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Effects of Reactive Neuromuscular Training on Forward Head Posture among Higher Learning Institution (Academician & Non-Academician) Population

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ABSTRACT
Introduction: Reactive Neuromuscular training (RNT) activities are designed to restore functional stability on the joints and to enhance motor control skills, which can be defined as awareness of posture, movement, and changes in equilibrium and the knowledge of position, weight, and resistance of objects in relation to the body. Posture has been very important in preserving human balance. Awkward posture in various activities contributes to the increased risks of developing musculoskeletal disorders. Maintaining an upright sitting and standing posture is thus often suggested, especially nowadays when people spend longer periods in the sitting posture for occupational or leisure activities. Purpose of this study is to determine the effects of RNT in postural deformities among academicians and non-academician in higher learning institution.
Methods: Sample size estimated as 100 male and female patients were selected, they will be randomly selected based on posture evaluation and work based on desk job and lecturing (academician & non academician). The inclusion criteria were as follows: (1) age between 30–50 years; and (2) willing and able to give informed consent for participation in the study. All participants were free from spinal pain and had no previous injury or surgery in the spine and abdominal regions.
Discussion: This randomized controlled trial assessed the effectiveness of Reactive Neuromuscular Training (RNT) on craniovertebral angle (CVA) and shoulder angle (SA) among higher learning institution populations, including academicians and non-academicians. Significant improvements in CVA were observed for both groups after 12 weeks of RNT, with academicians increasing from 45.60° to 52.20° ($p < 0.001$) and non-academicians from 45.31° to 50.13° ($p < 0.001$). The control group showed some improvements in SA, but the RNT group demonstrated a notable reduction in neck disability, as indicated by the Neck Disability Index (NDI), with scores decreasing from 6.46 to 5.04 for academicians ($p = 0.022$) and from 6.44 to 4.88 for non-academicians ($p = 0.005$). These findings suggest that RNT effectively enhances postural alignment and reduces neck disability in workplace settings.
Conclusion: This study demonstrated that Reactive Neuromuscular Training (RNT) effectively improves Forward Head Posture (FHP) among tertiary institution populations, including academic and non-academic professionals. Participants receiving RNT showed marked improvements in craniovertebral angle (CVA), enhancing neuromuscular control and postural alignment. Minimal differences in improvement between groups indicate a positive response to RNT, especially among sedentary academics. These findings suggest the integration of RNT into workplace wellness programs to address postural issues and reduce musculoskeletal disorder risks. Limitations include a short intervention period and reliance on CVA as the sole FHP measure, highlighting the need for further research on the long-term effects and additional postural assessments.

Keywords: Forward head posture, Reactive Neuromuscular training, Kinovea, Neck Disability index.

INTRODUCTION

Posture plays a critical role in maintaining balance and ensuring that the musculoskeletal system functions optimally. Proper posture helps reduce strain and injury risks, promoting overall health and well-being. According to Conroy & Murray (2024), posture is defined as the relative arrangement of body parts, and maintaining good posture ensures muscular and skeletal balance, protecting the body from injury or progressive deformity.

The cervical spine consists of seven vertebrae, C1 to C7, which support head movements such as extension, flexion, and rotation. The cervical vertebrae are smaller and more mobile compared to the lower spine. The neck's musculoskeletal structure includes synovial joints, ligaments, and muscles that help stabilize and move the head. Muscles such as the sternocleidomastoid, trapezius, and scalene are involved in neck movement and stabilization, while ligaments like the anterior and posterior longitudinal ligaments maintain vertebral alignment. (Faanp et al., 2024). Forward head posture (FHP) occurs when the head moves forward from its normal alignment with the cervical spine, disrupting the balance between mobility and stability. This displacement increases the load on the upper cervical joints, particularly C0-C2 and the Atlanto-axial joint. Chu et al. (2020) conducted a study using X-rays to explore the effects of FHP and found that this posture may cause biomechanical stress on these joints, potentially leading to neck pain and destabilization over time. While this study demonstrated slight improvements in vertebral alignment after cervical adjustments, more comprehensive research is needed to establish the long-term effects of FHP. Various factors, including prolonged screen time, poor ergonomics, and decreased physical movement, contribute to the widespread prevalence of FHP. The COVID-19 pandemic exacerbated this problem by increasing the time spent in sedentary activities, which led to poor posture. Meaza et al. (2020) highlighted the prevalence of musculoskeletal pain in academic staff, with 41.5% reporting neck pain due to prolonged work hours and poor ergonomic conditions. Singh et al. (2020) reported a 73% prevalence of FHP in students, emphasizing its impact on daily activities, while Goswami & Contractor (2022) found a 70% prevalence among physiotherapy students.

