



## **Effect of Stretching and Strengthening Protocol on Forward Flexed Posture in Post-Menopausal Women**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Forward flexed posture is one of the most common structural change which occurs during menopause due to osteoporosis. Stretching and strengthening of cervical and thoracic spine muscles helps to alter the postural changes and maintain COG. This study thus, aims to see the effectiveness of the structured exercise protocol in post-menopausal women.

**Aims and Objective:** To study the effectiveness of supervised and non-supervised stretching and strengthening protocol in post-menopausal women with forward posture.

**Materials and Methods:** A total 40 post-menopausal women with forward head posture were selected on the basis of selection criteria. They were randomly allocated in two groups A) Supervised Group= 20, B) Unsupervised Group=20 each. Forward flexed posture was assessed using Occiput to Wall Test and Craniovertebral Angle. Treatment was explained to both the groups. The pre and post measurements of the participants were recorded.

**Results:** Statistical analysis was performed using the unpaired t test. Occiput to wall test and craniovertebral angle were used as the outcome measures for determining the effect of stretching

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and strengthening on forward neck posture. Comparing the pre-intervention and post-intervention values of occiput to wall test, a significant difference was seen following administration of protocol ( $p < 0.0001$ ). For craniovertebral angle, a significant difference was seen between pre-intervention and post-intervention values ( $p < 0.0001$ ). Also, it was seen that there was a significantly higher difference in the values of craniovertebral angle and occiput to wall test values in the supervised groups as compared to the unsupervised group.

**Conclusion:** The current study demonstrated the effect of stretching and strengthening exercise in improving postural kyphosis in post-menopausal women. In addition, all variables of interest showed statistically significant post-treatment improvements in supervised group than unsupervised group.

*Keywords: Forward flexed posture; menopause; stretching; strengthening.*

## 1. INTRODUCTION

Menopause is one of the natural stages in every woman's life and occurs around the age of 48 to 65 years. This stage is associated with the cessation of ovulation and menstruation, the loss of fertility, and the symptoms of reduced and discontinued sex hormones. The common changes and symptoms experienced by women are hot flashes, changes in body structure, osteoporotic changes, and changes in some organs of the body [1]. One of the most important changes are musculoskeletal disorders, including osteoporosis, muscle atrophy, and the symptoms of muscle weakness; these changes are closely related to aging. Worldwide, the number of people over 60 years is growing faster than other age groups. It is expected to increase from 688 million in 2006 to almost 2 billion by 2050. This general upturn in life expectancy compels that more efforts have to be spent on the prevention and treatment for health condition, disability, and mental health in the elderly population.

The female sex hormone oestrogen plays a key role in maintaining the integrity of the musculoskeletal system. Therefore, a decrease in this hormone leads to muscle dysfunction. Osteoporosis is a skeletal disorder that disposes the person to increased fractures by damaging bone strength [2]. Women experience changes in the spine following osteoporosis, as they age. The most common postural changes are kyphosis that affects postural balance, gait, and postural function and oscillation. These contributors are all related with fall risk, that is one of the major public health related issues.

The complications of kyphosis include increased pain, decreased muscle strength, decreased vertebral density, decreased height, decreased rib mobility, and even decreased respiratory function [3]. Also, a curved posture can change

movement strategies and upset the balance owing to bringing the center of gravity closer to the stability range. On the other hand, the increase of the kyphosis angle reduces the range of motion of spinal extensions and significantly affects physical performance, the ability to perform daily life activities, and ultimately, the quality of life.

Faulty postures of neck, shoulders contribute to cervical pain and dysfunction. According to study, ideal head posture is depicted when the external auditory meatus is aligned with the vertical postural line, the vertical postural line as seen in a side view, passes slightly in front of the ankle joint and the centre of the knee joint, slightly behind the centre of the hip joint and through the shoulder joint and the external auditory meatus [4]. Mastoid process as the reference for alignment of the head on the shoulders. Forward head posture is a specific condition in which the head is positioned anterior to the vertical postural line.

If the COG of the body shifts from its normal position, high muscle activity is needed to recover from this unstable position. Therefore, in conditions of structural imbalance, such as FHP, it is difficult to adjust changes properly, in the external environment because the autonomic nervous system has a decreased ability to respond to external stimulus [5]. According to studies it is seen that there is prevalence of forward head posture in Post-menopausal women.

