness, nausea, stomach cramps, muscle tension and trembling, etc., based on several factors such as how challenging the subject is, the pressure from parents, feeling unprepared, high competitiveness among students and inadequate time management, etc.**(4)**.

In addition, anxiety generally involves impacting all the body's systems, such as the cardiovascular, pulmonary, nervous, muscular, and reproductive systems. Regarding the cardiovascular system, the onset of acute cardiac events and the long-term development of atherosclerosis are both correlated with acute and chronic mental stress. Moreover, they are related to an increase in blood pressure, heart rate, and peripheral microvascular constriction. There are two types of stress: acute mental stress, which may arise from anger, fear, or job strain, and chronic stress, which may arise from long-term or repetitive stress exposure **(5)**.

Atherosclerosis can be advanced, and acute CV illness may begin as a result of stress-induced hemodynamic, vascular, and inflammatory alterations, according to emerging epidemiological and experimental evidence**(6)**. This is true for high-risk people. Furthermore, longitudinal studies have demonstrated a link between increased cardiovascular (CV) reactions to demanding tasks and the long-term development of hypertension and an elevated risk of heart disease. Vascular hypertrophy, which is brought on by repeated cardiac contractions and gradually increases peripheral resistance, aids in the development of existing hypertension. In addition, there is a connection between developing atherosclerosis and systolic blood pressure that rises in reaction to mental stress**(7)**. The growth of atherosclerosis, instability of plaque, and an elevated risk of developing heart failure are all facilitated by sympathetic activation brought on by psychological stress. Acute emotional stress can result in heart failure syndrome, which can clinically be present as acute ST-segment elevation myocardial infarction. This condition is typically characterized by reversible balloon-like left ventricular wall motion abnormalities that are linked to myocardial infarction. rise a left ventricular apex and, in a few rare instances, a central ventricle without a major coronary artery obstruction are characteristics of Takotsubo Syndrome (TTS), often known as "broken heart syndrome." It is believed to be brought on by the

sympathetic nervous system's excessive activation, which is triggered by both mental and physical stress **(8)**.
This study aimed to address how anxiety levels among physical therapy students of various study years relate to changes in heart rate and blood pressure throughout various exams, depending on the difficulty of the subject and whether this influences their level of worry.

Research questions
1. Does anxiety change heart rate and blood pressure prior to and after physical therapy students' exams? 2. Does the difficulty levels of the subjects may affect the heart rate and blood pressure of physical therapy students? 3. What effects might environmental changes and life events have on physical therapy students' level of anxiety? And 4. Does the relationship between each academic year's level and levels of anxiety affect heart rate and blood pressure changes among physical therapy students?

Research hypothesis
1. It is anticipated that anxiety will adversely affect physical therapy students' heart rate and blood pressure levels, and 2. It is anticipated that Anxiety can reach higher levels as students approach their final years of study in physical therapy students.
Subjects and methods
This was a longitudinal study looking at how PT students' blood pressure and heart rates are affected by their anxiety before and after exams in varied materials based on the difficulty level.The subjects were healthy physical therapy students attending Kuwait University, and their age range was between 18 and 24 years. The sample included 60 students. Twenty students were selected from each academic year of study.
Inclusion criteria: From the second year, we chose students who examined fundamental procedures in physical therapy with electrotherapy. For the third year, we picked the students who were taking cardiopulmonary and exercise physiology. For the fourth-year students, they examined pharmacology and professional issues.
Exclusion criteria: Subjects were excluded if they had heart conditions, were diagnosed with anxiety by a psychologist, or were students who already knew about the study. Also, subjects who were athletes were excluded because their participation may alter the results' final values of heart rate and blood pressure.
Methods
Procedures
Prior to conducting the physical examination for each subject, data were collected in the datasheet, which included name, age, phone number, study year, any health conditions, diagnosed mental illnesses, and any smoking history. Then, if they fit the inclusion criteria explained previously, their consent will be taken verbally before conducting the examination, which includes measuring their heart rate using a pulse oximeter placed on the index finger and measuring their blood pressure using an electrical blood pressure monitor placed above the brachial artery in a seated position, and the measurements were documented. This procedure was repeated twice on each subject for both exams. The first trial was prior to the exam (2 hours maximum), and the second trial was post-event (2 hours maximum).This procedure was conducted again on the same subject in a different exam for another course, and measurements will be documented and compared.After the physical examination, a link to the questionnaire

was sent to each participant to complete. The questionnaire provided information about the participant's social life, mental health, physical activity level, and culture.