Work-related musculoskeletal disorders (WMSDs) are prevalent in various professions, including academic staff, healthcare professionals, and office workers. Mohan et al. (2015) identified neck pain as a common issue, with nearly 44.7% of participants in a study of academicians reporting discomfort in the neck. Ibrahim et al. (2024) examined the prevalence of FHP in cleaning workers and found that 61.54% presented with FHP, with those having a high BMI and prolonged working hours being at the highest risk. Posture assessment involves evaluating body alignment to identify deviations that could lead to musculoskeletal issues. Traditional methods include visual assessment and the use of a plumb line. A more modern technique is photogrammetry, which uses photographs and specialized software to measure angles in body posture, such as head tilt and spinal curvature. Photogrammetry is a non-invasive, inexpensive, and standardized method for assessing posture (Singla et al., 2017). FHP is characterized by the forward displacement of the head relative to the cervical spine, leading to strain on the neck muscles and joints. Kim et al. (2016) explained that FHP increases pressure on the muscles and joints surrounding the cervical vertebrae, resulting in pain and reduced neck mobility. FHP is commonly assessed using the craniovertebral angle (CVA), shoulder angle, and kyphotic angle. A CVA less than 50° indicates the presence of FHP, with more severe cases showing angles below 30° (Shaghayegh fard et al., 2015). This research highlights the widespread prevalence of FHP and its association with musculoskeletal pain. It underscores the importance of postural correction and ergonomic interventions to prevent the harmful effects of FHP, particularly in sedentary populations such as academic staff and students.

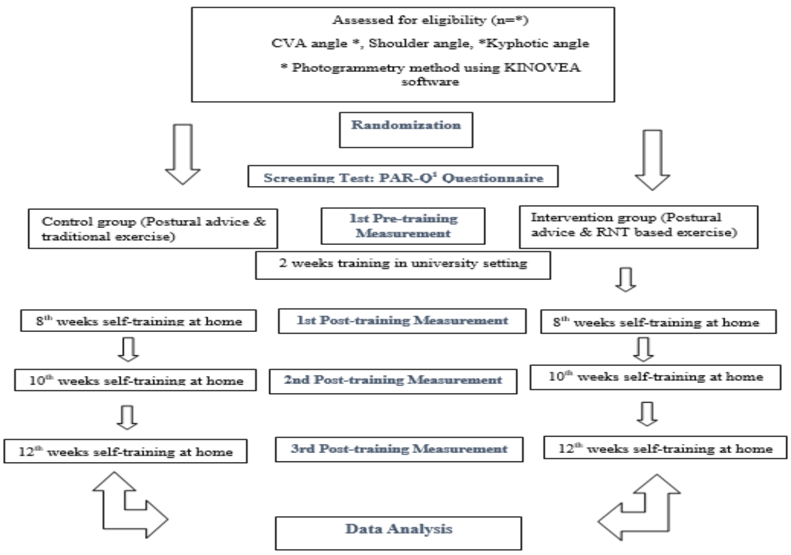
Forward head posture (FHP) is a prevalent postural dysfunction influenced by factors such as shoulder angle (SA) and thoracic kyphosis. The shoulder angle impacts overall body alignment and movement efficacy, while an increased kyphotic angle can exacerbate FHP. Numerous studies highlight the relationship between prolonged sitting, poor ergonomics, and FHP, especially among desk workers. Various interventions, including exercise programs targeting postural correction and strengthening, have shown promise in alleviating FHP. Reactive neuromuscular training (RNT) is emerging as an effective method for improving neuromuscular control and stability, but research on its specific efficacy for FHP remains limited, particularly among higher education professionals. This gap underscores the need for further investigation into RNT's potential benefits for this population, aiming to enhance understanding and develop effective management strategies for FHP.

