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PhD Students' Perceptions and Strategies For Managing Stress During Their PhD Studies

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Abstract: The combined effects of academic demands, the need for effective time management, balancing work and personal commitments, and financial challenges lead to a significant degree of stress among PhD students. Understanding how stress is perceived and managed is crucial to understanding the challenges faced by PhD students during their most intense period of academic study. The study aims to examine how doctoral students display stress during their studies. A specially designed Questionnaire on how doctoral students perceive and manage stress during their studies was created for this study. It had seven items, and respondents were asked to rate their level of agreement with each one on a five-point Likert-type scale. A sample of 438 doctoral students from the Republic of Serbia with varying demographic, professional, and academic characteristics was used in the study. ANOVA and correlation tests, among other statistical analyses, revealed a high degree of stress related to difficulties balancing personal and academic commitments, particularly for doctoral students who are self-funded and have jobs. Gender differences show that female PhD students experience higher levels of stress, older PhD students struggle to find time for relaxation, and employed respondents report higher levels of stress than their counterparts without jobs. Scientific disciplines also differ, so that PhD students in the humanities report high levels of pressure. In contrast, those in the natural and technical sciences are less stressed by the competitive aspect of their study. The results emphasize the necessity of specialized institutional support services, such as financial aid, mentorship, and adaptable stress management programs, in order to reduce stress and enhance PhD students' academic experiences.

Keywords: *stress, stressogenic aspects, doctoral studies, time management, academic institutional support.*

Introduction

Doctoral studies are the most advanced form of academic education that an individual can pursue, offering the opportunity to acquire the specialized knowledge and skills required to address complex issues in various scientific and artistic disciplines. Despite the wealth of prospects for professional growth that doctoral studies offer, they are frequently accompanied by several difficulties that can have a detrimental impact on doctoral students' academic performance and mental health. PhD students frequently experience higher levels of stress during their studies due to issues including having too many responsibilities, time constraints, financial instability, a competitive environment, and demanding academic requirements. Furthermore, certain stressors, like the academic environment's competitive culture and the varying expectations in scientific disciplines, can impede doctoral students' progress and general productivity (Pyhältö et al., 2009; Levecque et al., 2017; Karaman et al., 2019; Tadić and Kordić, 2023).

According to the majority of authors, stress is a person's psychophysiological response to an imbalance between their personal resources and the needs of their environment, whereby they believe that the demands of the situation are greater than their capacity (Lazarus and Folkman, 1984). In an academic setting, stress in doctoral students is frequently caused by the belief that the demands of their studies are

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too much for them, which can result in emotions of dissatisfaction and personal insecurity (Bedewy and Gabriel, 2015; Maluckov, 2018). According to the research findings, the most frequent causes of stress for doctoral students are complicated tasks like writing a doctoral thesis, assessing one's accomplishments, balancing personal and academic commitments, and expectations surrounding the publication of scientific papers (Stubb et al., 2011, 2012; Schmidt and Hansson, 2018).

The authors of the relevant articles often examine the causes of stress from two fundamental perspectives: institutional and individual. PhD students report feeling more stressed on an individual basis due to issues like time management, financial strains, and balancing personal and academic obligations (Jairam and Kahl, 2012; Alkhawaldeh et al., 2023; Milovanović et al., 2023). However, during their studies, PhD students experience more anxiety and insecurity due to institutional factors like regular performance reviews, a competitive environment, and a lack of mentorship support (Schmidt and Hansson, 2018; Sverdlik et al., 2018).

Furthermore, PhD students' perceptions of stress are significantly influenced by their professional and demographic characteristics. According to earlier studies, female PhD students are more likely than their male counterparts to experience higher levels of stress, which may be related to taking on more social tasks and obligations (Cotton et al., 2017; Schmidt and Hansson, 2018). While unemployed PhD students report lower levels of stress than working ones, who have to handle professional and academic obligations, older PhD students are more likely to struggle to find time for relaxation (Sverdlik et al., 2018; Barry et al., 2018; Husić and Dautbegović, 2023). An individual's experience of stress during the most advanced period of academic study is significantly influenced by their financial status. While self-funded students often feel more strain due to the high cost of their studies, PhD students who receive budgetary support report feeling less stressed (Lovitts, 2001; Cotton et al., 2017). Additionally, the nature of study programs can affect stress levels. For example, students in the natural and technical sciences frequently have to deal with the demands of laboratory research and results publication, whereas students in the social sciences and humanities report higher levels of stress because of the difficulties of conducting field research (Stubb et al., 2012; Schmidt and Hansson, 2018; Miltojević et al., 2022).

Anxiety, depression, and burnout are among the detrimental effects of high stress levels on PhD students' mental health (Pascoe et al., 2020). Additionally, stress might lower a person's academic performance and satisfaction with studies (Bedewy and Gabriel, 2015). A combination of individual tactics, including time management techniques, utilizing social support, building mental resilience, and implementing institutional measures, is necessary for effective stress management (Walker et al., 2008; Pyhältö et al., 2012; Turkal et al., 2018; Trigueros et al., 2020). Flexible academic requirements, mental health promotion programs, and consistent mentorship assistance are some ways that higher education institutions can help reduce stress (McAlpine and McKinnon, 2013; Lonka and Ketonen, 2019; Simić and Vranješević, 2022). The key to lowering stress and improving doctoral students' academic performance lies in effective time management, as well as intellectual and social support (Pyhältö et al., 2012; Mijatović and Strižak, 2023; Knežević and Polak, 2024).

Research analyzing the differences in stress levels based on academic, occupational, and demographic variables is uncommon, despite the large number of studies on the prevalence of stress among PhD students. Although time management techniques, institutional support, and mentoring have been recognized as important stress-reduction variables, little is known about how these elements impact various PhD student populations. In order to identify the variations in the levels of particular aspects of stress among various groups of doctoral students and the relationship between the level of certain aspects of stress and age and length of work experience, the research was conducted in the context of examining the expression of key stress-inducing factors, adhering to the previously mentioned framework. Additionally, the study analyzed the overall stress level and found correlations and variations among the variables indicated.

Materials and Methods

The study aims to investigate how doctoral students manage stress while pursuing their doctoral degrees. The goal was operationalized using the following tasks:

1. To investigate how different stress-managing factors manifest during doctoral studies, such as the capacity to control stress, the ability to find positive ways to lessen overload, the ability to cope with a competitive environment, the effectiveness of time management, the frequency of achievement

evaluations, the ability to balance academic and personal commitments, the ability to secure quality free time for relaxation, and the overall level of stress;

2. Ascertain the differences in the level of success of using the named stress management techniques in light of the various academic, professional, and demographic traits of PhD students;
3. Ascertain the relationship between doctorate students' age and duration of work experience and the ability to manage stress;
4. Identify the differences in the overall stress management associated with doctoral studies, taking into account the various academic, professional, and demographic traits of doctoral students;
5. To identify the correlation between doctoral students' age and duration of job experience and the overall degree of stress management behaviours associated with their studies.

