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EFFECTS OF AN INTERVENTION PROTOCOL ON MUSCULOSKELETAL SYMPTOMS IN PHYSICAL THERAPY STUDENTS

EFEITOS DE UM PROTOCOLO DE INTERVENÇÃO NOS SINTOMAS MUSCULOESQUELÉTICOS EM ESTUDANTES DE FISIOTERAPIA

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ABSTRACT: Physical activity and ergonomic guidance can reduce musculoskeletal symptoms in physical therapy students during their supervised internship. This study analyzed the effect of an intervention protocol on these symptoms in 30 students in their final semesters, randomized into three groups: exercise (EG), guidance (GG), and control (CG). The Nordic Musculoskeletal Questionnaire was applied. The EG performed global stretching and segmental/postural strengthening exercises, while the GG received ergonomic guidance through YouTube videos sent via WhatsApp®. The CG received no intervention. Data were analyzed with descriptive and inferential statistics ($p<0.05$). The CG showed increased symptoms in the upper/lower back, shoulders, and ankles/feet over the past 12 months and seven days. A significant group–time interaction was found, with the CG reporting more symptoms than the EG and GG. The intervention effectively reduced musculoskeletal symptoms during the internship.

KEYWORDS: Clinical Internship. Health Services. Student Health. Students. Physical Therapists.

RESUMO: A atividade física e a orientação ergonômica podem reduzir sintomas musculoesqueléticos em estudantes de Fisioterapia durante o estágio supervisionado. Este estudo analisou o efeito de um protocolo de intervenção em 30 estudantes dos últimos semestres, distribuídos em três grupos: exercício (GE), orientação (GO) e controle (GC). Utilizou-se o Questionário Nórdico de Sintomas Osteomusculares. O GE realizou alongamentos globais e exercícios de fortalecimento segmentar e postural, enquanto o GO recebeu orientações ergonômicas por meio de vídeos do YouTube enviados pelo WhatsApp®. O GC não recebeu intervenção. Os dados foram analisados por estatística descritiva e inferencial ($p<0,05$). O GC apresentou aumento de sintomas em região lombar e torácica, ombros e tornozelos/pés nos últimos 12 meses e sete dias. Houve interação significativa entre grupo e tempo, com o GC relatando mais sintomas que GE e GO. O programa foi eficaz na redução de sintomas musculoesqueléticos.

PALAVRAS-CHAVE: Estágio Clínico. Serviços de Saúde. Saúde do Estudante. Estudantes. Fisioterapeutas.

INTRODUCTION

Musculoskeletal disorders (MSDs) are a growing concern in the healthcare sector, significantly impacting the quality of life and work capacity of healthcare professionals. Among physical therapy professionals, the prevalence of these disorders is particularly high due to the intense and prolonged physical demands inherent in clinical practice. Repetitive movements, improper postures, and frequent patient handling are some of the risk factors that contribute to the development of these disorders[1-3].

Physical therapy students are equally exposed to these occupational risks during their supervised internships. Practical training, essential for developing clinical skills, can lead to musculoskeletal overload, resulting in pain and discomfort that may compromise learning and future professional practice. Furthermore, the habits and practices acquired during this formative period can significantly influence the occupational health of future physical therapists[4].

Implementing preventive measures and intervention protocols is essential to mitigate the risks of MSDs. Studies[5,6] have demonstrated the effectiveness of ergonomic interventions, specific exercise programs, and preventive education in reducing the incidence and severity of MSDs among healthcare professionals. However, most research focuses on active professionals, with a significant gap concerning preventing MSDs among physical therapy students during internships.

By addressing these issues, the study aims to contribute to improving the occupational health and well-being of future physical therapists, promoting a safer and more sustainable learning environment. With the growing demand for physical therapists in the global context of population aging and rising chronic diseases, ensuring the health and professional longevity of these professionals is of utmost importance for the healthcare system as a whole[7,8].

Given the above, this study aimed to analyze the effect of an intervention and prevention protocol on the manifestation of musculoskeletal symptoms in physical therapy students during their supervised internship period.

METHODOLOGY

TYPE OF STUDY AND ETHICAL ASPECTS

This randomized clinical trial was approved by the Research Ethics Committee of Cesumar University (Unicesumar), under opinion number 5.099.374, and conducted based on the CONSORT (Consolidated Standards of Reporting Trials) guidelines.