Forward head posture or forward flexed posture is considered as a postural abnormality caused due to reasons like cervical and thoracic muscle insufficiency. Thoracic Kyphosis is a complication of the combination of slouched-forward shoulders and rounded upper back. Many people develop chronic or recurrent problems because

they receive treatment for the pain (e.g. pain killers or anti-inflammatory medication) but never receive treatment for the underlying cause which is their FHP [6]. This study thus aims to treat the underlying root cause than a symptomatic treatment.

There are studies conducted for effectiveness of exercise protocol on adults and office going population. These studies have used a pectoral muscle stretching protocol along with postural correction [7]. There are significant gaps in research literature regarding postural correction among post-menopausal women. Stretching protocol combined with strengthening are known to be most effective combination given for therapeutic purposes. Thus, this protocol is being used for treatment of forward head posture in post-menopausal women.

Forward flexed posture causes disturbances in the daily life of such women adding to the other problems faced during this period. Forward head posture also can also cause imbalance leading to frequent falls in the later year. Thus, this study aims at the finding the effectiveness of stretching and strengthening exercise on forward flexed posture.

## 2. MATERIALS AND METHODS

An experimental study was carried out using a pre and post intervention. The samples were selected using the simple random sampling method. The study was conducted in and around Karad, Maharashtra. 40 females participated in the study who met the inclusion criteria. The sampling method was randomized sampling. The participants were divided into two groups of 20 each. The participants in the study were from the age group of 45-65 years. The participants who underwent menopause 2 years back, participants who were not enrolled in any kind of physical activity and participants for whom practice of physical activity was not contra-indicated were included in the programme. The participants with diagnosis of any other condition related to neck pain, uncontrolled hypertension or a recent history of myocardial infarction, or who were on any pain medications which may affect balance and co-ordination were excluded from the study.

### 2.1 Procedure

This study was conducted to find out the effect of stretching and strengthening exercise on forward flexed posture. the subject had been approached

for the purpose of the study. The procedure had been explained and written informed consent taken from those willing to participating. Demographic information of the subjects was taken. Patients were assessed by using:

- Occiput to Wall Test
- Craniovertebral Angle

The study was done in 6 months duration and was conducted in Karad. Subjects were selected based on the inclusion and exclusion criteria. Total 40 subjects were equally divided into two groups supervised and unsupervised groups were made using sampling with random allocation. Baseline treatment was explained to both groups. Group A was supervised and Group B was Unsupervised was given. The protocol was explained to both the groups. Supervised group was given treatment in Krishna College of OPD for 12 weeks 2-3 times/ week. It includes Unsupervised group was explained the protocol and asked to practice at home. The result of the study was done based on a detailed post intervention assessment. The study was concluded by statistical analysis was done by using the statistics software INSTAT. Data on all outcome measures were measured.

### 2.2 Protocol

#### 8 Weeks (2 months)

- 1) Hot Moist Pack: Cervical area and Upper Trapezius (10 Mins)
- 2) Exercises – Chin Tucks (10 Repetitions x 3 sets)

This exercise done in a supine lying position with the head in contact with the floor. This exercise targets the deep flexors muscles of the upper cervical region. This low - load exercise that involves performing and holding inner range positions of craniocervical flexion that specifically activates deep cervical flexor rather than superficial flexor.

- 3) Self-stretching using roller – 5 sets of 30 repetitions daily.
- 4) Isometric exercise to neck muscles (10 repetitions) – patient is in supine lying position, keeping towel roll below the neck as patient to press it down, hold for 10 sec then release.

- 5) T and Y exercises (10 repetitions)- Patient is in prone lying position. The patient retracts the scapulae with the arms abducted to 90°.As the patient advances, the shoulders are externally rotated with the elbows flexed to 90°, forming a Y. Then the patient moves into a position of full bilateral elevation with the elbow extension forming an Y.
- 6) Static sternocleidomastoid stretches (10sec hold x 3 sets)- Sternocleidomastoid stretching start in optimal posture and place right arm behind body, depression the shoulder. Draw abs in. Tuck chin and slowly draw left ear to the left shoulder. Continue by rotating the neck upward toward the ceiling until a slight stretch is felt on the right side. We can use the left hand to apply slight pressure and assist in lateral flexion and rotation. Switch sides and repeat.
- 7) Stretching for pectoral muscles- (10 sec hold x 3)
- 8) Progressive resistance exercises – using Thera Band

- Weight cuff

### 2.3 Statistical Analysis

The outcome measures were assessed at the baseline. The collected data in this study was statistically analysed using descriptive statistics as the mean standard deviation. The main outcome measures are occiput to wall test and craniovertebral angle. The experimental and control (intra group) group pre and post values were analysed using paired t test and intergroup were analysed using the unpaired t test.