The primary research hypothesis is that PhD students experience a significant amount of stress while pursuing their degrees. Additionally, the following auxiliary hypotheses were proposed:

H_1: The ability to manage stress, finding constructive ways to reduce overload, coping with a competitive environment, time management efficiency, the frequency of achievement evaluations, balancing academic obligations with personal life, and securing quality free time for relaxation are all significant stress-managing aspects of doctoral studies. These factors are reflected in the overall stress level of doctoral students, with those who manage their time more effectively reporting lower levels of stress.

H_2: Certain aspects of doctoral students' stress levels vary statistically significantly based on their academic, professional, and demographic characteristics; female doctoral students, unemployed students, and students who finance themselves all exhibit higher levels of stress, whereas no statistically significant difference was found when it came to belonging to a particular scientific or artistic field;

H_3: There is a statistically significant correlation between doctoral students' age and length of job experience and the degree of specific stressors, with older doctoral students and those with more work experience reporting greater levels of stress;

H_4: While there are no differences observed between doctoral students in different scientific or artistic fields, there are statistically significant differences in the overall level of stress among doctoral students when taking into account various demographic, professional, and academic characteristics; male doctoral students who are employed and self-financed exhibit a higher level of stress;

H_5: There is a statistically significant correlation between doctoral students' total stress level and their age and length of work experience; older doctoral students report higher levels of stress overall, but there is no significant correlation between the two variables.

The study included 438 doctoral students, 62.6% of whom were female, from various universities in the Republic of Serbia who are currently enrolled in doctoral programs. The average age of the respondents is M = 31.63 (SD = 4.81), with a range of 21 to 45 years. With an average tenure of M = 6.71 years (SD = 4.42), the majority of respondents (92.2%) are employed. When it comes to the scientific and artistic fields, the highest percentage of participants (40.9%) came from the social and humanities, followed by the natural and mathematical sciences (21.5%), technical and technological sciences (17.6%), philological sciences (7.1%), and medical sciences (6.6%). Four respondents (1%) were from the fields of arts and agriculture, while 5.5% of respondents did not specify the profession to which they belonged. In terms of funding their education, over half of the respondents (45.0%) do so with assistance from the Republic of Serbia's budget, whereas 28.3% do it on their own. 13.9% of respondents said that their doctoral school expenses are covered by their employer, while 10.3% said that their employer and the Republic of Serbia's budget partially finance their studies. 2.5% of respondents mentioned other sources of funding for their doctoral studies. Table 1 displays the sample's professional, academic, and demographic attributes.

Table 1. *Demographic, academic, and professional characteristics of the sample*

	General sample characteristics	
Demographic characteristics	**Gender,** n (%)	
	Male	164 (37.4%)
	Female	274 (62.6%)
	Age (mean value (standard deviation), range)	31.63 (4.81), 21.00 – 45.00
Professional characteristics	**Employment status,** n (%)	
	Employed	404 (92.2%)
	Unemployed	34 (7.8%)
	Length of service (mean value (standard deviation), range)	6.71(4.42), 1.00 – 26.00
Academic characteristics	**Scientific/artistic field,** n (%)	
	Social and Humanities Sciences	179 (40.9%)
	Medical Sciences	29 (6.6%)
	Engineering and Technology Sciences	77 (17.6%)
	Natural and Mathematical Sciences	94 (21.5%)
	Philological Sciences	31 (7.1%)
	Other*	4 (1.0%)
	I was not selected for the position	24 (5.5%)
	Method of funding doctoral studies, n (%)	
	Funded by the Budget of the Republic of Serbia	194 (45.0%)
	Self-Funded by the Student	124 (28.3%)
	Funded by the Budget of the Employing Institution	61 (13.9%)
	Partially Funded by the Budget of the Republic of Serbia and the Employing Institution	45 (10.3%)
	Other	11 (2.5%)

* Due to the small number of respondents (N = 2) in the categories: Art and Agriculture, they were combined into the category "other"

For the purposes of the study, *A questionnaire on the perception and management of stress among doctoral students during their doctoral studies* was created. The questionnaire consists of seven items, with respondents rating their level of agreement on a five-point Likert-type scale (1 - completely agree, 2 - agree, 3 - undecided, 4 - disagree, 5 - completely disagree) for each of them. The items refer to: successful management of stress levels related to doctoral studies; finding constructive ways to reduce the burden of doctoral studies; the emergence of a competitive atmosphere at doctoral studies; time organization in order to continuously engage in doctoral studies; provision of quality free time or relaxation activities; constructive ways of accepting frequent evaluations of personal achievements and finding a balance between academic obligations. The questionnaire was designed to achieve the study's aim, and the metric features were subsequently determined.

The structure of the seven-question questionnaire was examined using factor analysis. The Kaiser-Meyer-Olkin test of sample adequacy was used to assess the reliability of the factor analysis, and the result was 0.840, indicating that the model's factor analysis may be conducted. The correlation between the questions was checked using *Bartlett's Test of Sphericity*. The test resulted in a value of $\chi^2 = 1382.917$ ($p < 0.001$), indicating that factor analysis can examine the questionnaire structure. Only one eigenvalue is greater than one, indicating that a single construct accounts for all seven items. A single factor explained 55.19% of the variance. This one-dimensional questionnaire assesses the ability of doctoral students to manage stress. Factor saturation for all items ranges from 0.828 to 0.616. The reliability is appropriate ($\alpha = 0.858$ to $\alpha = 0.829$), and the overall reliability of the questionnaire is strong ($\alpha = 0.860$). Table 2 presents the results of the factor analysis and reliability analysis.