PARTICIPANTS

The non-probabilistic sample was intentionally and conveniently selected, comprising 30 physical therapy students from the 8th and 10th semesters of the 2023 academic year at Unicesumar, Maringá Campus, according to inclusion and exclusion criteria. Participants were randomly subdivided into three groups of 10: exercise group (EG), guidance group (GG), and control group (CG).

Inclusion criteria included students officially enrolled in the final semester of the physical therapy undergraduate program, engaged in supervised academic internships of both genders, and without any clinically diagnosed musculoskeletal pathology. Exclusion criteria encompassed students who discontinued their supervised internship during the 2023 academic year, pregnant students, those who

developed or were diagnosed with any systemic disease during the research, those who withdrew from the study, and those who missed or could not complete any data collection or intervention phase.

INSTRUMENTS

The authors developed the sociodemographic questionnaire and included questions on age, gender, and ethnicity. On the other hand, the Nordic Musculoskeletal Questionnaire (NMQ) is a widely used tool for data collection in scientific studies aimed at assessing musculoskeletal issues. This questionnaire standardizes the collection of epidemiological data on musculoskeletal pain and discomfort across different populations and occupational settings, with questions regarding the presence of musculoskeletal symptoms (such as pain, discomfort, and functional limitation) in various body regions over a specified period, typically within the last 12 months and the past seven days. The body regions covered include the neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, and ankles/feet[9,10].

INTERVENTION AND DATA COLLECTION PROCEDURES

The intervention protocol for the EG group consisted of global stretching of muscle chains (head, trunk, upper and lower limbs) and segmental and postural strengthening exercises (upper limb strengthening, lower limb strengthening, trunk strengthening, and postural reeducation) performed biweekly in 30-minute sessions, totaling 20 sessions throughout the supervised internship period. The biweekly schedule was established based on the students' available time for participation in the study.

Each session began with stretches, performed in one set of three repetitions, holding each position for 10 seconds under the researcher's guidance and supervision. This was followed by strengthening exercises for the trunk, upper, and lower limbs using elastic bands, dumbbells, and body weight, with three sets of 10 repetitions each. Finally, a postural correction exercise was conducted in one set of 10 repetitions, holding the posture for 10 seconds in each repetition.

For the GG group, the intervention was conducted through biweekly video guidance via the WhatsApp® smartphone application, featuring selected videos from the YouTube platform with advice on proper ergonomics and health during the internship, totaling 20 videos. The guidance topics included occupational safety and health, quality of life during the internship, work-life balance, ergonomics, and intern health. The videos were chosen to be short and to convey information simply and directly according to each theme.

After the interventions, individuals in the EG, GG, and CG groups were reassessed using the NMQ for the presence of musculoskeletal disorders. At the end of the study, students who expressed interest were referred to the physical therapy school clinic at Unicesumar, where they could receive free treatment for any reported signs and symptoms.

DATA ANALYSIS

Descriptive statistics were applied using absolute and relative frequencies, mean, and standard deviation. Data normality was verified using the Shapiro-Wilk test. To compare pre- and post-intervention responses, a mixed repeated measures analysis of variance (ANOVA) was employed to compare the two assessment points (before and after the intervention) across the three groups (CG, GG, and EG).

Bonferroni adjustment was used for multiple comparisons analysis, with a significance level of $p < 0.05$. The statistical analyses were conducted using SPSS for Windows v.25.0.

RESULTS

According to the data in Table 1, all three groups had a higher proportion of women and individuals of white race. The mean age for each group was as follows: CG = 22.40 years (±0.52); GG = 22.60 years (±2.01); and EG = 23.20 years (±1.40).

Table 1. Frequency distribution of sociodemographic characteristics, gender, and race across the three groups. Maringá, Paraná, Brazil (2023).

Variable	CG	GG	EG
	n (%)	n (%)	n (%)
Gender			
Male	3 (30.0)	3 (30.0)	3 (30.0)
Female	7 (70,0)	7 (70.0)	7 (70.0)
Race			
White	6 (60.0)	7 (70.0)	8 (80.0)
Other	4 (40.0)	3 (30.0)	2 (20.0)
Total	**10 (100.0)**	**10 (100.0)**	**10 (100.0)**

CG: control group; GG: guidance group; EG: experimental group.

