Physiotherapy

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ABSTRACT

INTRODUCTION:
Aerobic exercise improves cardiovascular endurance, helps in burning calories, reduces stress and maintains physical fitness of the person. In this modern era advancement in the technology and poor nutritive intake has made the upcoming generation more inactive and less physical fitness level when compared to the past generation. One of the best Aerobic exercises where the whole body is concentrated is Rowing exercises where the upper and lower body workouts is done if proper mechanics is analysed by the therapist during the workouts, works on all major muscles group (Total body workouts).

Rowing performances demands high level of technical skill and the ability to generate and sustain high amounts of force and power. The hip and elbow angular velocity, angular displacement and angular position at the catch do not change throughout the 2000m test, indicating that these are stable features of the rowing techniques even at high level physical exertion. Force and power are important to optimize rowing performance.

Rowing exercise is look like a cyclical sport in Olympic races, approximately 80% of the total energy comes from the aerobic system, but high intensity intermittent efforts are performed at strategic movements of the race.

Rowing in fitness:
Rowing exercise in rowing machine can helps to burn calories (using of rowing machine burn calories approximately 10%-15% more calories than running or cycling). A rowing machine workout burns an average of 600 calories per hour (it is more efficient that many other home gym machine). Approximately 78 minutes of stationary cycle workout arm involvement is equal to 60 minutes of workout in rowing machine. This not only helps in burning calories but also improves muscle strength and cardio endurance. Structured healthy balanced diet and eating habits along with exercises using a rowing machine consistently is a great way to achieve the fitness goals.

Alterations of exercise such as low impact exercises can be used for the persons with joint problem pain, overweight, healthy geriatrics as high impact workout are more risk then benefits. Persons who cannot perform weight bearing exercise (such as running, walking, hiking etc), can perform Low impact rowing exercise as it has the greater chance for injury prevention and lower risk of tissue injury during exercise which has been also prescribed as strengthening programme for post-operative conditions like after the knee surgery.

RESULT:
There was a significant difference in the Active Knee Extension Test and motor unit action potential of hamstrings with p<0.05 in enhancing the hamstring flexibility.

CONCLUSION:
Hence this study concludes that there is an immediate effect in working out in Rowing Machine in the improvement of hamstring flexibility.

KEYWORDS
Rowing Machine, Hamstring tightness, Electromyography, Active knee extension.

BACKGROUND:
Rowing is one of the effective forms of aerobic exercise which demands high level of technical skill and the ability to generate and sustain more amount of force and power with proper biomechanical knowledge. It is done for upper body and lower body workouts concentrating on all major muscle groups. It plays one of the best exercises in reducing abdominal fat (obesity). Hamstrings tightness is one of the common causes for altered muscle activation. Insufficient Hamstring flexibility leads to improper load to the body in long run if unnoticed.

MATERIALS AND METHODS:
A quasi experimental study was done for 30 subjects from VISTAS, School of Physiotherapy with the age group between 17-22 and were selected based on inclusion criteria. Rowing machine exercises were asked to perform and then the values of Active Knee Extension Test and the action potential of Medial Hamstrings and Lateral Hamstrings were noted using of electromyography for both right and left leg, further analysis was done using pre and post-test values.

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Alterations of exercise such as low impact exercises can be used for the persons with joint problem pain, overweight, healthy geriatrics as high impact workout are more risk then benefits. Persons who cannot perform weight bearing exercise (such as running, walking, hiking etc), can perform Low impact rowing exercise as it has the greater chance for injury prevention and lower risk of tissue injury during exercise which has been also prescribed as strengthening programme for post-operative conditions like after the knee surgery.

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Rowing in whole body workouts:

**Upper body:**
Rowing machine provide a small upper body workouts. Exercise like Triceps, Pectoralis, Rectus Abdominis, Transverse Abdominis, Internal & External Oblique and Rectus Dorsi in lower back. Deltoide in shoulder. The benefits of strong back and shoulder improves posture as well as there is significant reduction in back pain. It enhances Biceps, Triceps, Pectoralitis, Rectus Abdominis, Transverse Abdominis, Internal & External Oblique and Erector Spinae muscle power which helps to develop a strong core. Maintenance of grip on the oars helps to develop a strong hand intrinsic & extrinsic muscles.