### 3. RESULTS

The below Fig. 4 statistics show that there is a significant effect of stretching and strengthening on occiput to wall test values and craniovertebral angle values in both supervised and unsupervised groups of post-menopausal women.

The below Fig. 6 statistics show that supervised groups in both occiput to wall test as well as craniovertebral angle respond better as compared to unsupervised groups.

#### 1. Occiput to wall test (in supervised individuals)

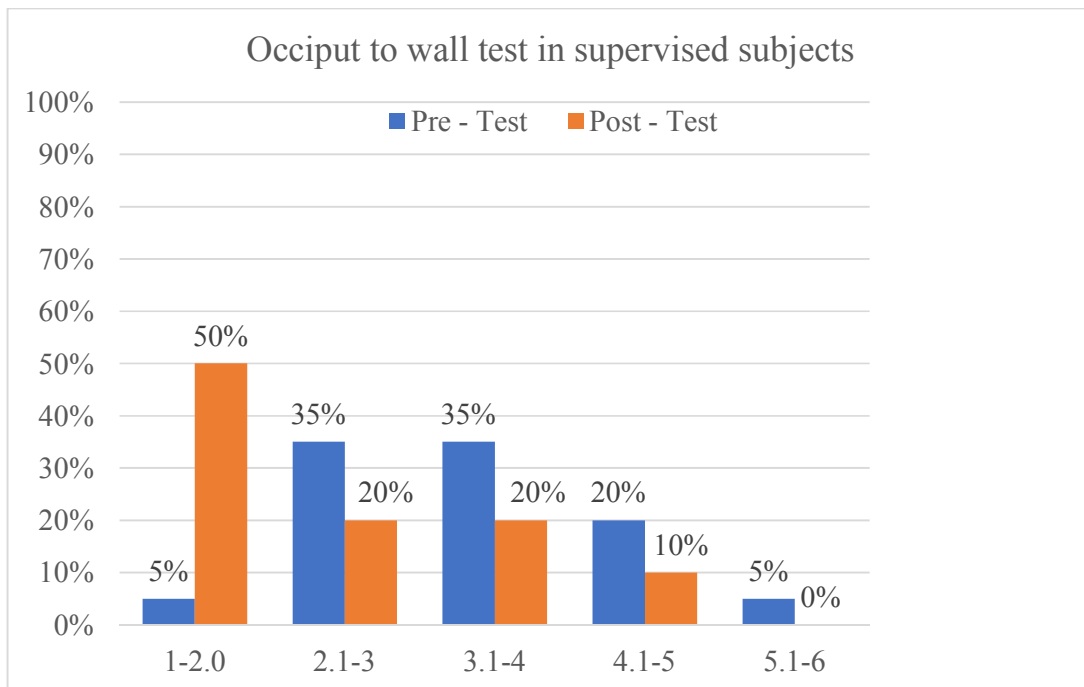
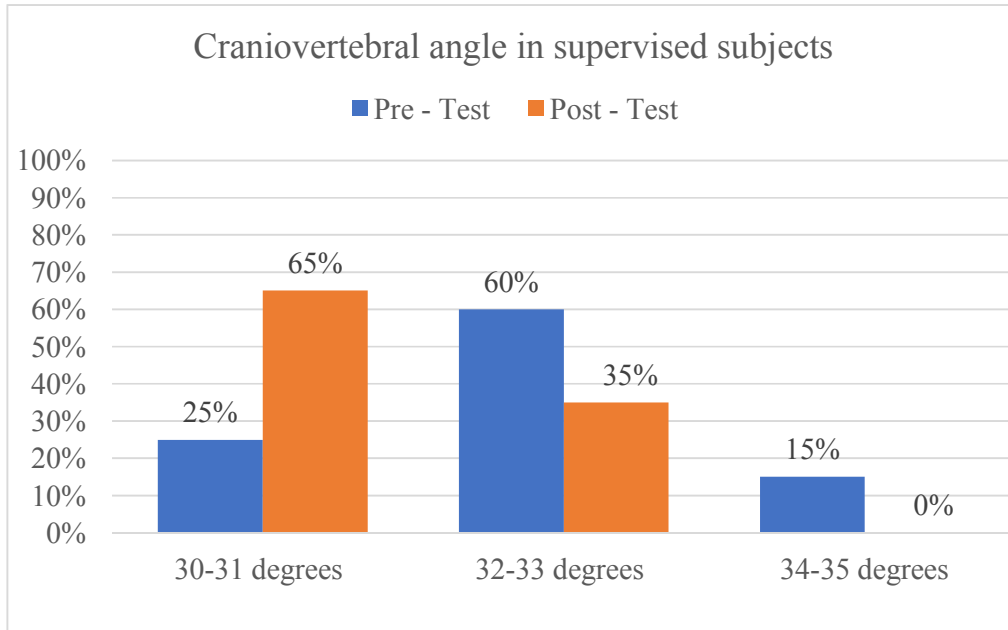