This study employs a Randomized Controlled Trial (RCT) to assess the effectiveness of Reactive Neuromuscular Training (RNT) on forward head posture (FHP) among populations in higher learning institutions, including both academicians (lecturers, tutors, clinical staff) and non-academicians (management and administrative staff). Participants were selected based on specific inclusion and exclusion criteria, and their craniovertebral angle (CVA) and shoulder angle (SA) were measured using photogrammetry with Kinovea software. The measurement process involved standardized photography, ensuring consistent distances and positions for accurate results. Kyphosis and scoliosis were assessed using the flexicurve ruler method and the Adams forward bending test, respectively, while limb length discrepancies were evaluated through measurements from the anterior superior iliac spine to the medial malleolus. Prior to randomization, participants completed a physical activity readiness questionnaire to assess their health status. Both groups received postural advice, but the intervention group engaged in RNT-based exercises, while the control group performed traditional exercises for the upper back. The training sessions were conducted three times per week over two weeks, with post-intervention measurements taken at the eighth, tenth, and twelfth weeks to evaluate changes in CVA and SA. Informed consent was obtained from all participants before their involvement in the study.

The study focuses on individuals working in higher learning institutions in Kedah and Penang, specifically targeting academicians (lecturers, tutors, and clinical staff) and non-academicians (management and administrative staff). A rigorous selection procedure ensured the validity of the study, which spans from January to May 2024 and involves 100 participants (50 in the intervention group and 50 in the control group). Data collection, including pre- and post-measurements, occurs over a 14-week period at various institutions, including Aimst University. The sample size was determined using G-power software, with α set at 0.05 and a power of 80%. Simple random sampling was employed to allocate participants into groups. Inclusion criteria include ages 30-50, specific craniovertebral and kyphotic angles, and completion of the Physical Activity Readiness Questionnaire (PAR-Q), while exclusion criteria encompass structural scoliosis, heart disease, previous spinal surgeries, limb length discrepancies, and recent neck or shoulder injuries. Data collection tools include the PAR-Q, Neck Disability Index (NDI), Kinovea software for motion analysis, and Flexicurve measurement for spinal curvature assessment. The study aims to assess the impact of Reactive Neuromuscular Training on forward head posture while considering the functional limitations caused by neck pain. The NDI serves as a self-reported measure of how neck pain affects daily life, while Kinovea aids in analyzing movement patterns. The Flexicurve is used for objective measurement of spinal curvature, demonstrating good reliability for assessing thoracic kyphosis but moderate for lumbar lordosis. Overall, the study seeks to enhance understanding of postural issues in higher learning institution employees, contributing to workplace wellness initiatives.

MATERIALS AND METHODS

This randomized controlled trial (RCT) investigates the effectiveness of Reactive Neuromuscular Training (RNT) on forward head posture (FHP) among higher learning institution populations, encompassing both academicians (lecturers, tutors, and clinical staff) and non-academicians (management and clerical staff). RCTs are particularly robust in establishing cause-and-effect relationships, minimizing biases and confounding factors. The study employed photogrammetry with Kinovea software to measure craniovertebral angle (CVA) and shoulder angle (SA) from standardized photographs taken with an iPhone 11 Pro. Participants were positioned 1 meter in front of a posture analysis chart, and adhesive markers were applied to the tragus (ear) and C7 vertebra to enhance measurement accuracy. The research focused on individuals with a CVA range between 30° and 50°, indicating mild FHP, while excluding those with severe kyphosis, scoliosis, or other spinal issues. Kyphosis was assessed using a flexicurve ruler to evaluate forward curvature, and scoliosis was screened using the Adam's forward bending test to identify any lateral spinal curves. Additionally, leg length discrepancy (LLD) was measured with a tape from specified anatomical landmarks. Participants were randomly assigned to either the intervention or control group. The intervention group received postural advice alongside RNT-based exercises, whereas the control group received postural advice and traditional upper back exercises. Both groups were instructed on ergonomic practices for workstation use. The training protocol involved three sessions per week for two weeks, after which post-intervention measurements were taken at 8, 10, and 12 weeks using the same photogrammetry method. All participants provided informed consent before the study, ensuring ethical compliance. This research aims to provide valuable insights into the effectiveness of RNT in correcting FHP and improving overall posture among various groups within higher learning institutions, thereby contributing to the understanding of postural health in academic environments.