Table 2 presents the frequency distribution of musculoskeletal symptom locations over the past 12 months and the past seven days in the pre-and post-test phases within the CG. It is observed that the body regions with an increase in musculoskeletal symptoms over the past 12 months from pre- to post-test were the upper and lower back, shoulders, and ankles/feet. Over the past seven days, the regions with the greatest increase in symptom frequency from pre- to post-test were the lower back, upper back, and ankles/feet.

Table 2. Distribution of musculoskeletal symptom locations in the past 12 months and the past seven days at pre- and post-test moments in the Control Group. Maringá, Paraná, Brazil (2023).

VARIABLES	Moments	
	Pre-test (n = 10)	Post-test (n = 10)
	f (%)	*f* (%)
Symptoms in the Last 12 Months (n=10)		
Did Not Experience	1 (10.0)	0 (0.0)
Neck	4 (40.0)	5 (50.0)
Shoulders	3 (30.0)	7 (70.0)
Upper Back	3 (30.0)	7 (70.0)
Lower Back	3 (30.0)	8 (80.0)
Elbows	1 (10.0)	0 (0.0)
Wrists/Hands	2 (20.0)	4 (40.0)
Abdomen	0 (0.0)	0 (0.0)
Hips/Thighs	1 (10.0)	0 (0.0)
Knees	2 (20.0)	4 (40.0)
Ankles/Feet	3 (30.0)	7 (70.0)
Total Symptoms	**22 (100.0)**	**42 (100.0)**
Symptoms in the Last 7 Days (n=10)		
Did Not Experience	2 (20.0)	0 (0.0)
Neck	4 (40.0)	5 (50.0)
Shoulders	2 (20.0)	5 (50.0)
Upper Back	3 (30.0)	6 (60.0)

VARIABLES	Moments	
	Pre-test (n = 10)	Post-test (n = 10)
	f (%)	*f* (%)
Symptoms in the Last 7 Days (n=10)		
Lower Back	2 (20.0)	7 (70.0)
Elbows	1 (10.0)	0 (0.0)
Wrists/Hands	1 (10.0)	4 (40.0)
Abdomen	0 (0.0)	0 (0.0)
Hips/Thighs	1 (10.0)	0 (0.0)
Knees	3 (30.0)	5 (50.0)
Ankles/Feet	2 (20.0)	6 (60.0)
Total Symptoms	**19 (100.0)**	**38 (100.0)**

Table 3 presents the frequency distribution of musculoskeletal symptom locations over the past 12 months and the past seven days in the pre-and post-test phases within the GG. It is observed that there was a reduction in the frequency of musculoskeletal symptoms over the past 12 months from pre- to post-test in the lower and upper back and shoulders. Over the past seven days, similar reductions were found in the lower and upper back and ankles/feet, with an increased frequency of individuals reporting no symptoms.

Table 3. Frequency distribution of musculoskeletal symptom locations in the last 12 months and the last seven days at pre-test and post-test moments in the Guidance Group. Maringá, Paraná, Brazil (2023).

VARIABLES	Moments	
	Pre-test (n = 10)	Post-test (n = 10)
	f (%)	*f* (%)
Symptoms in the Last 12 Months (n=10)		
Did Not Experience	3 (30.0)	2 (20.0)
Neck	4 (40.0)	5 (50.0)
Shoulders	4 (40.0)	2 (20.0)
Upper Back	4 (40.0)	2 (20.0)
Lower Back	4 (40.0)	3 (30.0)
Elbows	0 (0.0)	0 (0.0)
Wrists/Hands	2 (20.0)	2 (20.0)
Abdomen	0 (0.0)	0 (0.0)
Hips/Thighs	0 (0.0)	0 (0.0)
Knees	3 (30.0)	3 (30.0)
Ankles/Feet	2 (20.0)	0 (0.0)
Total Symptoms	**23 (100.0)**	**17 (100.0)**
Symptoms in the Last 7 Days (n=10)		
Did Not Experience	2 (20.0)	4 (40.0)
Neck	4 (40.0)	4 (40.0)
Shoulders	2 (20.0)	3 (30.0)
Upper Back	3 (30.0)	2 (20.0)
Lower Back	3 (30.0)	2 (20.0)
Elbows	0 (0.0)	0 (0.0)
Wrists/Hands	2 (20.0)	1 (10.0)
Abdomen	0 (0.0)	0 (0.0)
Hips/Thighs	0 (0.0)	0 (0.0)
Knees	2 (20.0)	2 (20.0)
Ankles/Feet	1 (10.0)	0 (0.0)
Total Symptoms	**17 (100.0)**	**14 (100.0)**