Data management and analysis: The Statistical Package for Social Sciences (SPSS) was utilized in the study to analyze the data. The ratio scale data will be displayed as percentages, means, and standard deviation. The questionnaire's responses will be gathered using Google Forms.

Results

Table (1) displays the demographic features of the participants in the study.

Demographic characteristics		**Frequency**	**%**
Gender	**Male**	9	%15.0
	Female	51	%85.0
Year of Study	**Second**	20	%33.3
	Third	20	%33.3
	Fourth	20	%33.3
		M	**Std. D**
Age		20.90	1.11

Of the 60 participants, 9 (15%) were male, and 51 (85%) were female. This gender gap is due to the lack of males who are enrolled in the physical therapy program.in The participants were evenly distributed across the second, third, and fourth years of study, with 20 participants (33.3%) in each category. The mean age of the participants was 20.90 years, with a standard deviation of 1.11. (Table 1)

Table (2) shows repeated measures of ANOVA to find differences between heart rates baseline before and after difficult exams for physical therapy students.

	Mean	Std. D	S.E	Repeated measures ANOVA					
				Wilks' lambda	F value	Hypothesis df	Error df	Sig (two-tailed)	Partial Eta Squared
Heart rate Baseline (difficult exam)	91.30	11.311	1.46	.862	4.650*	2	58.000	.013	.138
Heart rate before (difficult exam)	96.18	17.24	2.22						

Heart rate after (difficult exam)	89.60	13.19	1.70						

*Significant at 0.05

The mean heart rate at baseline was 91.30, while the mean heart rate before and after the difficult exam was 96.18 and 89.60, respectively. The paired t-test results indicate a significant difference between heart rate before and after the difficult exam (t = 2.22, p = 0.032, two-tailed). (Table 2)

Table (3) shows repeated measures ANOVA to find differences between heart rates baseline before and after easy exams for physical therapy students.

	Mean	Std. D	S.E	Repeated measures ANOVA					
				Wilks' lambda	F value	Hypothesis df	Error df	Sig (two-tailed)	Partial Eta Squared
Heart rate Baseline (easy exam)	91.30	11.311	1.46	.734	10.515**	2.000	58.000	.000	.266
Heart rate before (easy exam)	90.23	13.87	1.79						
Heart rate after (easy exam)	84.75	13.06	1.68						

**significant at 0.01

The mean heart rate at baseline was 91.30, while the mean heart rate before and after the easy exam was 90.23 and 84.75, respectively. The paired t-test results indicate a significant difference between heart rate before and after the easy exam (t = 4.142, p = 0.000, two-tailed). (Table 3)

Table (4) shows repeated measures ANOVA to find differences between Systolic baseline. Before and after difficult exams for physical therapy students

	Mean	Std. D	S.E	Repeated measures ANOVA					
				Wilks' lambda	F value	Hypothesis df	Error df	Sig (two-tailed)	Partial Eta Squared
Systolic Baseline (difficult exam)	120.86	15.59	2.01	.845	5.320*	2.000	58.000	.008	.155
Systolic before (difficult exam)	130.86	18.11	2.33						

Systolic after (difficult exam)	124.95	15.81	2.04						

*Significant at 0.05

The mean systolic blood pressure at baseline was 120.86, while the mean systolic blood pressure before and after the difficult exam was 130.86 and 124.95, respectively. The paired t-test results indicate a significant difference between systolic blood pressure before and after the difficult exam (t = 2.787, p = 0.008, two-tailed). (Table 4)