Table 2. *Results of factor analysis, Varimax rotation*

	Initial *Eigen* values			Factor saturations	Crombach Alpha coefficient
	Total	Variance (%)	Cumulative values		
1	3.863	55.19	55.19	0.828	0,829
2	0.92	13.144	68.334	0.813	0,826
3	0.628	8.975	77.309	0.783	0,858
4	0.596	8.511	85.82	0.718	0,844
5	0.482	6.889	92.708	0.717	0,845
6	0.284	4.051	96.759	0.703	0,846
7	0.227	3.241	100.000	0.616	0,829

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.840, Bartlett's Test of Sphericity = 1382.917 (p < 0,001). α Total = 0,860

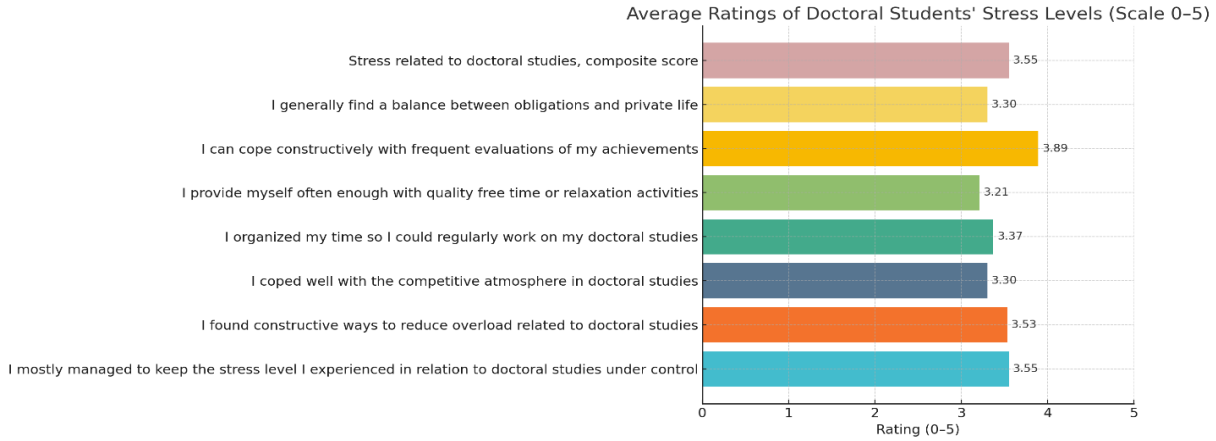
1 = Most of the time, I successfully controlled the level of stress I experienced in connection with doctoral studies, 2 = I found constructive ways to reduce the overload of doctoral studies, 3 = I tolerated well the emergence of a competitive atmosphere during doctoral studies, 4 = I organized my time so that I could regularly engage in my doctoral studies, 5 = I provide myself with sufficient quality free time or relaxation activities, 6 = I can deal constructively with frequent evaluations of personal achievement, 7 = I generally find a balance between obligations and private life.

The dimensionality of the questionnaire was investigated using factor analysis (Varimax rotation), and its reliability was assessed using the Cronbach's alpha coefficient. One-way ANOVA and Student's t-test were used to compare differences between groups. The Pearson correlation coefficient was used to assess the relationship between two numerical variables. The mean value with the appropriate standard deviation was employed to calculate descriptive statistics, whilst qualitative variables were given as frequencies and percentages. Statistical significance was defined as $p < 0.05$ for the null hypothesis. SPSS ver. 24 (*Statistical Package for the Social Sciences*) was used to process and analyze the research results.

Results

To investigate the ability to manage stress among doctoral students during their studies, numerous stress-management factors were examined in relation to the respondents' demographic, professional, and academic characteristics. The similarities and variations in stress management techniques among doctoral candidates with different characteristics were also examined.

The first research objective was to examine the prevalence rate of various stress-managing techniques during doctoral studies, including the ability to manage stress, finding constructive ways to reduce overload, coping with a competitive environment, the effectiveness of time management, the frequency of evaluation of achievements, balancing academic obligations with private life, and the ability to ensure quality free time for relaxation, as well as examining the general level of stress among doctoral students. The study's findings reveal that doctoral students generally manage well in a competitive environment (M = 3.99, SD = 0.99) and with frequent evaluations of their achievements (M = 3.89, SD = 0.90), perceiving these characteristics as less stressful. In contrast, the study results show that doctoral students feel more pressure in the segments related to controlling the level of stress experienced during their studies (M = 3.53, SD = 1.09), organizing their time (M = 3.37, SD = 1.26), and establishing a balance between academic obligations and their private life. While some PhD students successfully apply stress-reduction measures, others face significant difficulty in effectively managing these aspects (M = 3.53, SD = 1.10). It is crucial to note that doctoral students experience more difficulty in acquiring quality free time or engaging in relaxation activities (M = 3.21, SD = 1.35), resulting in insufficient time for rest and relaxation. The collected research findings show that the aforementioned elements imply a moderate level of stress management among PhD students (M = 3.55, SD = 0.84). Graph 1 illustrates the average ratings of various stress-related behaviours throughout PhD studies, as well as the overall average score of doctoral students' abilities to apply them.



Graph 1. Average perceptions of the stress-managing behaviours among PhD students

With regard to various demographic, professional, and academic characteristics of doctoral students (gender, work status, belonging to a certain scientific or artistic field, financing methods), the second research task aims to ascertain the differences in the level of success of using the named stress managing techniques (ability to manage stress, finding constructive ways to reduce overload, coping with a competitive atmosphere, efficiency of time management, frequency of evaluation of achievements, balancing academic obligations with private life, and the ability to ensure quality free time for relaxation).

Differences in respondents' judgments according to gender are evident in the examination of research findings on stress perception and stress management in PhD studies. In the areas of stress management and identifying productive strategies to lessen overload during coursework or thesis work, statistically significant gender disparities are evident. While female doctoral students exhibit a higher level of overall stress management ($M = 3.39$, $SD = 1.13$, $p < 0.01$) and find constructive ways to reduce overload ($M = 3.43$, $SD = 1.16$, $p < 0.01$), male doctoral students are more capable to control their stress level ($M = 3.78$, $SD = 0.99$, $p < 0.01$). No statistically significant gender differences were found in other stress-managing segments, such as managing a competitive environment, scheduling time, guaranteeing quality free time, constructively handling frequent evaluations of accomplishments, and creating a balance between responsibilities and personal life.

The research findings regarding differences in various aspects of stress management based on the employment status of the respondents indicate statistically significant differences between PhD students who are employed and those who are not, for the majority of studied factors. The statistical evidence supports the aforementioned claim that unemployed doctoral students are better able to handle the stress of their studies ($M = 4.12$, $SD = 0.95$, $p < 0.01$), find positive ways to reduce overload ($M = 4.03$, $SD = 0.97$, $p < 0.01$), learn how to manage the time needed to complete their studies ($M = 4.44$, $SD = 0.75$, $p < 0.01$), ensure quality leisure time ($M = 4.09$, $SD = 1.06$, $p < 0.01$), and balance their personal and professional commitments ($M = 4.00$, $SD = 1.10$, $p < 0.01$). However, when it came to managing the competitive environment and overcoming the regular evaluations of accomplishments required by PhD studies, the investigation revealed no statistically significant differences between employed and unemployed doctoral students. Regardless of the examinees' employment position, the challenges related to these areas of PhD study are common and equally severe.