**Lower body:**
Rowing exercise is one of the best workout for lower body, in fact rowing exercise is primarily a lower body workout. The main muscles involved are Glutes, Quadriceps in upper front of the thigh, Hamstrings in back of the thigh, calves(Gastrocnemius and Soleus) in back of the lower leg. Major muscles group. Good rowing posture lets your legs to do the work taking the pressure off your back.

Muscles work depends upon phases of rowing.[24]

The catch phase-Erector Spinae, Gastrocnemius, Soleus, and Hamstrings.

The drive - Erector Spinae, Rectus Abdominis, Triceps, Deltoide, Pectoralitis, Wrist Flexor and Extensor, Rhombooids, Quadriceps, Glutes, Gastrocnemius, Soleus, and Hamstrings.

The final - Erector Spinae, Wrist Flexor and Extensor, Triceps, Biceps, Deltoide, Pectoralitis, Rectus Abdominis, Internal and External Oblique, Quadriceps and Hamstrings

**Kinetics and kinematics of rowing:**
The study of forces that causes a motion or human biomechanical movement. Kinematics include the set of concepts that allow us to describe the displacement (the change in position over time) or motion of a segment without regard to the force that cause movement.

An electromyography detects the electric potential generated by muscle cells, when these cells are electrically or neurologically activated. The signals can be analyzed to detect medial abnormalities, activation level or recruitment order or to analyse the biomechanics of human or animal movement.

Hamstrings muscles on rowing:
Hamstring tightness is offered as an explanation for low back pain, poor stroke technique, restricted reach on the recovery, and the decline in stroke.[22] The muscular imbalance of quadriceps and hamstrings are resulting in low back pain, knee flexion to extension peak torque ratios and low back injuries in highly active individuals.[25]

Hamstrings are the major muscles group to play vital role in hip extension and hip hyper extension. During body forward movements are attain by out body, they need hip extension and then hyper extension. If the lack of hamstrings muscle flexibility or hamstrings muscle are tight there is lack of body forward movements.[26] It is an important anti-gravity muscles of the lower limb and its flexibility is important to maintain the normal posture and gait in both adult and children. The lack of hamstrings muscles extensibility creates a decrease of pelvic mobility leads to an invariable biomechanical change in pressure distribution in spine leads to low back pain.[27] Hence, poor hamstrings flexibility has been associated with postural deviation, gait limitation, increased risk of falls, and susceptibility to musculoskeletal injuries like low back ache.[28] Any factor which influences over a hamstrings length which indirectly produces an effect on gait, posture, and musculoskeletal problem. Hence physiotherapist play a vital role in preventing the problem. (K. kadivalan et al)

Some obtained data are novel or associated together and enable a better understanding of the rower movement. The information of the study were discussed to clarify the knowledge, coaches can apply the results summarized here to preventing injuries a planning a specific training. (P. pudlo, A. pinti, and F-X. lepouvre)

Hence it is necessary to analysis the action potential of hamstring during rowing exercise. Improper muscle activation due to improper body position during rowing exercise leads to increase the risk of tissue strain & further lead to mechanical low back pain as well as reduced efficacy of rowing exercise. So we need to know the proper body position (both kinetic and kinematic) during rowing exercise. Hence this study was aimed to know the immediate effect of rowing technique in enhancing hamstring flexibility among young adults.

**MATERIALS AND METHODS**
A quasi experimental (pre & post test) study was conducted using convenient sampling technique sample size was calculated and 30 students from SOFT, VISTAS, Thalambur, were enrolled for the study based on inclusion criteria: Active Knee Extension test positive, College students with sedentary life style, Both genders & Age 17-22. Exclusion criteria: non willing participants, Any recent fracture in lower limb or spine, Any recent upper limb or lower limb surgery, Any other neurological, orthopaedic and cardiovascular condition.

![Fig 1: Active knee extension test.](image)

**PROCEDURE:**
The participants for the study were taken based up on inclusion and exclusion criteria. The subject included for the study were asked to fill the informed consent form, stating that they had a no objection in participating in this intervention and the assessment was taken based the outcome measures.

30 subjects were taken (both gender) based on the inclusion and exclusion criteria. Initially the subject was asked to do ACTIVE KNEE EXTENSION TEST (pre test) to analyse the tightness and flexibility of hamstrings.