Flow Chart 1

The control group plan includes a structured approach focusing on postural advice and traditional exercises aimed at addressing forward head posture (FHP) and promoting overall spinal health. This plan is designed to serve as a baseline comparison against the intervention group, which employs Reactive Neuromuscular Training (RNT).

1. Postural Advice

Participants in the control group receive comprehensive postural guidelines to improve ergonomics during the use of mobile electronic devices (MED) and desktop computers. This advice emphasizes maintaining proper alignment to minimize strain on the neck and back. Specific recommendations might include adjusting screen height, ensuring chair support, and promoting regular breaks to alleviate prolonged static posture. Additionally, general back care advice is provided to raise awareness about maintaining a neutral spine during various activities.

2. Traditional Exercises

The exercise component focuses on traditional stretching and strengthening exercises that target key muscle groups involved in maintaining proper posture:

I. Upper Trapezius Stretches:
These stretches aim to lengthen the upper trapezius muscles, which often become tight due to forward head posture. By loosening these muscles, the exercise helps alleviate tension in the neck.

II. Levator Scapulae Stretch:
Similar to the upper trapezius stretch, this exercise targets the levator scapulae, which can contribute to neck discomfort. Stretching this muscle helps reduce tightness and enhance mobility.

III. Shoulder Blade Squeezes:
This exercise focuses on activating the rhomboids and trapezius muscles to encourage the shoulders to retract. Strengthening these muscles helps counteract the forward pull often seen in individuals with FHP.

IV. Wall Angels:
Performed against a wall, this exercise improves upper back strength and mobility. It encourages proper shoulder alignment and works to open up the chest, supporting better postural habits.

V. Chin Tucks:
Chin tucks are crucial for strengthening the deep cervical flexors, which play a significant role in maintaining head alignment. This exercise helps counteract the tendency for the head to migrate forward, promoting better neck posture.

VI. Cat-Camel Stretch:
This dynamic stretch increases spinal mobility and helps release tension in the back muscles. It encourages flexion and extension of the spine, promoting better overall back health.

Participants are instructed to complete three exercise sessions per day, with ten repetitions for each exercise. This structured frequency ensures that participants engage regularly with the exercises, reinforcing the importance of consistent practice in improving postural alignment and reducing discomfort.

The intervention group plan incorporates a multifaceted approach aimed at addressing forward head posture (FHP) through a combination of postural advice and Reactive Neuromuscular Training (RNT) exercises. This approach recognizes that FHP can significantly impact musculoskeletal health and overall well-being, particularly among individuals who spend extended periods using mobile devices and computers.

Postural Advice

The plan starts with comprehensive postural guidelines for using mobile electronic devices (MED) and desktop computers. Participants will learn the correct ergonomic positions to reduce strain on the neck and spine while using these devices. This includes tips on screen height, chair posture, and the importance of taking regular breaks to prevent prolonged static positioning. Additionally, general advice on back care will be provided, which emphasizes the need for awareness of one’s posture throughout daily activities. The aim is to cultivate a mindset of postural awareness that encourages healthier habits in everyday settings.

RNT-Based Exercises

The core of the intervention is the RNT exercises, which are specifically designed to target the deep cervical muscles and upper back. These exercises aim to improve muscle activation, strength, and flexibility, which are crucial for correcting postural imbalances.

I. Chin Tucks with Towel Resistance:
This exercise involves gently tucking the chin while using a towel for resistance, helping to engage the deep cervical flexors. This movement counters the forward pull of the head and strengthens the muscles that support proper head alignment.

II. Neck Flexion (Suboccipital Stretch):
This exercise focuses on stretching the back of the neck, particularly the suboccipital muscles. It helps alleviate tension in this area, which can become tight due to FHP, promoting better mobility and relaxation.

III. Wall Angels:
Performed against a wall, this exercise enhances upper back strength and mobility. It involves sliding the arms up and down while maintaining contact with the wall, which encourages proper shoulder alignment and strengthens the muscles around the shoulder blades.

IV. Self-Resistance Neck Flexion and Extension:
These movements are designed to strengthen the neck muscles by providing resistance during flexion and extension. Participants can perform these exercises using their hands to resist the motion, promoting muscle activation and endurance.

V. Bilateral Pectoral Stretch:
This stretches targets the chest muscles and helps open up the pectoral region, which can become tight with prolonged sitting and forward head posture. By stretching one arm at a time against a wall, participants will feel a stretch in the chest while engaging their core to maintain proper alignment.