Fig. 1. Occiput to wall test in supervised group

**Table 1. Comparison of pre and post intervention values in occipital to wall test**

Values	Mean± SD	P value	
Pre	3.5±1.078	<0.0001	P<0.0001
Post	2.1± 0.7857	<0.0001	<b>(significant)</b>

**2. Craniovertebral angle (supervised subjects)**

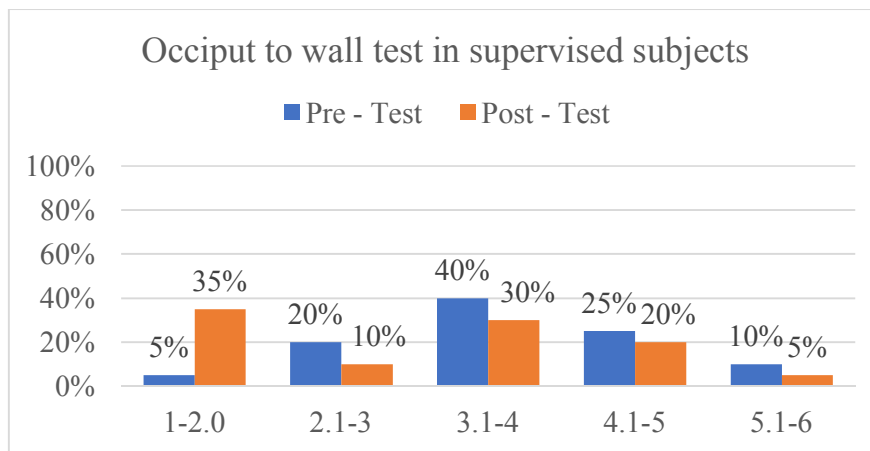


**Fig. 2. Craniovertebral angle values in supervised group**

**Table 2. Comparison between pre and post intervention values**

Values	Mean ± SD	P value	
Pre	30.15±1.268	<0.0001	P<0.0001
Post	29.15±0.7452	<0.0001	<b>(significant)</b>

