VIMS Journal of Physical Therapy

[ORIGINAL ARTICLE]

Effect of self stretching before sleep on nocturnal leg cramp, pain & sleep quality among older adults – A Quasi Experimental Study

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ABSTRACT

Background: Many older adults have leg cramps problems during night sleep which causes disturbance of sleep pattern and it also affects their quality of sleep.

Methodology: In 6 week interventional study 47 older adults were selected according to the inclusion and exclusion criteria by convenient sampling technique. Pre-treatment evaluation of Numerical pain rating scale (NPRS) and Pittsburgh sleep quality index (PSQI) was done before initiating the treatment. Self Stretching exercises of hamstrings and calf combine with Heel raise given to participants. Post intervention evaluation was done. Statistical analysis was carried out using paired t test.

Results: On intragroup comparison using paired t test, there was extremely significant difference between pre-post comparison of NPRS(<0.0001) and PSQI (<0.0001) in older adults.

Conclusion: Self stretching exercises before sleep is effective on nocturnal leg cramps pain and sleep quality among older adults.

Keywords- *Nocturnal leg cramps, Pittsburgh sleep quality index, sleep quality, Self stretching exercises of lower limb*

Introduction: -

Nocturnal leg cramps are suddenly occurring, episodic, painful, sustained, involuntary muscle contractions of the calf muscles, hamstrings and foot muscles.[1] Night leg cramps also called Nocturnal leg cramps are involuntary contractions or spasms of muscles in your legs usually occurring when you're in bed. Cramps are usually unilateral and it can last from several seconds to minutes and may remit spontaneously. The pain from these contractions is strong and intense[2]. These painful contractions particularly occur in posterior compartment of lower limbs.

Leg cramps occur across the daylight in 20% of patients who suffer from nocturnal leg cramps. Nocturnal leg cramps can come in waves that lasts few days or week[2]. Nocturnal Leg cramps may cause severe pain and sleep disturbance4. Nocturnal Leg cramps strike anyone at any age, although they are more widespread and often more severe as grow older[2]. The cramps are usually followed by residual pain lasting for up to half an hour and disturbs sleep.

According to existing data, it is estimated that between 37% and 50% of older adults do not experience nocturnal leg cramps. Women and individuals with other health conditions, particularly those with neurological and cardiovascular diseases, are more likely to experience nocturnal leg cramps. The origin of nighttime leg cramps is unidentified. Nevertheless, dehydration, electrolyte and mineral imbalance, muscle fatigue, and reduced blood flow to the extremities have been proposed as potential contributing factors[5]. Based on clinical observations, it is believed that individuals with large calves and benign fasciculations may also experience frequent nocturnal leg cramps. In order to accurately

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diagnose nocturnal leg cramps, a thorough history and examination should be conducted to exclude other potential conditions such as restless leg syndrome, myositis, claudication, and peripheral neuropathy. The identification of nocturnal leg cramps can be determined by individuals reporting episodes of sudden and painful muscle contractions in the leg calf or foot that occur during the night and recur at irregular intervals. The rate at which a single voluntary muscle fiber contracts is 300 times faster than during voluntary activity, which typically ranges from 10 to 50 contractions per second. Multiple pieces of evidence indicate that cramps occur due to involuntary electrical impulses in the nerves rather than within the muscle tissue. Research in the field of neurophysiology and electromyography indicates that cramps occur when there is an involuntary firing of the anterior horn cells group, leading to contractions of multiple motor units. Initially, electromyography (EMG) during muscle cramp demonstrates involuntary repetitive firing of motor unit action potentials at a high frequency, which is unlikely to be a result of spontaneous muscle activity. Second, during cramps, it is also observed that fasciculations occur at the beginning and end of the cramps. Neuromuscular twitches arise from peripheral nerves. Third, the cramps are linked to the loss or damage of lower motor neurons. Therefore, it is evident that cramps are caused by issues in the motor nerves. Spontaneous fasciculation is more commonly observed in muscles prone to cramping, as opposed to normal muscles. Additionally, there is an overactivity of motor units, which contributes to the hyper excitability observed in this condition.5 Lack of physical activity was also suggested as a cause, with insufficient stretching resulting in decreased muscle and tendon length. Although the exact cause of nocturnal leg cramps is not fully understood, it aligns with the higher prevalence of the disorder among individuals with reduced lower limb activity and joint range, such as those with varicose veins and arthritis. Muscle stretching should be taken into account as an additional form of therapy. It is simple to execute and has fewer adverse effects and frequently alleviates pain when cramps occur.8 Stretching exercises can foster a resilient mindset in patients suffering from nocturnal leg cramps by encouraging them to adopt a bounce back and move on approach, as they provide patients with effective strategies to seek immediate relief. Nocturnal leg cramps occur primarily at night and may be associated with physical inactivity and muscle shortening, so stretching before sleep may be effective preventive therapy.