VI. Static Stretching of the Sternocleidomastoid:
This exercise involves stretching the sternocleidomastoid muscle, which plays a significant role in neck movement. It helps alleviate tightness and improves flexibility in the neck, contributing to better overall posture.

Participants are instructed to complete three exercise sessions per day, with each session comprising ten repetitions of each exercise. This frequency encourages consistent engagement and practice, essential for achieving the desired improvements in posture and muscle balance

RESULTS

Table 2: Background characteristics of the respondents

Variables	Frequency	Percent %
Type of profession		
Academic	49	49.5
Non-Academic	50	50.5
Intervention		
Control	50	50.5
RNT	49	49.5
Gender		
Male	27	27.3
Female	72	72.7

The baseline data presented in Table 2 The study included a total of 99 participants, with nearly equal distribution across academic and non-academic professions. Specifically, 49.5% of participants were from academic roles, while 50.5% were non-academics. Similarly, the participants were evenly divided between the intervention groups, with 50.5% in the control group and 49.5% in the Reactive Neuromuscular Training (RNT) group. In terms of gender, there was a larger proportion of female participants, representing 72.7% of the total, while males accounted for 27.3%.

Table 3: Comparison of craniovertebral angles and shoulder angles before training and after 12 weeks of training

variable	Profession	Time	control Group (mean ±SD)	RNT Group (mean± SD)	t	p-value
CVA	Academician	Before training	45.60 ±2.93	45.38±3.24	-16.656	0.000*
		After 12 weeks	52.20±2.56	50.18 ±2.43		
	Non-Academician	Before training	45.31 ±3.24	44.48 ±3.37	-15.798	0.000*
		After 12 weeks	50.13 ±2.41	50.98 ±2.08		
SA	Academician	Before training	32.64 ±4.45	31.34 ±5.85	3.134	0.003*
		After 12 weeks	29.52 ±4.28	30.13 ±4.95		
	Non-Academician	Before training	31.54 ±4.91	27.82 ±4.93	1.589	0.119
		After 12 weeks	29.26 ±4.10	28.1 ±4.23		

- The table presents the changes in Craniovertebral Angle (CVA) and Shoulder Angle (SA) for both academic and non-academic participants before and after a 12-week training period. In the CVA category, both academic and non-academic participants in the Reactive Neuromuscular Training (RNT) group showed significant improvements after 12 weeks compared to the control group, with p-values of 0.000 for both professions, indicating statistically significant differences. For the shoulder angle (SA), academic participants in the RNT group also demonstrated significant improvements after 12 weeks ($p = 0.003$), while non-academic participants did not show a statistically significant difference ($p = 0.119$). These results suggest that RNT had a greater effect on improving postural alignment (CVA) in both groups and was more effective in improving shoulder angle in academic participants. These results seen in a control population imply that RNT is likely an effective alternative for academicians to enhance CVA and SA with this method training but the significant improvements achieved by at least one group. Results suggest the potential of RNT as an intervention for improving posture, with variation in effect size depending on population and outcome measured.

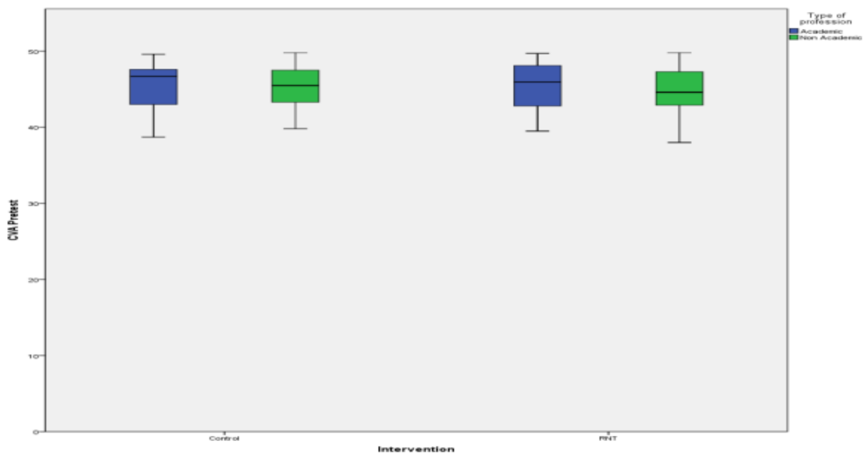


Figure 1: Craniovertebral angles – pretest measurement

The boxplot compares two main groups: the control group and the Reactive Neuromuscular Training (RNT) group. These subgroups were again stratified into academic and non-academic members in order to assess the role of profession on baseline CVA.