Table 4 presents the frequency distribution of musculoskeletal symptom locations over the past 12 months and the past seven days in the pre-and post-test phases within the EG. It is noted that the body regions showing a reduction in musculoskeletal symptom frequency over the past 12 months from pre- to post-test included the neck, lower and upper back, ankles/feet, wrists/hands, shoulders, and knees. Over the past seven days, the regions with the greatest reduction in symptom frequency from

pre- to post-test were the lower and upper back, ankles/feet, and wrists/hands, along with an increase in the frequency of individuals reporting no symptoms.

Table 4. Frequency distribution of musculoskeletal symptom locations in the last 12 months and the last seven days at pre-test and post-test moments in the Exercise Group. Maringá, Paraná, Brazil (2023).

VARIABLES	Moments	
	Pre-test (n = 10)	Post-test (n = 10)
	f (%)	*f* (%)
Symptoms in the Last 12 Months (n=10)		
Did Not Experience	2 (20.0)	2 (20.0)
Neck	4 (40.0)	2 (20.0)
Shoulders	3 (30.0)	2 (20.0)
Upper Back	5 (50.0)	2 20.0)
Lower Back	3 (30.0)	2 (20.0)
Elbows	0 (0.0)	0 (0.0)
Wrists/Hands	3 (30.0)	2 (20.0)
Abdomen	0 (0.0)	0 (0.0)
Hips/Thighs	1 (10.0)	1 (10.0)
Knees	2 (20.0)	1 (10.0)
Ankles/Feet	5 (50.0)	3 (30.0)
Total Symptoms	**26 (100.0)**	**15 (100.0)**
Symptoms in the Last 7 Days (n=10)		
Did Not Experience	2 (20.0)	5 (50.0)
Neck	4 (40.0)	4 (40,0)
Shoulders	2 (20.0)	3 (30,0)
Upper Back	4 (40.0)	2 (20,0)
Lower Back	3 (30.0)	1 (10,0)
Elbows	0 (0.0)	0 (0,0)
Wrists/Hands	1 (10,0)	1 (10,0)
Abdomen	0 (0,0)	0 (0,0)
Hips/Thighs	1 (10,0)	0 (0,0)
Knees	2 (20,0)	2 (20,0)
Ankles/Feet	3 (30,0)	0 (0,0)
Total Symptoms	**20 (100,0)**	**13 (100,0)**