There are statistically significant disparities in doctoral students' capacities to navigate a competitive environment, according to an analysis of respondents' perceptions of stress associated with doctoral studies across various scientific and artistic professions. Compared to those in other scientific or artistic disciplines, doctoral students in the scientific field of medical sciences ($M = 4.17$, $SD = 0.93$, $p < 0.05$) and those not elected to the title ($M = 4.17$, $SD = 0.87$, $p < 0.05$) are better able to handle the stresses of competition. On the other hand, in light of the prevailing competitive atmosphere during doctoral studies, respondents from the scientific discipline of Philological Sciences ($M = 3.58$, $SD = 1.29$, $p < 0.05$) exhibit a lower level of stress management. Doctoral students, coming from various domains report varying degrees of coping skills, including the Natural Sciences ($M = 3.77$, $SD = 1.07$, $p < 0.05$), Engineering and Technology Sciences ($M = 4.12$, $SD = 0.87$, $p < 0.05$), and Social Sciences ($M = 4.08$, $SD = 0.94$, $p < 0.05$). However, they are more skilled in coping techniques than those in the Philological Sciences. The

respondents classified as "other" (Art and Agriculture) exhibit a moderate level of stress management ($M = 3.75$, $SD = 1.26$, $p < 0.05$). No statistically significant differences were found among doctoral students of different scientific and artistic fields in other stress-management behaviors, such as time management, providing quality free time, frequency of achievement evaluations, effectiveness of managing stress related to studies, finding constructive ways to reduce overload, and balancing professional and private obligations. This suggests that these challenges have an equal impact on the presence of stress in all doctoral students, regardless of their specific academic discipline.

Statistically significant differences in stress management are observed concerning the method of financing doctoral studies, particularly in the areas of time management, maintaining quality free time, and balancing professional and personal obligations. Doctoral students funded by the Republic of Serbia's budget experience the highest stress-management abilities related to time management in meeting the demands of their doctoral studies ($M = 3.58$, $SD = 1.27$, $p < 0.05$). PhD students who receive partial funding from the Republic of Serbia's budget and/or their employer report slightly lower abilities in time management ($M = 3.02$, $SD = 1.25$, $p < 0.05$), indicating that combining multiple funding sources does not make time management any easier. The somewhat lower time management ability among self-financing students ($M = 3.22$, $SD = 1.21$, $p < 0.05$) could be a result of extra financial strains that make time management challenging. Doctoral students who receive funding from their employer's budget exhibit even more reduced stress-managing ability ($M = 3.30$, $SD = 1.24$, $p < 0.05$), indicating that time management remains challenging even with a steady income. Lastly, the group of PhD students who received funding from "other different ways" reported stress-managing levels that were comparable to those of self-funded students ($M = 3.27$, $SD = 1.35$, $p < 0.05$). This suggests that various unconventional funding sources can have comparable impacts on time management. When it comes to methods of funding doctoral studies, statistically significant variations in stress management are visible in the area of achieving quality leisure time. When it comes to planning their spare time, doctoral students who have alternative sources of funding report the highest score ($M = 3.73$, $SD = 1.27$, $p < 0.05$), which suggests that they have more time to relax and fewer demanding responsibilities. Furthermore, a major factor in reducing stress associated with time management is the financial stability of doctoral students, which is derived from funds allocated to their institution's budget ($M = 3.41$, $SD = 1.46$, $p < 0.05$). Although budget money ($M = 3.36$, $SD = 1.32$, $p < 0.05$) offers some assurance, free time management might still be challenging due to academic commitments. The lowest level of leisure time quality is experienced by self-funded PhD students ($M = 2.88$, $SD = 1.34$, $p < 0.05$), suggesting that financial difficulties may severely restrict their leisure time. Doctoral students who receive partial funding from the Republic of Serbia's and/or the institution's budgets ($M = 3.07$, $SD = 1.32$, $p < 0.05$) struggle to manage their free time; even with partial funding, they find it challenging to plan leisure activities. There were also statistically significant differences in the balancing of personal and professional commitments among PhD students based on the financing strategy. Doctorate students with various unconventional sources of funding exhibit the highest scores in this segment ($M = 3.64$, $SD = 1.12$, $p < 0.05$), suggesting that these sources of funding offer them more flexibility or extra resources that help them better balance their personal and professional commitments. Additionally, PhD students funded by the Republic of Serbia's budget ($M = 3.50$, $SD = 1.28$, $p < 0.05$) report finding a balance between their private lives and responsibilities more challenging. Doctoral students who get funding from their employer's budget report significantly lower scores ($M = 3.20$, $SD = 1.29$, $p < 0.05$), suggesting that while institutional funding can offer some stability, it can still present difficulties in balancing commitments. Similar to this, doctoral students who receive partial funding from both the Republic of Serbia's budget and their employer report an average score ($M = 3.18$, $SD = 1.17$, $p < 0.05$), indicating that it can be challenging to manage responsibilities when funding comes from several sources. Self-funded PhD students, on the other hand, report the lowest levels of balance ($M = 3.06$, $SD = 1.11$, $p < 0.05$), indicating that financial strain significantly impairs their ability to strike a balance between personal and professional obligations. Additionally, research findings on funding did not reveal statistically significant differences in how doctoral students cope with a competitive environment, find constructive ways to reduce overload, and manage frequent evaluations of their accomplishments.

There is a significant correlation between the age of the respondents and the ability to manage stress. Specifically, a substantial negative correlation ($r = -0.166$, $p < 0.01$) confirms that older PhD students are less likely to provide quality leisure time or relaxation activities. According to these findings, older PhD candidates struggle more to find time for rest and relaxation, which may be a contributing factor

to their elevated stress levels. However, there was no significant correlation found between the length of job experience and any particular component of stress management ability (the ability to manage stress, find constructive ways to reduce overload, deal with a competitive atmosphere, the effectiveness of time management, the frequency of evaluation of achievements, balancing academic obligations with private life, and the ability to ensure quality free time for relaxation), indicating that it is not a significant factor in determining how PhD students manage stress. Correlations between length of service and stress management ability are very low and not statistically significant ($p > 0.05$) ($r = 0.05$ for stress level control, $r = 0.049$ for finding constructive ways to reduce pre-load, $r = 0.034$ for coping with a competitive atmosphere, $r = 0.021$ for time management, $r = -0.094$ for ensuring quality free time, $r = -0.028$ for constructive behavior with frequent evaluation of achievements, $r = -0.024$ for balancing duties and private life).

Table 3 displays the results concerning the relationship between the age and the duration of work experience of the respondents and theeur ability to cope with the specific stressors.