The box plot in figure 1 compares the Craniovertebral Angle (CVA) across different intervention groups—control and Reactive Neuromuscular Training (RNT)—for academic and non-academic participants. The CVA is shown for both groups, with blue representing academicians and green representing non-academicians. It appears that both academic and non-academic participants in the RNT group have higher median CVA values compared to those in the control group, suggesting improved postural alignment after the intervention. The box plot indicates a wider range of CVA values in the control group compared to the RNT group, which has a more consistent improvement across participants.

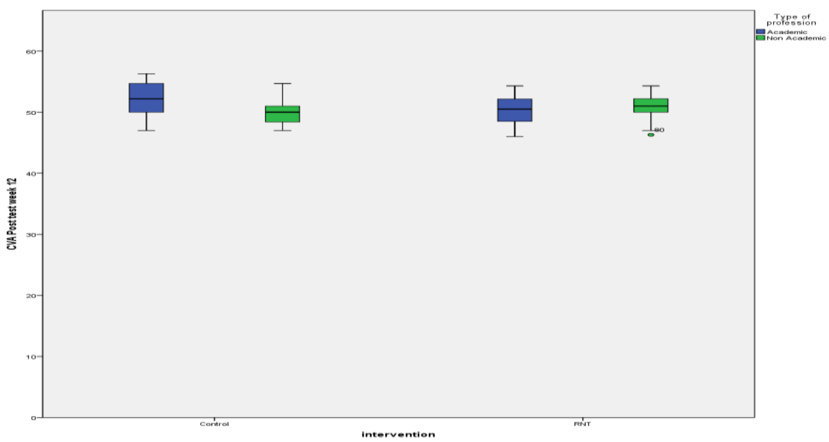


Figure 2: Craniovertebral angles after 12 weeks of training – post-test measurement.

The graph above presents CVA measurements post 12 weeks for each of the participants as those in a control group and Reactive Neuromuscular Training (RNT) intervention group.

The boxplot illustrates the post-test Craniovertebral Angle (CVA) values at 12 weeks for both control and Reactive Neuromuscular Training (RNT) intervention groups, divided into academic and non-academic participants. CVA, an indicator of forward head posture (FHP), reveals that higher values represent better posture, while lower values indicate more evident FHP. In the control group, academic participants had a slightly higher median CVA post-test value compared to non-academics, but with minimal improvement overall. In the RNT group, there was a larger improvement, particularly among academic participants, those median CVA was higher than that of non-academics, suggesting better postural gains. The boxplot also shows outliers, particularly in the non-academic RNT subgroup, indicating variability in how participants responded to the intervention. The interquartile range (IQR) reflects the spread of data, with whiskers indicating data points within a specific range. The study concludes that while RNT had a beneficial impact on posture, the effect was small and may diminish over time, with variability in response highlighting the need for further research into individual differences.

Table 4: The pairwise comparisons of craniovertebral angles and shoulder angles by paired t test

Variable	pairwise comparisons	mean difference	SD	p-value
CVA	pretest-week 8	-5.265	2.338	0.000*
	week8-week 10	-0.147	0.460	0.002*
	week 10-week 12	-0.276	0.663	0.000*
	pretest-week 12	-5.688	2.457	0.000*
SA	pretest-week 8	0.940	3.608	0.011*
	week8-week 10	0.348	1.225	0.006*
	week 10-week 12	0.043	0.672	0.522
	pretest-week12	1.332	4.104	0.002*

*Statistically significant differences were observed. CVA: craniovertebral angle, SA: shoulder angle, SD: standard deviation

Pairwise comparisons of craniovertebral angles (CVA) and shoulder angles (SA) at multiple points in time describe the effects of intervention over the study period. Table 3 presents these changes from the pretest to week-12, disaggregated by intervals (weeks 8 and 10) as well as corresponding paired t-tests with exact p-values.