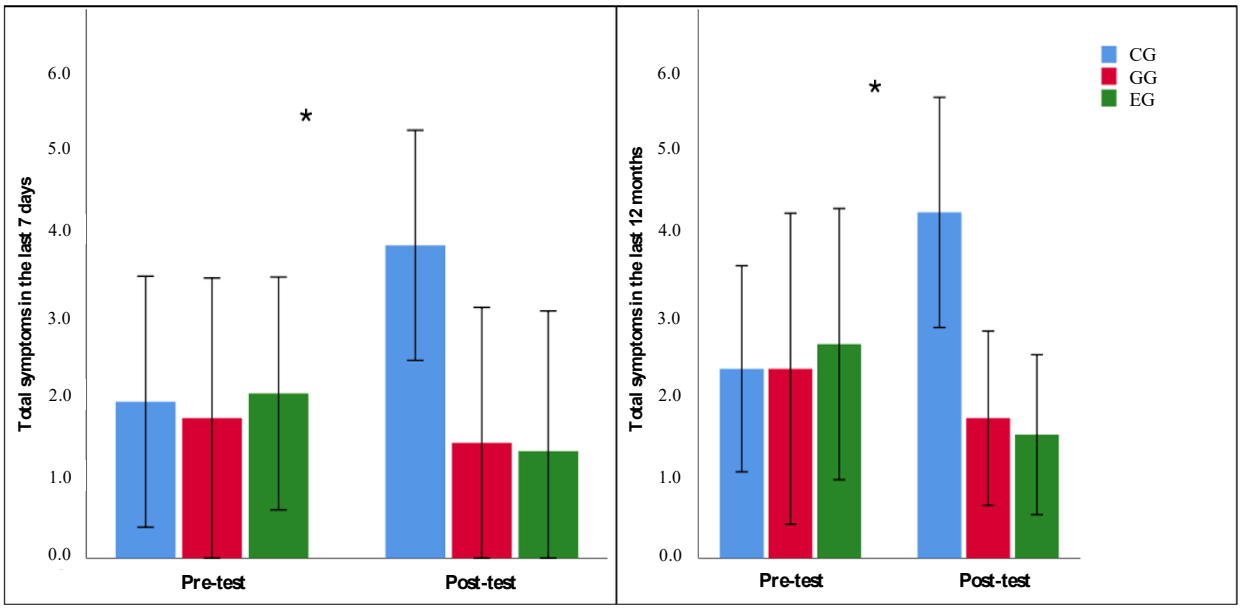

Figure 1. Results of the total musculoskeletal symptoms in the last 30 days and the last seven days of the study participants before and after interventions. Maringá, Paraná, Brazil (2023). Data are presented as mean and standard deviation. CG: Control Group; GG: Guidance Group; EG: Experimental Group.

Figure 1 shows the total musculoskeletal symptoms in the last 30 and seven days in the pre- and post-test phases. A significant interaction effect was observed between group and time on the total symptoms in the last 30 days ($F = 6.531$; $p < 0.001$) and the total symptoms in the previous seven days ($F = 3.976$; $p = 0.025$). An increase in the total symptoms in the CG over the last 30 days from pre- to post-test was noted (M = 2.30; SD = 1.25 vs. M = 4.20; SD = 1.40), with a higher number of symptoms in the CG (M = 4.20; SD = 1.40) in the post-test compared to the GG (M = 1.70; SD = 1.05) and EG (M = 1.50; SD = 0.97). Similar results were found in the total symptoms over the last seven days, with an increase in total symptoms in the CG from pre- to post-test (M = 1.90; SD = 1.52 vs. M = 3.80; SD = 1.40) and a higher number of symptoms in the CG (M = 3.90; SD = 1.40) in the post-test compared to the GG (M = 1.40; SD = 1.65) and EG (M = 1.30; SD = 1.70).

DISCUSSION

The main findings of this study revealed a notable increase in the frequency of symptoms in the upper and lower back, shoulders, and ankles/feet over the past 12 months and the last seven days in the CG. The GG showed an overall reduction in the frequency of these symptoms, particularly in the lower and upper back and shoulders, with an increase in the number of individuals without symptoms in the last seven days. The EG also demonstrated a significant reduction in symptom frequency across various body regions, including the neck, back, ankles/feet, and wrists/hands, along with an increase in the number of individuals without symptoms in the last seven days. A significant interaction effect was observed between group and time, with the CG displaying more symptoms than the GG and EG over the past 30 days and the last seven days.

The increase in symptom frequency in the CG may be explained by several factors that differentiate this group from the others. Although all groups were in an internship phase, the CG was exposed to all potentially detrimental factors that could impact musculoskeletal health without any assistance or guidance on prevention. Another factor that could explain the increase in the number of symptoms in the CG and support the hypothesis raised in this study, as reported by Ezzatvar[11], is that students are already exposed to physical postures during their internship routine, which compromises physical health. If these postures are not properly guided and corrected, they can lead to serious future impairments and symptom manifestation, particularly in the spine and upper limb segments.

The CG data also show that as the internship progresses, the number of musculoskeletal symptom locations increases, indicating that the physical stress required by the professional practice of physical therapy can already manifest during the academic period. This situation may contribute to developing long-term disorders or, in the worst-case scenario, lead to discouragement or early departure from the profession[12].

Although all groups showed a similar distribution in terms of gender and race/ethnicity, with a predominance of females and individuals of white race/ethnicity, the higher incidence of musculoskeletal symptoms in this population is well-documented in the literature. According to An[13], white women are often considered more susceptible to this type of health impairment, especially in the context of professional activities. This factor may help explain the increase in symptoms in the CG, which, in addition to being predominantly composed of white women, did not receive any preventive intervention, potentially contributing to the greater manifestation of these symptoms[13].