Table 3. *Differences in doctoral students' levels of particular stress-management factors according to their academic, professional, and demographic traits, as well as the correlation between these factors and the students' ages and duration of work experience*

	Stress-management factors during doctoral studies						
General characteristics of the respondents	1	2	3	4	5	6	7
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
Gender (p)[a]	**< 0,01**	**< 0,01**					
Male	3.78(0.99)	3.71(1.00)	4.04(0.96)	3.45(1.22)	3.25(1.36)	3.99(0.86)	3.29(1.21)
Female	3.39(1.13)	3.43(1.16)	3.96(1.01)	3.33(1.28)	3.18(1.36)	3.83(0.93)	3.31(1.24)
Employment status (p)[a]	< 0.01	< 0.01		< 0.01	< 0.01		< 0.01
Not employed	4.12(0.95)	4.03(0.97)	3.97(0.97)	4.44(0.75)	4.09(1.06)	4.18(1.00)	4.00(1.10)
Employed	3.49(1.09)	3.49(1.11)	4.00(1.00)	3.28(1.26)	3.13(1.36)	3.87(0.89)	3.25(1.22)
Scientific/artistic field (p)[b]			**< 0.05**				
Social and humanities	3.55(1.13)	3.58(1.14)	4.08(0.94)	3.32(1.27)	3.13(1.36)	3.93(0.85)	3.30(1.18)
Medical sciences	3.76(1.06)	3.59(1.05)	4.17(0.93)	3.52(1.21)	3.21(1.24)	3.72(1.16)	3.45(1.18)
Technical and technological sciences	3.61(1.02)	3.48(1.07)	4.12(0.87)	3.36(1.22)	2.96(1.39)	3.79(0.95)	3.12(1.25)
Natural and mathematical sciences	3.32(1.12)	3.45(1.09)	3.77(1.07)	3.45(1.29)	3.39(1.30)	3.86(0.86)	3.30(1.29)
Philological sciences	3.35(1.14)	3.26(1.18)	3.58(1.29)	3.10(1.27)	3.19(1.40)	3.77(1.09)	3.26(1.26)
Other*	3.25(0.96)	3.25(0.96)	3.75(1.26)	3.25(1.50)	3.25(2.06)	4.25(0.96)	3.50(1.91)
Not appointed	4.04(0.81)	4.04(1.00)	4.17(0.87)	3.71(1.27)	3.83(1.34)	4.33(0.64)	3.83(1.20)
Method of funding doctoral studies (p)[b]				**< 0.05**	**< 0.05**		**< 0.05**
Funded by the Budget of the Republic of Serbia	3.54(1.13)	3.51(1.16)	4.06(0.99)	3.58(1.27)	3.36(1.32)	3.95(0.93)	3.50(1.28)
Self-Funded by the Student	3.53(1.02)	3.56(0.96)	3.94(0.94)	3.22(1.21)	2.88(1.34)	3.74(0.88)	3.06(1.11)
Funded by the Budget of the Employing Institution	3.59(1.19)	3.61(1.16)	4.00(1.05)	3.30(1.24)	3.41(1.46)	4.07(0.89)	3.20(1.29)
Partially Funded by the Budget of the Republic of Serbia and the Employing Institution	3.44(1.06)	3.36(1.21)	3.87(1.01)	3.02(1.25)	3.07(1.32)	3.73(0.86)	3.18(1.17)
Other	3.45(1.13)	3.82(0.98)	3.82(1.33)	3.27(1.35)	3.73(1.27)	4.09(0.83)	3.64(1.12)
	r	**r**	**r**	**r**	**r**	**r**	**r**
Age (p)[c]	-0.041	-0.026	-0.02	-0.058	**-0.166****	-0.067	-0.091
Years of employment service (p)[c]	0.05	0.049	0.034	0.021	-0.094	-0.028	-0.024

Stress-menagement factors: 1 = Most of the time, I successfully kept under control the level of stress I experienced in connection with doctoral studies, 2 = I found constructive ways to reduce the overload of doctoral studies, 3 = I coped well with the emergence of a competitive atmosphere during my doctoral studies, 4 = I organized my time in a way that allows me to focus on my doctoral studies regularly, 5 = I provide myself with enough quality free time or relaxation activities, 6 = I can deal constructively with frequent evaluations of my achievement, 7 = I generally find a balance between obligations and private life. Abbreviations: M (SD) = mean (standard deviation), r = Pearson correlation coefficient.

[a]Student's t test; [b]ANOVA test; [c]Pearson correlation coefficient
** Statistical significance at the < 0.01 level
The table shows values of p ≤ 0.05

The obtained research results demonstrate the existence of significant differences in the general ability to manage stress among doctoral students. The examined differences were related to doctoral students in regard to demographic, professional, and academic characteristics (gender, work status, belonging to a particular scientific or artistic field, and methods of financing). Although male respondents reported slightly higher levels of stress management (M = 3.64, SD = 0.78) compared to female doctoral students (M = 3.49, SD = 0.88), generally, coping with potential stress can not be attributed to gender differences. The degree of stress management varied statistically significantly based on employment status, with unemployed respondents demonstrating a higher capacity to manage stress during doctoral studies (M = 4.12, SD = 0.73) than employed doctoral students (M = 3.50, SD = 0.84), p < 0.01. The stress management associated with doctoral studies is similar for PhD students in the following scientific and artistic fields: Philological sciences (M = 3.36, SD = 0.92), Natural and Mathematical Sciences (M = 3.50, SD = 0.84), Medical Sciences (M = 3.63, SD = 0.92), Technical and Technological Sciences (M = 3.49, SD = 0.82), Social and Humanities (M = 3.55, SD = 0.83), the category "other" (Art and Agriculture) (M = 3.50, SD = 1.32), and those who were not appointed (M = 3.99, SD = 0.69). There are no statistically significant differences between PhD students who receive different forms of funding; however, those who self-finance (M = 3.42, SD = 0.80) and those who receive partial funding from the Republic of Serbia's and the institution's budget (M = 3.38, SD = 0.83) reported lower levels of stress management. In contrast, respondents who receive funding from the Republic of Serbia's budget (M = 3.64, SD = 0.87) and those who have "other different ways of financing" (M = 3.69, SD = 0.65) reported the highest levels of coping with stress. These variations are not statistically significant, though.

