MÆDICA - a Journal of Clinical Medicine

MAEDICA – a Journal of Clinical Medicine
2026; 21(2): 452-457
https://doi.org/10.26574/maedica.2026.21.2.452

ORIGINAL PAPER

Combating Sedentary Lifestyle: Effect of Static Workplace Stretching on Balance in Medical Students

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ABSTRACT

Background: *Medical students often lead sedentary lifestyles due to prolonged academic commitments, which may negatively affect balance and overall physical well-being. Incorporating short bouts of physical activity into daily routines may help counteract these effects.*

Objectives: *To investigate the efficacy of integrating short periods of stretching and physical activity into daily routines on balance and physical well-being among medical students.*

Method: *A total of 60 healthy medical students aged 18–21 years, without neuromuscular abnormalities, were randomly assigned into two equal groups, including the study group (n=30) and the control group (n=30), using simple random sampling. Members of the control group continued their routine activities without intervention, while those of the study group performed supervised stretching exercises along with their regular activities. Balance was assessed both before and after the intervention using the single leg balance test (SLBT) and the Berg balance scale (BBS).*

Results: *The study group demonstrated significant improvements in balance following the intervention. Post-test scores showed marked enhancement in eyes-open SLBT ($p=0.0025$, $Z=-3.019$, Cohen's $d=0.874$), eyes-closed SLBT ($p=0.0007$, $Z=-3.372$, Cohen's $d=1.175$) and BBS ($p < 0.0001$, $Z=-6.86$, Cohen's $d=3.998$), indicating moderate to large effect sizes.*

Conclusion: *Incorporating short periods of stretching and physical activity into daily routines significantly improves balance and physical well-being among medical students.*

Keywords: students, breakout, health, sedentary lifestyle.

CLINICAL IMPLICATIONS

Simple structured stretching programs can be effectively integrated into academic settings to promote physical health, prevent sedentary-related impairments and enhance functional balance in young adults.

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Article receieved on the 13th of May 2026 and accepted for publication on the 5th of June 2026

INTRODUCTION

The modern era has significantly transformed lifestyle patterns due to rapid technological advancements, the COVID-19 pandemic and increased automation, resulting in a predominantly sedentary way of life. The education sector has particularly shifted toward e-learning platforms, leading to prolonged sitting, static postures and suboptimal ergonomic conditions (1). These factors contribute to mental fatigue, work monotony and repetitive strain, especially among students and medical professionals (2).

Falls are increasingly recognized as a public health concern across all age groups, including young adults. Previous research has shown that falls occur frequently in this population and are influenced by a variety of intrinsic and environmental factors (3). Sedentary behavior and prolonged sitting are associated with musculoskeletal discomfort, reduced physical fitness, impaired postural control and work-related musculoskeletal disorders (WRMSDs), which may negatively affect balance and functional performance (4). Given the high prevalence of sedentary behaviors among medical students, interventions that promote movement and physical activity may help improve balance and overall musculoskeletal health.

Medical students are particularly vulnerable due to extended use of smartphones, tablets, and prolonged classroom sitting in improper postures. These habits often result in muscle stiffness, ligament strain, pain and reduced mobility. Physical activity (PA) plays a critical role in mitigating these effects. Evidence suggests that PA interventions improve postural balance, enhance lower limb strength and reduce fall risk (5).

Given that many individuals lack motivation or time for structured exercise, identifying simple, feasible interventions is essential. Stretching, resistance training and balance exercises are key components for improving physical function (5). Among these, static stretching is practical and easily incorporated into daily routines.

Therefore, this study aims to evaluate the effect of static workplace stretching on balance among medical students using the single leg balance test (SLBT) and Berg balance scale (BBS), and to assess its potential role in reducing WRMSDs and promoting a healthier learning environment.

METHODOLOGY

Participants

A priori power analysis using G*Power indicated that a sample size of 60 would detect a medium effect size ($f = 0.25$) with 80% power and $\alpha = 0.05$, consistent with previous research (6).