**3. Occiput to wall test (Unsupervised subjects)**

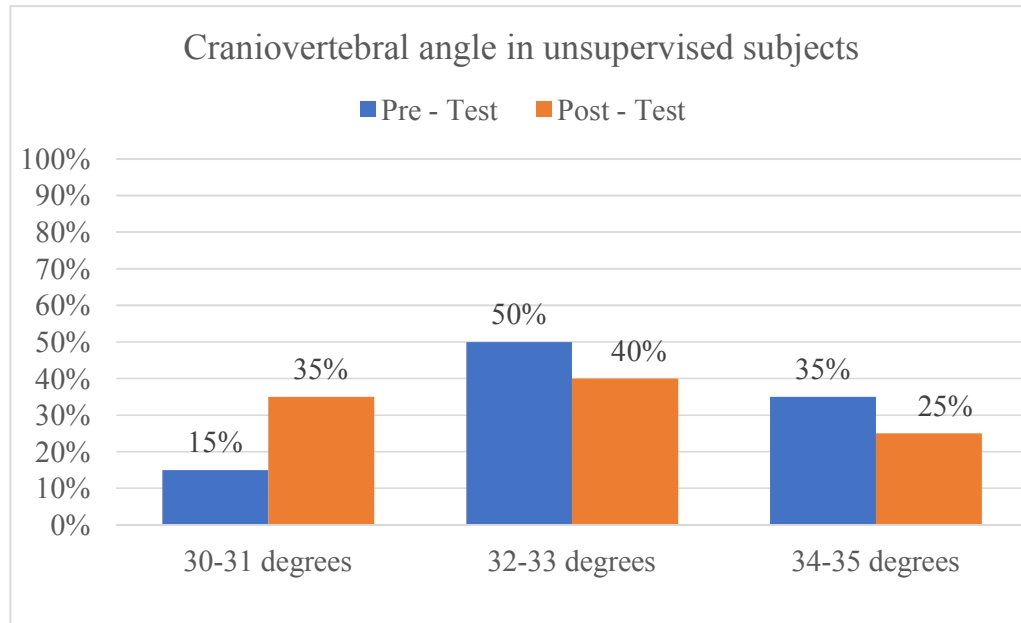


**Fig. 3. Occiput to wall test in supervised subjects**

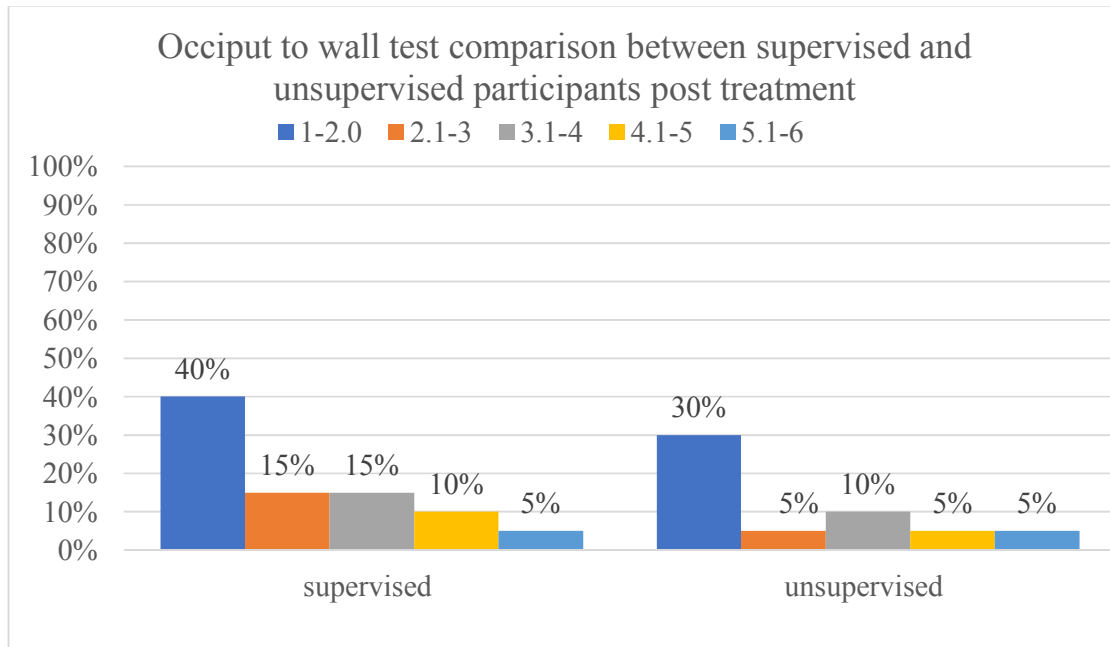
**Table 3. Comparison between pre and post intervention values**

Values	Mean ± SD	P -Value	p
Pre	3.74±1.208	3.2	<0.0001 (significant)
Post	3.2±1.134	1.134	