Pair-wise comparisons demonstrate improvement in both craniovertebral and shoulder angles over the study periods, especially during the earlier weeks. The largest changes are seen between the pretest and week 8, with continued (though waning) improvements through to week 12. This pattern of a decreasing CVA indicates reduced forward head posture, and the SA reflects an overall better shoulder position. This clearly indicates the positive effects that had been gained and maintained during this currently practiced intervention upon posture alignment over time.

Table 5: Disability level based on neck disability index by chi-square test

Profession	Time	Disability level	Control group n(%)	RNT group n(%)	p-value
Academician	Before training	none	6 (24)	6(25)	0.859
		mild	17(68)	15(62.5)	
		moderate	2(8)	3(12.5)	
	After 12 weeks	none	6(24)	7(29.2)	0.357
		mild	17(68)	17(70.8)	
		moderate	2(8)	0(0)	
Non-Academician	Before training	none	7(28)	7(28)	0.598
		mild	18(72)	17(68)	
		moderate	0(0)	1(4)	
	After 12 weeks	none	7(28)	11(44)	0.377
		mild	18(72)	14(56)	

Table 4 shows levels of disability by Neck Disability Index (NDI) among participants in control and Reactive Neuromuscular Training group according to profession, academicians vs. non-academicians. The table presents data on disability levels using the Neck Disability Index (NDI) among academic and non-academic participants in both the control and Reactive Neuromuscular Training (RNT) groups, before training and after 12 weeks of intervention. Before training, disability levels were similar between the control and RNT groups. For academicians, 24% in the control group and 25% in the RNT group reported no disability, with 47% and 37.5% reporting severe disability, respectively. However, the differences were not statistically significant (p-value: 0.859). After 12 weeks, there was a slight shift, with 29.2% of RNT participants reporting no disability compared to 24% in the control group. Notably, no RNT participants reported moderate disability after 12 weeks, though again, the differences remained statistically insignificant (p-value: 0.357). Among non-academicians, before training, 28% of both the control and RNT groups reported no disability, with a similar percentage having mild disability. After 12 weeks, the RNT group saw a higher percentage (44%) reporting no disability compared to the control group (28%), but this difference was also not statistically significant (p-value: 0.377). While there were noticeable trends towards improvement in the RNT group, particularly after 12 weeks, none of the differences between groups were statistically significant, indicating no significant effect of RNT on NDI-based disability levels in either group.

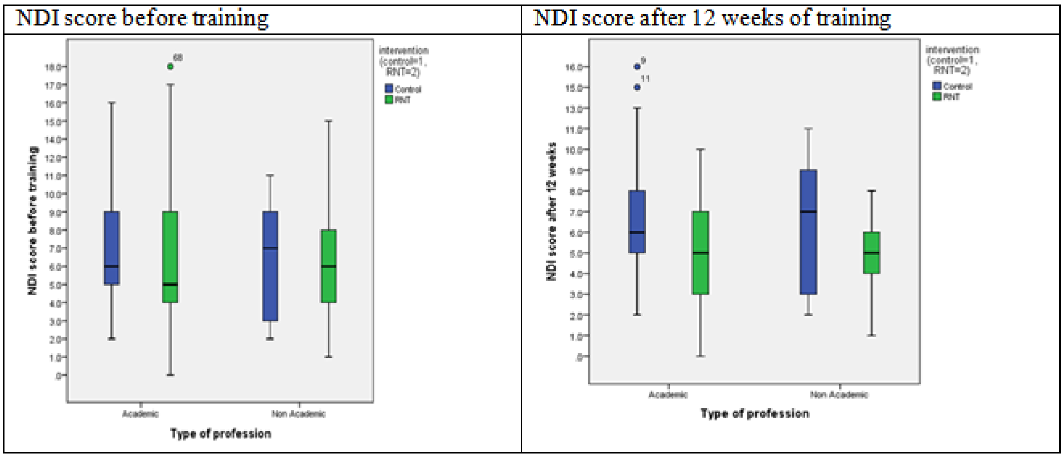


Figure 3: NDI score comparison before training and after 12 weeks of training

Figure 3 box plot represents NDI (Neck Disability Index) scores after 12 weeks for different types of professions (academic and non-academic), divided into control (blue) and RNT (green) intervention groups. Academic professionals in Control group recorded Median NDI score is around 7, with a wider range and a few outliers (marked at 9 and 11) and RNT group recorded Median NDI score much lower (around 5), showing a narrower range compared to the control group, indicating less variability and improvement. Non-academic professionals in Control group recorded Median NDI score is around 8, with a similar range to the academic control group and RNT group recorded Median NDI score is lower (around 4.5), with a more compact distribution compared to the control group, indicating reduced neck disability. The RNT group (green) in both professional categories show lower median NDI scores and less variability, suggesting that RNT was effective in reducing neck disability after 12 weeks. The control groups (blue) maintain higher NDI scores with wider ranges, reflecting greater disability and less improvement.