The study was conducted in the Department of Anatomy and included 60 MBBS students aged 18–21 years. Participants had a mean weight, height and body mass index (BMI) of 59.8±7.03 kg, 1.59±0.08 m and 23.75±4.1 kg/m², respectively. All of them were free from neuromuscular disorders and provided written informed consent. Ethical approval for the present study was obtained (AIIMS/BBN/IEC/AUG/2021/68).

Participants were randomly assigned into a study group (n = 30) and a control group (n = 30).

Baseline balance assessment (pre-test) was performed using SLBT and BBS.

Single leg balance test (SLBT)

The SLBT is an assessment tool used to evaluate static postural and balance control. The test is performed with the patient standing on one leg without assistance, with eyes open and closed and hands on their hips. The test measures the time elapsed from the moment the opposing foot leaves the ground until it touches the ground again or the hands come off the hips (as illustrated in Figure 1). Individuals who are unable to stand on one leg for at least five seconds are more likely to experience falls and related injuries (7). Normal values (18–39 years) were 49 seconds (eyes open) and nine seconds (eyes closed).

FIGURE 1. Students' performance on the single leg balance test (SLBT), highlighting their ability to maintain balance on one leg

Berg balance scale (BBS)

The BBS is a comprehensive assessment tool that evaluates functional balance by testing both dynamic and static balance through 14 mobility-related tasks (as illustrated in Figure 2). The assessment is relatively quick, taking approximately 15-20 minutes to complete, and requires minimal equipment, including a timer, ruler or measuring tape, chair, step and an object to pick up. Each task has specific instructions and is scored on a five-point ordinal scale, ranging from zero (unable to perform the task) to four (able to complete the task independently), with a maximum score of 56. The BBS provides a detailed assessment of an individual's balance abilities, with higher scores indicating greater independence and mobility (8).

Intervention

Participants of the study group were taught a series of simple stretching exercises that targeted various muscles and joints, including the head, neck, upper limb, spine, pelvis and lower limb, involving a total duration of seven minutes. The intervention consisted of a structured exercise package comprising a series of standing mobility, flexibility, balance and coordination exercises performed in a sequential manner under supervision. The exercise sequence included: 1) cervical range-of-motion exercises involving lateral neck flexion and rotation to both sides; 2) upper-limb and shoulder mobility exercises with bilateral arm elevation and overhead stretching; 3) trunk mobility exercises incorporating lateral reaching and gentle trunk rotation; 4) dynamic balance activities involving single leg stance while performing upper-limb movements; and 5) lower-limb strengthening and coordination exercises consisting of alternating knee lifts and marching-in-place movements (Figure 3). All members of the study group were advised to perform these exercises every two hours (preferably during tea breaks and lunch breaks, thereby practicing it at least five times a day) during their daily routine for duration of six months. Participants in the control group did not receive any specific intervention and were advised to follow healthy ergonomic principles. After six months, balance was assessed again for all subjects of both groups using SLBT and BBS.