Methodology:

To conduct the study Permission from Institutional ethical committee was taken. The trial was registered under the Clinical Trials Registry-India (ICMR-NIMS) with CTRI No. CTRI/2024/05/067876. 47 Subjects were screened according to the inclusion and exclusion criteria by convenient sampling technique. Subject included in this study was- Age group between 65-85years, Both sex , Older adults experiencing regular episodes of Nocturnal leg cramps, having no specific pathology included, Subject excluded in this study was Subject with musculoskeletal problems, several medical conditions or comorbidities known to cause muscle cramps, any vascular disorder of lower limb, subjects using quinine or any medication to assist sleep, subject who is not willing to participate.

A written consent was obtained from the selected subjects. Procedure was thoroughly explained to the subjects selected for study. Earlier the demographic data, History of nocturnal leg cramps of each and every individual was taken. Numerical pain rating scale (NPRS) and Pittsburgh sleep quality index (PSQI) were evaluated at baseline and 3 week intervention period. They were recorded daily in the dairy card throughout the trial. Physiotherapist took follow up twice a week. For each stretch, Participants were advised to adopt the position and move to comfortable limit of motion, move beyond this to until a moderately intense stretch will feel and sustained for 10 seconds, then return to starting position. Participants were instruct to remain calm and never to hold their breath during the stretch. Each stretch was performed for a total of 3-5 times with 10 seconds hold & 5sec of relaxation between each stretch. Self stretching exercises of hamstrings, calf combine with Heel raise of both legs was done for 6 days/ week, for 3 weeks.

Intervention: -

1) Calf stretch in Long sitting

Patient is asked to sit on the floor or a firm bed with back supported and both legs extended.

Tell patient to Wrap a towel around the foot and hold the two ends of strap in hands.

Then ask to Gently pull the towel toward themselves while keeping knee straight. Also Keeping the trunk as straight as possible.

Then ask to Dorsiflex at ankles with the help of towel.

Dosage-1 set of 3-5 repetitions with 10sec hold with 5 sec of relaxation between each stretch

Fig 1 : Self stretching of calf muscles.

2) Hamstring Stretch in Supine

Patient is asked to Lie on the floor on their back, with the one leg flat on the ground and ask to slowly lift the other leg.

Tell patient to Wrap a towel around the dorsum of the lifted foot and hold the two ends of straps in hands. Then ask to Gently straighten out the lifted leg and bend the other knee slightly to 90 angle.

Fig 2 : Self stretching of hamstring muscles.

3) Heel Raise

Patient is asked to Stand with back straight.

Patient should use their one or both hands to hold on to a sturdy chair, railing, counter, or table.

Patient is then ask to rise up on toes and then slowly lower heels to the floor.

Dosage- 1 set of 3-5 repetitions with 10sec hold with 5 sec of relaxation between each stretch

Fig 3 : Strengthening of calf muscles.

Results:

The study included 47 subjects according to inclusion criteria and exclusion criteria.

Statistical analysis was done using "GraphPad Instat version 3.05" for MS Windows. Paired t test was done for pre & post comparison of NPRS & PSQI. Statistical significance was set at $p \leq 0.05$.