Table 4. *Differences in doctoral students' overall stress coping across various demographic, professional, and academic traits, as well as the correlation between overall stress coping and doctoral students' age and length of work experience*

General characteristics of the respondents	Stress related to PhD studies, total
Gender (p)[a]	**M (SD)**
Male	3.64 (0.78)
Female	3.49 (0.88)
Employment status (p)[a]	**< 0.01**
Not employed	4.12 (0.73)
Employed	3.50 (0.84)
Scientific/artistic field (p)[b]	
Social and humanities	3.55 (0.83)
Medical sciences	3.63 (0.92)
Technical and technological sciences	3.49 (0.82)
Natural and mathematical sciences	3.50 (0.84)
Philological sciences	3.36 (0.92)
Other*	3.50 (1.32)
Not appointed	3.99 (0.69)
Method of funding doctoral studies (p)[b]	
Funded by the Budget of the Republic of Serbia	3.64 (0.87)
Self-Funded by the Student	3.42 (0.80)
Funded by the Budget of the Employing Institution	3.59 (0.87)
Partially Funded by the Budget of the Republic of Serbia and the Employing Institution	3.38 (0.83)
Other	3.69 (0.65)
	r
Age (p)[c]	**-0.096***
Years of employment service (p)[c]	-0.002

Abbreviations: M (SD) = mean (standard deviation), r = Pearson correlation coefficient
[a]Student's t test; [b]ANOVA test; [c]Pearson correlation coefficient
* Statistical significance at the level < 0.05
The table shows values of p ≤ 0.05

The relationship between PhD students' overall stress management ability and their age and length of job experience was also analyzed as part of the study. According to the study's findings, older PhD candidates experience greater difficulty coping with stress related to their studies ($r = -0.096$, $p < 0.05$), whereas there was no significant correlation between stress levels and the length of job experience ($r = -0.002$, $p > 0.05$). According to these results, doctoral students' abilities in stress management are more significantly influenced by age as a demographic component than by professional experience.

Table 4 presents the findings from the analysis of variations in overall stress coping among PhD candidates with diverse demographic, professional, and academic characteristics. It also shows the correlation between the overall stress coping during PhD studies and the students' age and length of work experience.

Discussions

The study's objective was to investigate how PhD students experience stress, and it identified the ways students manage stress while pursuing their degrees. The established patterns, as determined by statistical results, validate that a variety of institutional, professional, and individual factors influence doctoral students' perceptions and stress levels (Bair and Haworth, 2004; Gardner, 2009; Barry et al., 2018).

The multifaceted nature of the stress management experience for doctoral students is illustrated by the examination of the manifestation of several stress-management behaviours throughout their doctoral studies. A high degree of competence in handling a competitive environment and regular performance reviews demonstrates that PhD students can effectively manage their stress levels in these areas, even in the face of a competitive setting and ongoing evaluations. However, there is a greater emphasis on managing stress through time management and finding a balance between personal and academic commitments. These factors are significant sources of coping with stress for PhD students. According to statistical data, the need to improve time management abilities and, consequently, reduce stress levels should be highlighted. For doctoral students, finding productive strategies to reduce overload and guarantee quality free time also presents obstacles. Although some PhD students are able to apply stress-reduction techniques successfully, many still struggle significantly with these areas. Research indicates that doctoral students often lack sufficient time for rest and relaxation, which has a detrimental impact on their overall and mental well-being. The results obtained support earlier studies that show doctoral students are resilient to academic stress, despite competition and frequent evaluations. Time constraints and overload continue to be major obstacles in managing stress, particularly for those balancing work and personal commitments (Jairam and Kahl, 2012; Cotton et al., 2017; Schmidt and Hansson, 2018; Sverdlik et al., 2018). Overall, the study's findings indicate that doctoral students deal with stress moderately ($M = 3.54$, $SD = 0.84$), suggesting that while they are able to manage certain aspects of stress effectively, there are still important issues that need further attention. The hypothesis, which holds that doctoral students who manage their time better deal with stress more easily, was partially confirmed based on the research findings. Time management has been recognized as a key stressor, which further supports its significance in lowering the feeling of stress, even if it is not the only factor that impacts the overall amount of stress among PhD students.

The analysis of the research findings reveals significant differences among respondents with varying demographic, professional, and academic characteristics in their perception and management of stress through stress-management techniques in the context of doctoral studies. First, based on the respondents' gender-based evaluations, male PhD students are better able to manage their stress levels and discover healthy strategies to reduce their study overload, whereas female PhD students exhibit lower levels of stress management in the aforementioned segments. According to earlier studies, women are more prone to stress due to their emotional sensitivity, adherence to gender norms, and the challenge of balancing work and personal commitments (Stubb et al., 2012; Watson and Watson, 2016; Cotton et al., 2017; Schmidt and Hansson, 2018; García-Martínez et al., 2021). These data support these findings. Other stress-management factors, such as managing a competitive environment, organizing time, guaranteeing quality leisure time, coping with frequent appraisals of accomplishments, and striking a balance between academic responsibilities and personal life, did not show statistically significant gender differences. This data supports the gender-disparities portion of the hypothesis, which states that female PhD students find it harder to manage stress. It also emphasizes the necessity of specific guidance techniques for female PhD students in order to lower their stress levels. The level of adaptability of both genders in a competitive setting disagrees with previous research, which suggests that men are more resilient to pressures from competition (Schmidt and Hansson, 2018).

The study's findings reveal that employed and unemployed doctoral students perceive stress in distinctly different ways. Compared to PhD students who were employed, unemployed students showed greater efficacy in managing study-related stress, identifying positive strategies to reduce overload, time management, finding free time, and balancing work and personal commitments. These findings align with earlier studies that have found unemployed PhD students to be better organized and experience less stress, as they have more time and flexibility to devote to their academic obligations (Sverdlik et al., 2018; Barry et al., 2018). However, doctoral students who are employed encounter additional difficulties because of their work commitments, which results in a shortage of time and resources for both academic work and appropriate stress management. Maintaining a balance between work and studies was identified as a major issue for this set of respondents, and this study demonstrates that it is challenging due to the combination of professional and academic expectations. However, no statistically significant differences were found between employed and unemployed doctoral students in the sections on overcoming frequent evaluations of accomplishments and dealing with a competitive atmosphere. This suggests that these challenges are universal regardless of employment status (Cotton et al., 2017; Schmidt and Hansson, 2018). The section of the hypothesis that predicts a lower level of stress management among unemployed doctorate students is rejected by the aforementioned findings, which imply that unemployed doctoral students show higher level of stress management due to better flexibility and resource availability.