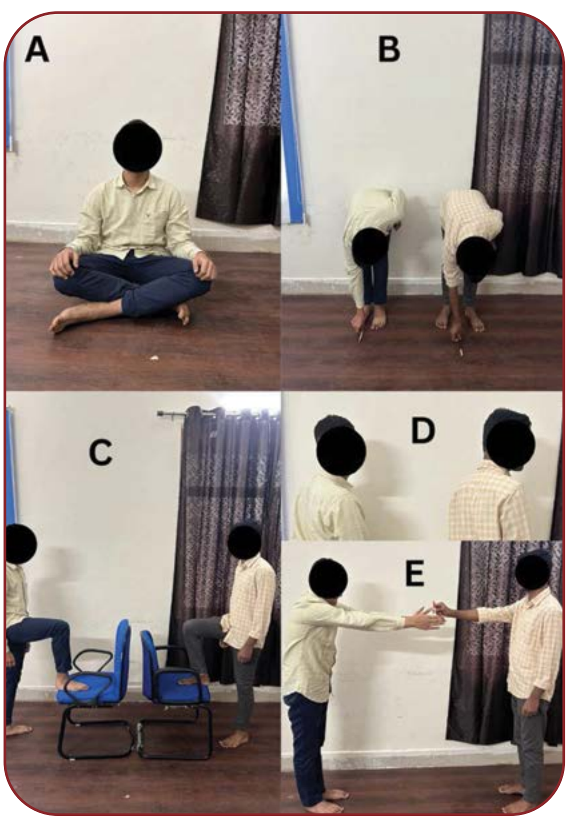

FIGURE 2. Students' performance on selected events of the Berg balance scale, assessing their ability to perform various balance tasks: (A) sitting unsupported; (B) grabbing an object from the floor; (C) placing one foot on a step; (D) turning to look behind; and (E) reaching forward with outstretched arms while standing.

Statistical analysis

Data normality was assessed using the Shapiro–Wilk test and was found to be non-normal. Therefore, the Mann–Whitney U test was used for between-group comparisons.

Effect size was calculated using Cohen's d and interpreted as: trivial (0–0.19); small (0.20–0.59); moderate (0.60–1.19); large (1.20–1.99); very large (2.0–3.99); and extremely large (>4.0).

Analysis was performed using MedCalc version 23.0.2.

RESULTS

The present study analyzed the effects of an exercise intervention on balance in medical students using the Mann-Whitney U test due to non-normal data distribution. To gain a more complete understanding of data, the mean and standard deviation (SD) were calculated alongside the median and interquartile range, allowing for a robust calculation of the effect size. Eyes open pre-test showed no significant difference between the control and study groups ($p=0.91$, Z score=-0.102, Cohen's d=0.125), while eyes open post-test revealed a significant difference ($p=0.0025$, Z score=-3.019, Cohen's d=0.874), with a medium to large effect size indicating a notable improvement in the