Table no. 1: - Age Distribution of subjects

Age	65-70	71-75	76-80	81-85
No. Of subjects	22	16	6	3
Percentage	47%	34%	13%	6%

Graph no. 1:- Age Distribution of subjects

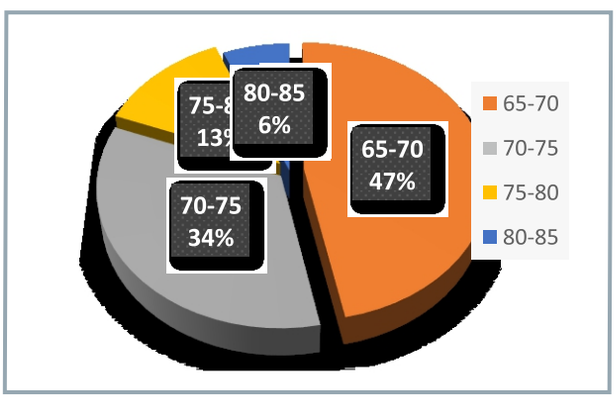


Table no. 2: - Gender Distribution of subjects

Gender	**Male**	**Female**
No of Subjects	17	30
Percent	36%	64%

Graph no. 2: Gender Distribution of subjects

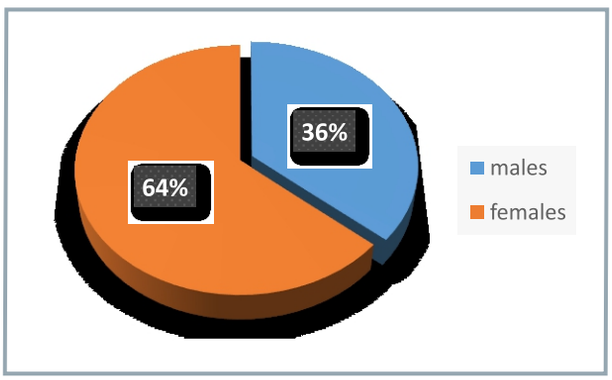


Table no. 3:- Pre-Post comparison of NPRS-

PRE NPRS (MEAN ± SD)	POST NPRS (MEAN ± SD)	t VALUE	P VALUE	SIGNIFICANCE
5.894 ± 0.075	3.915 ± 0.1131	21.11	<0.0001	Extremely significant

Graph no. 3:- Pre-Post comparison of NPRS-

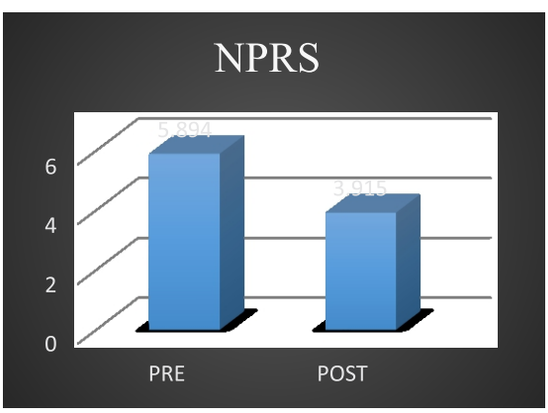
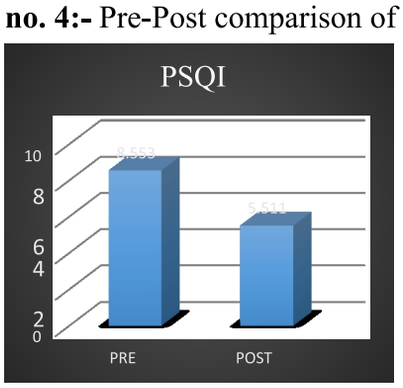


Table no. 4:- Pre-Post comparison of PSQI-

PRE PSQI (MEAN ± SD)	POST PSQI (MEAN ± SD)	t VALUE	p VALUE	SIGNIFICANCE
8.553 ± 2.430	5.511 ± 1.412	11.118	<0.0001	Extremely significant