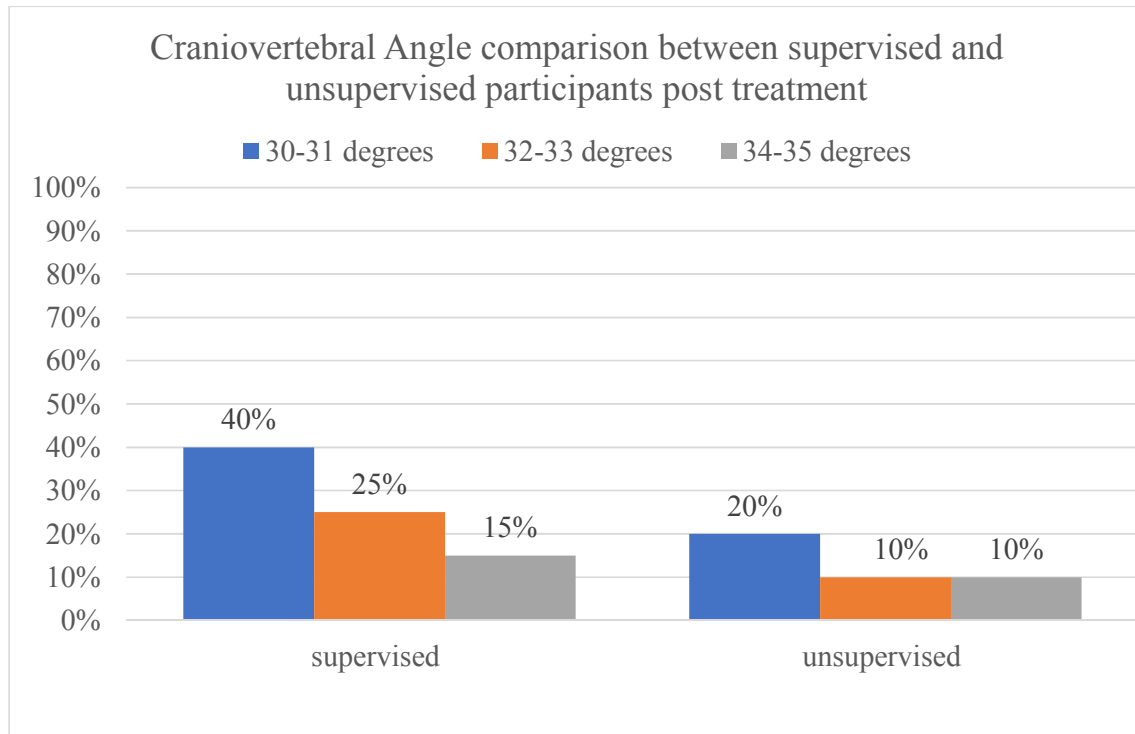
**4. Craniovertebral Angle (Unsupervised subjects)**



**Fig. 4. Craniovertebral angle in unsupervised group**



**Fig. 5. Occiput to wall test comparison between supervised and unsupervised participants post treatment**



**Fig. 6. Craniovertebral Angle comparison between supervised and unsupervised participants post treatment**

**Table 4. Comparison between pre and post intervention values**

Values	Mean ± SD	P- value	
Pre	33.15 ± 1.182	<0.0001	p <0.0001 (significant)
Post	32.2±1.152	<0.0001	

**4. DISCUSSION**

This study indicates that a targeted exercise program performed 4 times/week integrated over 8-week period, can result in posture improvement, with increases in cervical and shoulder angles. The study was conducted into 2 groups with 20 participants in each group. Group A underwent the protocol under supervision of therapist, whereas Group B underwent the protocol without supervision of therapist. 2 outcome measures were used for the study to determine the effect of protocol on forward neck posture which were Occiput to wall test and Craniovertebral angle. In Group A which was under supervision of the therapist, there was significant difference seen in the occiput to wall test values as well as craniovertebral values pre and post the administration of the protocol. In the assessment taken before the administration of protocol, it was seen that majority had the

occiput to wall test values ranging between 2.1 to 3 cm and 3.1 – 4 cm, very few participants had values ranging between 1-2 cm and 4.1-5 cm. However, post-test, it was seen that there was a significant rise of participants having values between 1-2cm from whereas participants having values between 2.1-3cm and 3.1-4cm recorded a significant drop post-intervention. Range of 5.1-6cm range recorded no participants. Similarly for Group A the craniovertebral angle values also differed significantly before and after the protocol administration. In the pre-test it was recorded that majority had the craniovertebral angle ranging between 31-32 degrees and between 30-31 degrees whereas about few participants had values between 34-35 degrees. After administering the protocol for 2 weeks, there was a significant rise of participants having values between 30-31 degrees whereas participants having values between 32-33 degrees and 34-35 recorded a significant drop. The unsupervised

group B also noted a significant change in the values of occiput to wall test and craniovertebral angle.