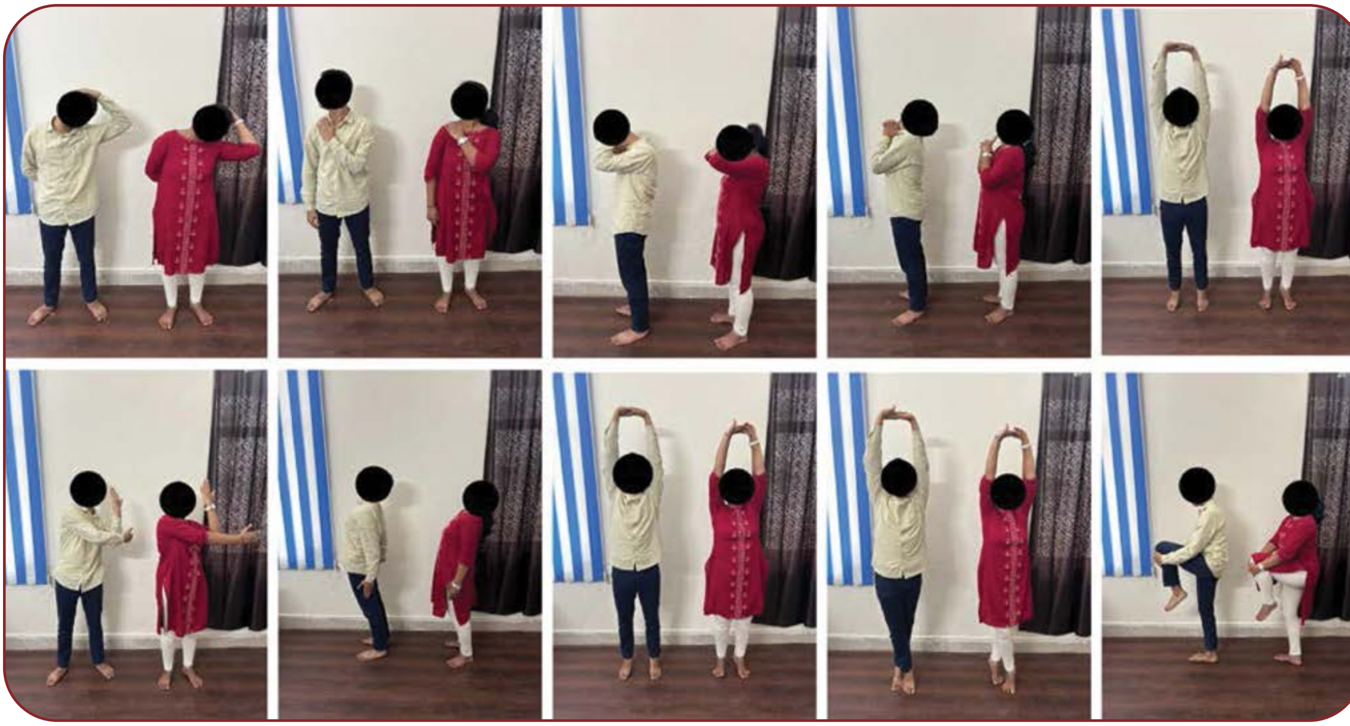

FIGURE 3. Students' performance on the active intervention exercises consisting of simple exercises designed to improve balance and strength

TABLE 1. Results of pre- and post-test of single leg balance eyes open test across the control and study groups

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
EO pre-test – 1*	47 (8)	43.8 (8.6)	-0.102	0.91	0.125
EO pre-test – 2**	49.5 (10)	42.5 (11.9)			
EO post-test -1*	48 (6)	45.5 (6.2)			
EO post-test -2**	50 (0)	49.4 (1.16)	-3.019	0.0025***	0.874

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; EO: eyes open; ***significant P value

TABLE 2. Results of pre- and post-tests of single leg balance eyes closed test across the control and study groups

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
EC pre-test – 1*	8 (4)	7.3 (2.9)			
EC pre-test – 2**	8 (4)	7.3 (2.7)	-0.205	0.83	0
EC post-test -1*	8.5 (4)	7.9 (1.99)			
EC post-test -2**	10 (1)	9.6 (0.47)	-3.372	0.0007***	1.175

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; EC: eyes closed; ***significant P value

TABLE 3. Results of pre- and post-tests of Berg balance scale across the control and study groups

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
BBS pre-test – 1*	52 (2)	50.9 (1.37)			
BBS pre-test – 2**	52 (2)	50.8 (1.57)	-0.049	0.96	0.067
BBS post-test -1*	52 (2)	51.4 (1.16)			
BBS post-test -2**	56 (1)	55.4 (0.81)	-6.86	< 0.0001***	3.998

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; BBS: Berg balance scale; ***significant P value

study group after the intervention (Table 1). Similarly, eyes closed pre-test showed no significant difference ($p=0.83$, Z score=-0.205, Cohen's d=0), while eyes closed post-test revealed a significant difference ($p=0.0007$, Z score=-3.372, Cohen's d=1.175) with a medium to large effect size, indicating a notable improvement in the study group (Table 2). The BBS pre-test results showed no significant difference between groups ($p=0.96$, Z score=-0.0049, Cohen's d=0.067), indicating minimal to no effect. However, the BBS post-test results revealed a significant difference ($p < 0.0001$, Z score=-6.86, Cohen's d=3.998) with a very large effect size, suggesting a substantial difference and a poten-

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
EO pre-test – 1*	47 (8)	43.8 (8.6)	-0.39	0.69	0.22
EO post-test -1*	48 (6)	45.5 (6.2)			
EO pre-test – 2**	49.5 (10)	42.5 (11.9)	-2.71	0.006***	0.81
EO post-test -2**	50 (0)	49.4 (1.16)			

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; EO: eyes open; ***significant P value

TABLE 4. Results of pre- and post-tests of single leg balance eyes open test within the control and study groups