Graph no. 4:- Pre-Post comparison of PSQI-



Discussion :

Nocturnal leg cramps are suddenly occurring, episodic, painful, sustained, involuntary muscle contractions of the calf muscles, hamstrings and foot muscles[1]. It is characterized by intense and severe pain that wakes up the patient and disrupts their sleep. The purpose of this study was to investigate the impact of self-stretching exercises before bedtime on the intensity of leg cramps experienced during sleep and the overall quality of sleep among older individuals. When comparing the results of NPRS and PSQI before and after implementing self-stretching before sleep, it was discovered that this practice can effectively alleviate nocturnal leg cramp pain and enhance sleep quality in older adults. In this research, a total of 47 participants were involved, with 17 males and 30 females. As we are aware that nocturnal leg cramps are more common among women, this study also confirmed the same. In this research, the subject experienced a notable decrease in pain intensity and an improvement in sleep quality after practicing self-stretching before going to bed.

1) Effect of self stretching on Nocturnal leg cramp pain-

On intragroup comparison using paired t test, the mean pre-treatment mean value of NPRS(pain) was 5.894 + 0.075 and post treatment mean NPRS was 3.915 + 0.1131 with p value was <0.0001. Our study found that there was a significant reduction of nocturnal leg pain and intensity after self stretching exercises before sleep.

This could be due to the fact that when a muscle is stretched, some of its fibers elongate, while others remain inactive. The longer the fibers are stretched, the greater the extension achieved by the stretched muscle. When the muscle is stretched, the muscle spindle is also stretched. When you stretch, the muscle fiber elongates to its maximum length, and the connective tissue fills in the remaining space.[7] The muscle spindle detects the alteration in length (and the speed) and transmits signals to the spinal cord, conveying this information. This activates the stretch reflex, which tries to counteract the change in muscle length by causing the stretched muscle to contract. One of the reasons for holding a stretch for an extended period of time is that as you maintain the muscle in a stretched position, the muscle spindle adapts and decreases its signaling. The more abrupt the change in muscle length, the more forceful the muscle contractions will be.[9] The constant

contraction of muscles leads to an increase in the number of afferents from the neuromuscular spindles, while simultaneously inhibiting the activity of golgi tendon organs. When the stretch reflex is triggered in a muscle that is being stretched, there is a decrease in activity (inhibition) within the muscle. When the golgi tendon organs are activated by a prolonged stretch, they induce the stretched muscle to relax. As a result, stretching leads to muscle relaxation, enhanced blood circulation to the muscles, increased flexibility and mobility, and decreased pain. The results reported by Joannes M Hallegraeff (2012), showed that six weeks of nightly stretching of the calf and hamstring muscles significantly reduced the frequency and severity of nocturnal leg cramps in older people1.

2) Effect of self stretching on Sleep quality-

On intragroup comparison using paired t test, the mean pre-treatment value of PSQI was 8.553+ 2.430 and post treatment mean of PSQI was 5.511 + 1.412 with p value was <0.0001 respectively. Our study found that there was a significant improvement in sleep quality after self stretching exercises before sleep.

When nocturnal leg cramps occur, they disrupt sleep patterns and decrease the quality of sleep. Stretching helps to relax muscles, increase blood flow to the muscles, enhance flexibility and mobility, and alleviate pain. Engaging in physical activity before bedtime could potentially induce a stress response that may decrease the duration of subsequent slow wave sleep.[17]

Louise Rabbitt (2016), agreed that Nocturnal leg cramps can have a major impact on quality of life. In addition to distress caused by pain, people with frequent cramps also report more disturbances of sleep and poorer quality sleep.[2]

Conclusion:

The present study concluded that self stretching before sleep is effective on nocturnal leg cramps pain & sleep quality among older adults.

Conflict of Interest: All authors declare that they have no conflicts of interest.

Source of Funding: None

Clinical Implication: Self Stretching before sleep can be helpful as an additional intervention to reduce nocturnal leg cramp pain and improve sleep quality in older adult patients with nocturnal leg cramps.

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