According to the study's findings, PhD students' perceptions of stress management vary significantly depending on how they intend to pay for their education. The results of previous studies on the significance of financial stability in reducing academic pressure are supported by the fact that doctoral students funded by the Republic of Serbia's budget report better coping with stress in terms of time management and balancing obligations (Lovitts, 2001; Cotton et al., 2017). Self-funded PhD students, on the other hand, find it harder to manage stress in every area studied, suggesting that financial insecurity presents additional challenges (Barry et al., 2018; Sverdlik et al., 2018). The results for PhD students who receive partial funding from their own budget or the budget of the organization where they work are especially intriguing because they show the lowest degree of time management. According to this research, balancing many sources of funding might make academic work much more challenging and make it more difficult to manage obligations. Doctorate students with alternative funding sources report less stress while balancing their personal and professional commitments, which may be a sign of more flexibility or more resources offered by this type of support (Stubb et al., 2012). However, the hardest time in stress management in this segment is reported by PhD students who finance themselves and those who share funding sources, which supports earlier findings about the detrimental effects of financial insecurity on the capacity to balance personal and professional commitments (Sverdlik et al., 2018). Doctoral students who receive funding from their employer's budget report to experience fewer concerns when it comes to finding quality free time, demonstrating the stability this type of funding offers. On the other hand, self-funded PhD students report the lowest level of stress management, which can be because of their continuous financial and academic commitments that limit their free time. These results are in line with studies by Cotton et al. (2017), which emphasize how crucial institutional support is for reducing academic stress. The results did not reveal statistically significant differences between groups of doctoral students in the areas of managing stress levels, identifying healthy strategies to lessen overload, navigating a competitive environment, and regularly evaluating accomplishments. This may suggest that, as prior research has shown, these factors are generally stressful for PhD students, irrespective of the funding source (Jairam and Kahl, 2012; Schmidt and Hansson, 2018). The part of the hypothesis related to the method of funding is supported by findings indicating that financial insecurity significantly lowers the level of stress management ability among PhD students, which is consistent with the results of previous research (Lovitts, 2001; Cotton et al., 2017; Sverdlik et al., 2018).

The findings of how PhD students in various scientific and artistic disciplines manage stress show notable variations in their capacity to handle a competitive environment. While PhD students in the Philological Sciences find it harder to cope in the aforementioned area, doctoral students in the Medical Sciences and those who were not selected for the title handle competing pressures better than others. These results emphasize the significance of specialized techniques and strategies to support PhD students by pointing to particular requirements and obstacles within each academic subject. No statistically significant differences were found among doctoral students of various scientific and artistic fields in other stress-managment segments, such as time management, ensuring quality free time, dealing with frequent evalu-

ations of accomplishments, the effectiveness of stress management, and balancing professional and private obligations. This suggests that these challenges are universal regardless of the academic discipline. While the individualized nature of research and reliance on subjective evaluations of results in other fields can increase the level of stress (Cotton et al., 2017; Schmidt and Hansson, 2018), the established differences in prior research indicate specific challenges and needs within each academic discipline, highlighting the fact that teamwork and professional discipline characteristics of the medical field can reduce stress among doctoral students (Vekkaila et al., 2013; Sverdlik et al., 2018). Since it was not found that, aside from the appearance of a competitive atmosphere, doctoral students' stress levels are significantly impacted by their affiliation with a particular scientific or artistic field, part of the hypothesis that says that affiliation does not have a significant effect on the perception of stress was partially confirmed.

In conclusion, it was partially confirmed that there are statistically significant differences in how doctoral students manage stress across various demographic, professional, and academic characteristics. Specifically, female doctoral students, those without employment, and students who finance themselves find it harder to manage stress, while belonging in a particular scientific or artistic field has no discernible impact on stress perception. The respondents' employment status revealed results that were contrary to expectations, even though the influence of gender differences and funding methods on the presence of coping behaviours among doctoral students was confirmed. The influence of belonging to a particular scientific or artistic field was also partially confirmed, with statistical significance only noted when dealing with a competitive atmosphere.

The study's findings about the link between doctoral students' age and length of work experience and coping with stressful aspects of their studies show a strong correlation between respondents' age and stress management ability. In particular, a significant negative correlation ($r = -0.166$, $p < 0.01$) indicates that older PhD students are less likely to engage in quality leisure time or relaxation activities, which may lead to elevated stress levels. These findings are consistent with earlier studies that show older PhD students have less schedule flexibility and greater constraints when it comes to planning leisure time because of work and family commitments (Sverdlik et al., 2018). Nevertheless, there was no discernible correlation between the duration of work experience and any particular stress management behaviour. Doctoral students' stress management behaviors and the duration of their work experience had very weak and statistically negligible correlations. According to these results, doctoral students' responses to stress are not significantly influenced by length of service, suggesting that this aspect of the hypothesis is not supported by empirical evidence. Furthermore, Cotton et al. (2017) found that PhD students' stress is caused by the demands of their studies rather than by their prior work experience. In summary, the hypothesis that the age and length of work experience of doctoral students are correlated to managing stressful aspects of their studies was partially confirmed. It is assumed that older doctoral students and those with more extensive work experience tend to have higher levels of stress.

The study's findings shed important light on how the general stress levels of doctoral students differ depending on their academic, professional, and demographic characteristics. First, the research findings do not support the section of the hypothesis that deals with gender differences in doctoral students' stress management. Stress management levels were marginally greater among male respondents than among female respondents, but the differences were not statistically significant. While certain factors like emotional sensitivity and social roles can lead to gender differences in the perception of certain stressors, the findings are consistent with earlier research showing that academic stress is universal among doctoral students, regardless of gender (Cotton et al., 2017; Schmidt and Hansson, 2018). Because statistically significant variations were observed in the stress responses of employed and unemployed doctoral students, part of the hypothesis regarding the working status of PhD students was validated. According to the findings, PhD students who are unemployed report better stress management because they have more flexibility and time to dedicate to their studies, whereas PhD students who are employed balance their professional and academic responsibilities, which reduces their stress management abilities. The results of Jairam and Kahl (2012), who highlight the significance of time and flexibility in the successful completion of doctoral studies, and Sverdlik et al., (2018), who noted that additional professional obligations for employed doctoral students increase the level of stress, are both supported by a statistically significant difference in stress management between employed and unemployed doctoral students ($p < 0.01$). According to the findings, doctoral students in various scientific or artistic fields had similar average stress management behaviors, and the differences in stress management between these groups were not statistically significant. This suggests that doctoral students' overall stress levels are not significantly

impacted by their affiliation with a scientific or artistic field. Within the hypothesis, it was confirmed that there were no appreciable differences in stress management across PhD students from various scientific and creative disciplines. According to this research, stressors are present in all academic domains, meaning that PhD candidates in other fields face comparable difficulties while pursuing their degrees. There was no evidence to support the notion that students who finance their own education experience higher levels of stress than those who receive funding from the Republic of Serbia's budget. But, the results showed that self-funded students and those partially funded from the budget of the RS reported lower levels of stress management, whereas those who received funding from the RS budget and those who had other sources of funding reported better handling of stress management behaviours. Although the changes were not statistically significant, the results suggest that stress management may become harder in response to financial strains, but not to the extent that the financing method significantly affects overall stress management. This result aligns with research by Barry et al. (2018) and Lovitts (2001), which suggests that while financial stability may mitigate certain stressors, it does not entirely eliminate the common stressors associated with PhD studies. Regarding various demographic, professional, and academic characteristics, the hypothesis that there are statistically significant differences in the general stress management among doctoral students was partially confirmed. It was assumed that female doctoral students who are employed and self-financed exhibit a lower level of stress management, while differences are not recorded among doctoral students of different scientific or artistic fields. According to these findings, doctoral students' stress management abilities vary statistically significantly based on their employment status; however, there were no statistically significant differences in stress management according to gender, financing method, or affiliation with the scientific or artistic community.