In contrast, when analyzing the GG data, a reduction in symptom frequency is observed, particularly in the lower and upper back and shoulders, with an increase in the number of people

without symptoms in the last seven days. Compared to the previous group, this can be explained by the fact that students tend to experience fewer musculoskeletal symptoms when provided with at least essential guidance on good ergonomics and physical health. Such guidance may reduce musculoskeletal impairments during the internship, especially in common ergonomic risk areas like the spine and upper limbs[14].

Another possible explanation is that, with greater attention to prevention and ergonomics in the workplace, students could observe and analyze routine internship situations more critically. This awareness allowed them to identify occasions more accurately when their health could be at risk, leading to greater attention to necessary precautions and positively impacting musculoskeletal health[15].

It is also important to highlight the crucial role of incorporating student health awareness within the university environment. The study demonstrated that an orientation program applied to the GG effectively reduced the manifestation of musculoskeletal symptoms among the analyzed population compared to the CG. This effectiveness was particularly notable among white women and in the spine and upper limb segments, a group that literature already identifies as more susceptible to these symptoms[16].

These findings reinforce the hypothesis that health programs aimed at students are essential and should be integrated into the curriculum to support more vulnerable populations and as a preventive measure for those with a lower incidence of symptoms. According to Ferreira[17], including such programs is fundamental for promoting musculoskeletal health, aligning with this study's objective of mitigating the impact of academic and professional activities on students' health.

The most notable improvement was observed in the EG, highlighting that physical exercise is an effective intervention in promoting musculoskeletal health, especially among university students, such as those in physical therapy. Even in a program focused on physical health, implementing a targeted exercise protocol for preventing musculoskeletal symptoms significantly reduced the frequency and location of symptoms in the studied sample[18].

One explanation for this finding is that, as Oakman[19] suggest, preventive exercises tailored to the demands of supervised physical therapy internships may have enhanced students' awareness of their health during these activities. This includes improved posture and physical capacity to perform internship tasks more healthily, supporting the hypothesis that physical exercise is an effective strategy for promoting health among university students.

The lower number of affected areas and reduced symptom frequency observed in the EG compared to other groups may also indicate that physical inactivity and lack of proper information or guidance are detrimental factors for physical therapy students' health during internships. Although they are constantly engaged with health-related information and share it with patients, many students may overlook their health, prioritizing the care of others over self-care. This underscores the importance of integrating self-care and preventive practices into academic training[20,21].

Despite the important results, this study has limitations. It was conducted with a small number of participants from a single institution, so the results are not generalizable to other populations or contexts. Additionally, participant selection may introduce bias, especially since the history of physical activity—which could influence the manifestation of musculoskeletal symptoms—was not considered.

Heterogeneity in adherence to the intervention protocol may also influence the results. Participant motivation and commitment to follow the guidelines may vary, potentially leading to discrepant outcomes. Finally, external factors, such as the participants' academic environment, study-related stress, and other living conditions, may influence musculoskeletal symptoms in ways not directly related to the intervention protocol. These factors may not be fully controlled or accounted for in the study, potentially affecting the clarity of the results.

To further understand and improve intervention and prevention protocols for musculoskeletal symptoms in physical therapy students, it is essential to conduct new studies that address the identified limitations. Future research could employ a more robust experimental design with larger and more diverse samples to ensure the generalization of results. Exploring different types of interventions and comparing approaches may contribute to developing more effective protocols tailored to the specific needs of physical therapy students.

CONCLUSION

In conclusion, the study demonstrated that both the guidance and intervention programs effectively reduced musculoskeletal symptoms in physical therapy students during their internship period, with the EG showing a greater overall decrease and an increase in the number of individuals without symptoms.

Although this study analyzed the incidence of musculoskeletal symptoms in physical therapy interns and collected sociodemographic data, an important gap is evident due to the lack of information on participants' physical activity levels or sedentary behaviors. Including this data would have allowed for a more robust analysis, considering that sedentary behavior is a well-known factor contributing to musculoskeletal pain and discomfort development.

The practical implications suggest that implementing guidance and intervention strategies may be crucial for reducing musculoskeletal symptoms and improving the well-being of these individuals. Future studies are recommended to investigate the specific types of interventions that are most effective and their applicability in different academic contexts.

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