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
EC pre-test – 1*	8 (4)	7.3 (2.9)	0.33	0.73	0.24
EC post-test -1*	8.5 (4)	7.9 (1.99)			
EC pre-test – 2**	8 (4)	7.3 (2.7)	-3.73	0.0002***	1.18
EC post-test -2**	10 (1)	9.6 (0.47)			

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; EC: eyes closed; ***significant P value

TABLE 5. Results of pre- and post-tests of single leg balance eyes closed test within the control and study groups

	Median (IQR)	Mean (SD)	Z score	P value	Cohen's d
BBS pre-test – 1*	52 (2)	50.9 (1.37)	-1.61	0.1	0.39
BBS post-test -1*	52 (2)	51.4 (1.16)			
BBS pre-test – 2**	52 (2)	50.8 (1.57)	-6.86	<0.0001***	3.68
BBS post-test -2**	56 (1)	55.4 (0.81)			

1*: control group; 2**: study group; IQR: interquartile range; SD: standard deviation; BBS: Berg balance scale; ***significant P value

TABLE 6. Results of pre- and post-tests of Berg balance scale within the control and study groups

tial intervention effect in the study group (Table 3).

In the control group, there was no significant difference in pre-test and posttest values (p=0.69, Z score=-0.39, Cohen's d=0.22). In contrast, within the study group, eyes open post-test showed a statistically significant difference (p=0.006, Z score=-2.71), with a large effect size (Cohen's d=0.81), indicating substantial improvement after intervention (Table 4). Similarly, within the study group, eyes closed post-test showed a statistically significant difference (p=0.0002, Z score=-3.73) with a large effect size (Cohen's d=1.18), indicating substantial improvement in scores after the intervention (Table 5). Also, BBS post-test within the study group showed a highly statistically significant difference (p < 0.0001, Z score=-6.86) with a very large effect size (Cohen's d=3.68), indicating substantial improvement in scores after the intervention (Table 6).

DISCUSSION

Physical activity is essential for maintaining both physical and mental health, particularly in academically demanding environments. Short duration activity breaks, such as stretching, provide a practical approach to reducing sedentary behavior and improving well-being (9).

The present study demonstrated significant improvements in both static and functional balance among participants who performed regular stretching exercises. These findings align with previous studies showing that stretching is an effective, non-pharmacological intervention for reducing WRMSDs in sedentary populations (10–13). Additionally, an eight-minute stretching program has been shown to reduce WRMSD prevalence by 2.4% (14).

Active breaks incorporating stretching and joint mobilization are more effective than passive rest in reducing muscle discomfort (15). Similarly, Galinsky *et al* reported reduced WRMSD symptoms in participants who were performing workplace stretching compared to controls (16).

The frequency and duration of stretching are critical factors. In our study, participants performed stretching five times daily for six months. Reddy *et al* reported improved balance with 30-second stretches performed four times daily over ten weeks (17). However, other studies suggest that durations beyond 30 seconds may not yield additional benefits (18, 19).

The mechanism underlying these improvements may involve increased muscle flexibility, improved joint range of motion and enhanced neuromuscular coordination. Stretching of interconnected fascial networks may also contribute to improved stability by influencing distant joints and enhancing spinal and pelvic control (20).

Limitations of the study

The relatively small sample size of the present study limits generalizability. Additionally, confounding factors such as time of day, prior activity levels and hydration status may have influenced the results.

CONCLUSION

The present study demonstrates that a simple structured static stretching program significantly improves balance in medical students. Incorporating short stretching breaks into daily routines may reduce the risk of WRMSDs and enhance overall physical well-being.

These findings support the integration of workplace stretching programs in educational settings to promote healthier and more active lifestyles among students. ❑

Acknowledgements: We thank the 60 MBBS students who participated in this study, and appreciate the support and guidance from the faculty and staff of AIIMS, Bibinagar, India. We are grateful for the valuable feedback and insights received during study design and implementation.

Conflicts of interest: none declared.

Financial support: none declared.

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