Table (5) shows repeated measures of ANOVA to find differences between the systolic baseline.
Before and after easy exams for physical therapy students

	Mean	Std. D	S.E	Repeated measures ANOVA					
				Wilks' lambda	F value	Hypothesis df	Error df	Sig (two-tailed)	Partial Eta Squared
Systolic Baseline (easy exam)	120.86	15.59	2.01	.970	.897	2.000	58.000	.413	.030
Systolic before (easy exam)	124.05	16.36	2.11						
Systolic after (easy exam)	120.83	16.99	2.19						

The mean systolic blood pressure at baseline was 120.86, while the mean systolic blood pressure before and after the easy exam was 124.05 and 120.83, respectively. The paired t-test results indicate that there is no significant difference between systolic blood pressure before and after the easy exam (t = 1.240, p = 0.220, two-tailed). (Table 5)

Table (6) shows a one-way ANOVA to compare students' groups' heart rate differences before and after difficult and easy exams.

	Descriptive				One way ANOVA					
	N	Mean	Std. D	S.E		Sum of Squares	df	Mean Square	F	Sig.
Heart rate differences are a difficult exam.										
Second year	20	11.90	15.21	3.40	Between Groups	913.033	2	456.517	1.649	.201
Third year	20	2.65	21.62	4.83	Within Groups	15783.550	57	276.904		
Fourth-year	20	5.20	11.45	2.56	Total	16696.583	59			

Total	60	6.58	16.82	2.17						
Heart rate differences easy exam										
Second year	20	5.40	11.01	2.46	Between Groups	99.433	2	49.717	.430	.653
Third year	20	7.10	8.24	1.84	Within Groups	6593.550	57	115.676		
Fourth-year	20	3.95	12.55	2.80	Total	6692.983	59			
Total	60	5.48	10.65	1.37						

There were no significant differences in heart rate changes before and after exams, regardless of exam difficulty level or year of study p>0.05. (Table 6)

Table (7) showsa way ANOVA can be used to compare students' groups in Systolic differences between before and after difficult and easy exams.

	Descriptive				One way ANOVA					
	N	Mean	Std. D	S.E		Sum of Squares	df	Mean Square	F	Sig.
Systolic differences difficult exam										
Second year	20	-.20	15.51	3.46	Between Groups	3634.633	2	1817.317	4.453*	.016
Third year	20	16.90	23.95	5.35	Within Groups	23261.950	57	408.104		
Fourth-year	20	1.05	20.24	4.52	Total	26896.583	59			
Total	60	5.91	21.35	2.75						
Systolic differences easy exam										
Second year	20	-2.85	13.70	3.06	Between Groups	2691.733	2	1345.867	3.985*	.024

Third year	20	12.55	20.96	4.68	Within Groups	19248.450	57	337.692		
Fourth-year	20	-.05	19.64	4.39	Total	21940.183	59			
Total	60	3.21	19.28	2.48						

*Significant at 0.05

There were significant differences in systolic blood pressure differences between the three student groups after taking both the difficult and easy exams P<0.05. The third-year group consistently had the highest systolic blood pressure differences, while the fourth-year group had the lowest. (Table 7)

Table (8): shows- way ANOVA to compare students' groups in Diastolic differences between before and after difficult and easy exams

	Descriptive				One way ANOVA					
	N	Mean	Std. D	S.E		Sum of Squares	df	Mean Square	F	Sig.
Diastolic differences are a difficult exam.										
Second year	20	-1.05	17.48	3.91	Between Groups	2069.433	2	1034.717	2.526	.089
Third year	20	7.00	25.13	5.61	Within Groups	23345.500	57	409.570		
Fourth-year	20	-7.35	17.06	3.81	Total	25414.933	59			
Total	60	-.46	20.75	2.67						
Diastolic differences easy exam										
Second year	20	-3.45	10.58	2.36	Between Groups	954.316	2	477.158	3.170	.050
Third year	20	4.36	9.39	2.15	Within Groups	8429.921	56	150.534		
Fourth-year	20	-4.85	15.74	3.52	Total	9384.237	58			
Total	60	-1.40	12.71	1.65						

The one-way ANOVA results show that there was not a significant difference between the groups in difficult and easy exams p>0.05. (Table 8)

Discussion

Anxiety during the examination period is a very common phenomenon that negatively affects many aspects, such as the student's performance and hemodynamics, which we are concerned about in this study.