However, the difference between the values was not as significant as compared to the values of the group A which was supervised. According to the above statistics, it can be seen that there was a significant higher change in values of participants occiput to wall test in supervised subjects as compared to unsupervised subjects.

Forward head posture (FHP) is most often described as excessive anterior positioning of the head in relation to a vertical reference line, involving increased cervical spine lordosis (head forward, middle cervical spine extended, lower cervical spine flexed) and rounded shoulders with thoracic kyphosis. Although exercise is routinely used to improve FHP, relatively little data exists on efficacy of the exercise prescribed. A study was performed to check the effectiveness of an exercise program on improving the forward neck posture in adults. According to Katherine Harman, Cheryl L. Hubley-Kozey et.al study they have shown that 10-week targeted home protocol exercise program can significantly help in improving the postural alignment in forward neck posture in adults [7]. Forward head posture has been associated with shortened levator scapulae, sternocleidomastoids, upper trapezius, and posterior cervical spine muscles. Lesser craniovertebral angle meant poorer forward head posture. There is lesser isometric strength of the upper cervical flexors as well as lesser isometric endurance of these muscles which in turn can lead to headaches in those with forward neck posture. Forward head posture can lead to increased compression of the zygapophyseal joints can result in the inception of degenerative changes leading to spondylosis. The greater and lesser occipital nerves might be compressed because of a reduction in the intervertebral space, leading to stimulation of the trigeminal nerve. This, in turn, can lead to facial pain and headache [8]. Miyakoshi N, Kudo D, Hongo M, et. al conducted a study to compare spinal alignment, muscular strength, and quality of life (QOL) between women with postmenopausal osteoporosis and healthy volunteers concluded that BMI, back extensor strength, and grip strength were significantly higher in the healthier group than in the osteoporosis group ( $p < 0.01$ ). Both thoracic kyphosis and lumbar lordosis were significantly greater in the osteoporosis

group than in the volunteer group ( $p < 0.01$ ) [9]. This shows that osteoporosis in postmenopausal women could lead to reduced strength of neck muscles and impaired postural alignment which in turn could lead to forward neck posture. Osteoporosis is a progressive disease that has physical and psychosocial consequences. Osteoporosis can lead to reduced muscle strength, decreased bone mineral density which in turn can lead to postural abnormalities [10]. Kim DH, Kim C et.al they conducted a study to evaluate musculoskeletal alterations in osteoporotic postmenopausal women and healthy women, it was seen that one of the alterations observed in the participants studied was a reduction in muscle strength. Back flexor and extensor strength was poorer in women with osteoporosis [2]. This concludes that due to weak back flexor and extensor muscle groups, there is a high risk of developing an abnormal postural pattern. It is necessary to administer exercises in this target population to prevent occurrence of complications and improve the quality of life of post-menopausal women.

Overall, results of this investigation demonstrated that exercise training could be an effective method to improving the posture. In regard to that, literature provides studies done on forward head posture in other target population, however only prevalence studies have been conducted in post-menopausal women. Sawant RS, Shinde SB also shown that hydrotherapy based exercises are proven beneficial for chronic nonspecific low back pain [11]. Similarly multicomponent exercise program on selected gait and balance parameters in young obese females [12]. Various disorders and dysfunction have been studied in post-menopausal women; however, no studies have been performed to prevent as well as treat forward neck posture in menopausal women [13]. It is necessary to create awareness as well as provide an effective treatment measure for postural alteration in menopausal women, thus helping improve their quality of life and prevent further complications [14].

## 5. CONCLUSION

On the basis of the results, it was concluded that, there was extreme effect in the supervised group than in the unsupervised group. The findings of the study showed that supervised exercises programme helped in significant reduction in Craniovertebral angle and occiput wall test.



## CONSENT

All the participants were thoroughly explained about the need and purpose of the study and an informed consent was obtained.

## ETHICAL APPROVAL

The study was also approved by the Institutional Ethics Committee (IEC). After the approval from the Institutional Ethical committee of the KIMSDU

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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