Table 6: Comparison of NDI score before and after the training

Profession	Time	control Group (mean ±SD)	RNT Group (mean± SD)	t test	p-value
Academician	Before training	6.92±3.95	6.46 ±4.99		
	After 12 weeks	6.76 ±3.79	5.04 ±2.93	2.376	0.022*
Non-Academician	Before training	6.52 ±2.86	6.44 ±3.16	2.922	0.005*
	After 12 weeks	6.52 ±2.86	4.88 ±2.26		

*Statistically significant differences were observed

DISCUSSION

Based on the results, the Reactive Neuromuscular Training (RNT) intervention showed a positive impact on participants' forward head posture (FHP) and neck disability levels as measured by the Craniovertebral Angle (CVA) and Neck Disability Index (NDI). The data reveals significant improvements in CVA in both academic and non-academic groups after 12 weeks of RNT, demonstrating enhanced postural alignment, especially in the intervention group compared to the control group. This suggests that RNT was effective in addressing postural imbalances, reducing FHP, and improving neuromuscular control, regardless of professional background.

The NDI results indicate a reduction in neck disability in the RNT group, with lower median scores compared to the control group, particularly after 12 weeks of training. While both academic and non-academic participants benefited, academic participants showed slightly better improvements in CVA and NDI, perhaps due to their more sedentary nature and the greater impact of posture-correcting exercises on their daily activities. The outliers observed in the NDI results, especially in non-academic participants, suggest individual variability in response to the intervention, indicating that some participants experienced more substantial improvements in disability than others. However, despite these positive findings, the improvements were modest, and the statistical significance was not always strong across all measures (such as the NDI). This could indicate that while RNT is effective, it might need to be complemented with other interventions or applied over a longer duration to achieve more pronounced and sustained effects. The lack of significant difference between the control and RNT groups at the 12-week point for certain variables, like neck disability in the academic group, further supports the idea that RNT alone may not be a comprehensive solution for all individuals. Additionally, the presence of outliers in the non-academic group suggests inter-individual variability in the response to the RNT, pointing to potential factors like varying degrees of pre-existing musculoskeletal issues, lifestyle differences, or adherence to the exercise regimen. These differences should be explored in future studies to better understand the long-term effects of RNT on different occupational populations. In assumption, the results support the efficacy of RNT in improving FHP and reducing neck disability in both academic and non-academic populations. However, the modest improvements and inter-individual variability highlight the need for more comprehensive approaches and longer-term follow-up to assess the sustainability of these benefits. Future research should focus on combining RNT with other interventions and exploring factors that influence individual responses to maximize its effectiveness in workplace wellness programs.

CONCLUSIONS

The results of this study demonstrated that Reactive Neuromuscular Training (RNT) is an effective intervention for improving Forward Head Posture (FHP) among higher education institution populations, including both academic and non-academic professionals. Participants who underwent RNT showed significant improvements in Craniovertebral Angle (CVA), indicating enhanced neuromuscular control and better postural alignment. While there were minimal differences in the extent of improvement between academic and non-academic groups, the findings suggest that both groups responded well to RNT. This was especially notable for sedentary academics, who are more susceptible to postural deviations due to prolonged sitting. The results highlight RNT as particularly valuable for addressing posture issues in sedentary professions.

These findings have significant implications for workplace wellness programs in academic settings, suggesting that integrating RNT into daily routines could reduce the risk of musculoskeletal disorders related to poor posture. Despite the positive results, the study acknowledges some limitations, including the short intervention period and reliance on CVA as the primary measure of FHP. Future research should explore the long-term sustainability of RNT, investigate additional measures of postural control, and consider the potential benefits of combining RNT with other interventions. Overall, this research points to the potential for RNT to improve the physical well-being of staff in sedentary roles within higher education institutions, which could enhance both personal health and workplace productivity.

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