The study's findings provide an empirical foundation for testing the hypothesis that there is a statistically significant relationship between age and length of work experience, as well as overall stress, in the context of doctoral studies. The findings indicated that the respondents' age and stress coping ability had a strong negative correlation ($r = -0.096$, $p < 0.05$), suggesting that older PhD students find it harder to apply stress magement behaviours. This result validates the portion of the hypothesis concerning PhD students' ages. With increased work and family obligations, as well as other challenges, older PhD students may struggle to balance their studies with other aspects of their lives, which further exacerbates their stress levels. However, there was no statistically significant correlation between the duration of job experience and overall stress management ($r = -0.002$), which lends support to the theory that work experience has no discernible effect on PhD students' stress management techniques. This finding can be explained by the fact that, in the context of doctoral studies, work experience does not always translate into improved stress management abilities. Instead, other factors-like personal coping mechanisms and the support doctoral students receive-are more crucial in lowering the stress levels of doctoral candidates. According to the hypothesis, the study's findings support the idea that older PhD candidates feel higher levels of stress overall, but there is no discernible correlation between stress perception and the duration of job experience.

Conclusions

The primary hypothesis of the study, according to which PhD students experience difficulties in managing stress while pursuing their degrees, was validated. The findings demonstrated that doctoral students experience considerable stress, regardless of their varying demographic, professional, and academic characteristics. This suggests that there are common difficulties and stressful elements that arise throughout PhD study. Although specific characteristics, such as work status, had a specific impact on the ability to manage stress, we assumed that a general trend of high stress was present in all groups of doctoral students, which highlights the need for a comprehensive approach to student support during doctoral studies. These results suggest that stress is a pervasive issue that warrants systematic interventions to enhance the academic experience and reduce stress levels among all PhD students, rather than being limited to specific groups. Universal stressogenic factors, such as high academic expectations, time pressures, and frequent evaluations, remain important sources of stress (Tadić and Kordić, 2023). In addition, the psychological well-being of doctoral students also depends on the institutional environment and support, whereas unfavorable academic expectations might result in burnout and exhaustion (Maluckov, 2018). PhD students' varying stress levels are caused by a variety of stressors, which have an immedi-

ate impact on their mental health and stress management ability. The completion of education and future professional direction may become more uncertain, leading to anxiety as a result of these circumstances.

The findings of the study indicate that in order to reduce stress and enhance doctoral students' academic experiences, an encouraging academic atmosphere must be established. Academic standards should be more flexible, time management skills should be enhanced, and institutions should promote mental wellness. Doctoral students' ability to balance their personal and academic lives depends on their perception of the academic environment, highlighting the necessity of institutional support through organizational programs, mentoring, and stress-coping mechanisms (Pyhältö et al., 2012; Lonka et al., 2019; Mulyati et al., 2023). Some authors (Miltojević et al., 2022) draw attention to the issue of burnout among technical faculty students, while Simić and Vranješević (2022) note the particular difficulties faced by sensitive categories of PhD students, such as those from marginalized populations. Doctoral students' academic and psychological well-being can be enhanced by specially designed support programs, such as courses on time management and stress management. Strategies for coping with the academic difficulties that PhD students experience are important in addition to institutional support measures. Research indicates that PhD students' academic and psychological well-being can be enhanced by flexible academic time management, stress management classes, and increased mentor participation (Milovanović et al., 2023). Additionally, financial assistance can reduce certain types of stress and enhance PhD students' commitment to their research, especially when financial security alleviates pressure and allows for better focus and academic engagement (Levecque et al., 2017; Barry et al., 2018; Sverdlik et al., 2018).

This study's shortcomings include the respondents' subjective assessments of stress management, which could compromise the accuracy of the findings, and the exclusion of key academic and cultural settings from the sample. Furthermore, not all possible stress-management factors have been examined, including institutional regulations and the particular possibilities of particular scientific domains. The aforementioned conditions limit the broad applicability of the findings, but they also underscore the need for further study. Recommendations are provided to lessen stress and enhance doctoral students' academic experiences based on the research that has been done. To help doctoral students better handle academic problems, time management skills must be improved in the direction of more flexible academic standards, which highlights the necessity of institutional support through organizational programs, mentoring, and stress coping mechanisms (Posselt, 2018). The use of technological solutions, such as mobile applications for time management, has been shown to be effective in supporting students' self-organization and reducing stress levels (Alhasani and Orji, 2023; Malik et al., 2024). At the same time, enhancing the role of mentors through training and resources to provide high-quality support is essential to improving the academic experience. The introduction of mental health programs, such as mindfulness training, relaxation techniques, and group support, can greatly contribute to lowering stress and improving the general well-being of aspiring doctors (Mulyati et al., 2023). Furthermore, granting PhD students financial assistance and reliable support networks might lessen additional pressure and free them up to concentrate more on their academic obligations. It is advised to carry out longitudinal research to track shifts in stress perception during the course of PhD studies and assess how well stress-reduction techniques work.

In conclusion, the results of this research highlight the need for a comprehensive approach to supporting doctoral students, including the specific challenges faced by certain groups, in order to effectively reduce stress levels and personal well-being. The research results point to the need to create a supportive academic environment that will reduce stress and improve the academic experience of doctoral students.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, A.S.S., T.M.Đ., A.S., B.N.C, I.T.M., S.M.; methodology, A.S.S., T.M.Đ., A.S., B.N.C, I.T.M.; software, B. N. C.; formal analysis, A.S.S. and T.M.Đ.; writing—original draft preparation, A.S.S., T.M.Đ., A.S., B.N.C, I.T.M., S.M.; writing—review and editing, A.S.S., T.M.Đ., A.S., B.N.C, I.T.M., S.M. All authors have read and agreed to the published version of the manuscript.

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Update note (Crossmark)

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