The results supported our first hypothesis, which stated that anxiety will adversely affect physical therapy students' heart rate and blood pressure levels. Similar to a previous study**(9)**, we found a strong relationship between anxiety and hemodynamic changes in which a high level of anxiety was associated with an increase in heart rate, blood pressure, and peripheral microvascular constriction due to sympathetic nervous system activation. Another study showed that repeated cardiac contractions cause vascular hypertrophy, which gradually raises peripheral resistance and contributes to the development of hypertension. Furthermore, there is a direct link between increased systolic blood pressure in response to mental stress and the development of atherosclerosis. Emerging epidemiological and experimental evidence suggests that stress-induced hemodynamic, vascular, and inflammatory changes may interact and play an important role in the progression of atherosclerosis and the initiation of acute CV disease.

Furthermore, our second hypothesis, which stated that anxiety can reach higher levels as students approach their final years of study among physical therapy students, is similar to a previous study[10] on nursing students, which demonstrated that as nursing students approach their graduation year, their test anxiety levels tend to increase in comparison to first-year students. Surprisingly, our study found that third-year students experienced the greatest anxiety levels according to the physical examination of HR and BP before and after taking the difficult and easy exams, in addition to their high scores on the modified PHCC TEST anxiety questionnaire. Second-year students reported moderate anxiety levels, while fourth-year students reported the least amount of anxiety.

We think that the reason behind this unexpected result (third-year students experiencing the highest anxiety levels) is that third-year students have more materials to study than fourth-year students, in addition to clinical rotations that they are not used to like fourth-year students. Second-year students have more materials than third-year students, but they don’t have clinical rotations yet. We think fourth-year student experienced the lowest anxiety levels because the materials were no longer surprising for them; they got used to the examination, and clinical hours have become a part of their daily life routine.

In addition, our research has covered a previous study’s (10) limitation, as they mentioned in their papers that the difficulty level of each exam or subject may have influenced their outcome. In our study, we repeated the physical examination in two exams with different difficulty levels for each study year, according to the students' opinions of deciding which subject was challenging and which one was not.

We also covered the environmental aspects that could influence the student's anxiety and hemodynamic fluctuations under stress, as there's a great emphasis on the lifestyle and the impact of students' level of anxiety. From how active they are to what type of diet they follow and what other habits might affect the outcomes, it can all have a significant effect on their tolerance to stress of any kind, especially test stress. A previous study**(11)** supports this idea, as well as our research, that indeed, students will have significantly raised levels of anxiety and stress due to lack of sleep, skipping breakfast meals, and not being physically active. Another study also talked about physical fitness and its impact on the cardiorespiratory system**(12)**. IT stated that the effect of being physically active would decrease the amount of anxiety and create a way to prevent it. In return, your tolerance will improve in any sudden anxiety situation because that particular student will learn to breathe and take in what they might be facing. Our

results showed no correlation between anxiety and physical fitness in exercising or following a healthy diet, as it showed that the group with the highest anxiety levels is the group that sticks to exercising regularly and following a healthy diet. However, we think that we didn't cover these aspects fully, and further research is needed. When it comes to the environment and family support, it was clear that family pressure is a major factor in students' exam anxiety, as the group with the highest anxiety level deals with greater family pressure.

Conclusion

Readjusting the curriculum to minimize the students' overload, creating a relaxed examination environment, and teaching the students better ways to cope with stress prior to each exam. Mentoring the students' psychological and mental health by having an adviser office that they can reach out to.

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Ethical approval

Before collecting the data, the HSC ethics committee approved the study's conduct.

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