Then the subjects were asked to do the workout on rowing machine. During rowing machine workout the action potential of semimembranosus and semitendinosus (hamstrings) was taken using electromyography.

After the completion of procedure the subject were again asked to do active knee extension test to know the flexibility or tightness of hamstrings and values were noted using Goniometer.

**ACTIVE KNEE EXTENSION TEST:**
Ask the patient to lying down (supine) on the couch, and instructed them to maintain the hip and knee flex to 90 degree and ask the patient to extend the knee as much as possible without any discomfort. Therapist record the value or angle with the help of goniometer pre and post. The test done in the both the legs.

**EMG recording:**
The subject was asked to sit on the rowing machine and do to the rowing exercise, at the same time EMG record of the muscle activity should be done in the hamstrings muscle. Therapist notes the EMG value of pre and post. EMG recording was done in the both the legs.

**Data Analysis and Interpretation:**
All statistical analysis were performed on IBM compatible micro computer using statistical package for the social sciences (SPSS 20.0)

The significance was set at alpha=0.005 level paired-t test was used to compare the pre and post values of Active Knee Extension Test and motor unit action potential of hamstrings.

**Table-1 : Immediate Impact Of Rowing In Hamstring Flexibility In Young Adults(left Leg)**

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>t Value</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKE (Pre &amp; Post test values)</td>
<td>10.33</td>
<td>27.47</td>
<td>10.79</td>
<td>.000</td>
</tr>
</tbody>
</table>
RESULTS:

- Table 1: shows the immediate impact of rowing in hamstring flexibility in young adults – left leg, the post-test values of Active knee extension 143.17 ± 7.25 & MuAP of Medial hamstrings 71.05 ± 12.12 & Lateral Hamstrings 71.68 ± 10.42
- Table 2: shows the immediate impact of rowing in hamstring flexibility in young adults – right leg, the post-test values of Active knee extension 140.17 ± 6.23 & MuAP of Medial hamstrings 72.35 ± 12.83 & Lateral Hamstrings 67.03 ± 13.35

DISCUSSION:

This study was done to observe the immediate effect of rowing in hamstring flexibility and to know the action potential of Hamstrings muscles (medial & Lateral groups). Hamstring flexibility has an indirect cause for musculoskeletal problems, posture, gait etc.

Several measures are used to test the muscle length but active knee extension test is more reliable test as it involves less motion on lumbar spine as well as pelvis. Active knee extension test has been considered by some to be gold standard for hamstring flexibility assessment. In this test, locating the end point of motion is reliable as we use the strict upper body stabilization of adjacent joints, so the knee extension is active and subjects were instructed not to force the leg past the point of initial mild resistance, we believe the motion in the hip of tested extremity, while the sacroiliac joints are eliminated.

This study reported the muscle activity levels and patterns of the major thigh muscles during training session of on-water rowing. Only the start phase (Maximal intensity) showed difference in muscular activity. During an all-out 500m section a decrease in power and stroke rate was found. These mechanical changes were not associated with changes in muscle activation pattern. During the leg drive the muscle activation of quadriceps was unchanged, while the activity of hamstrings muscles decreased during all-out 500m.

Because of the tested lifts are performed with the intention of stressing the hamstrings, it is important to note that the muscle activity was maximized for the BF during the RDL, and glue-ham raise. The concentric action from the ST and SM was highest in the glue-ham raise, whereas the eccentric action from the ST and SM was highest in RDL; therefore the current findings suggest the athletes and coaches who seek to maximize involvement of different regions of the hamstrings musculature should consider a specific exercise.

To our knowledge, no such study is conducted to observe the impact of extended sitting on flexibility in educational setups, especially in young and healthy, asymptomatic university students, the important finding was an alarming high rate of hamstring tightness among most of students, and a significant positive correlation found among extended sitting hours and hamstring tightness, but it is consistent with the finding of study conducted by Adar who claims that hamstring tightness increases with the increasing age.

The hamstring tightness has a tendency to increases with sitting duration and also modification of sedentary life style (lack of physical activates), it can lead to muscles weakness, different researchers studied that long-term strength training can improve muscle strength.

Another study claims that maximum flexibility is found in the mid-twenties for both male and females, contrary to this claim, we found significant reduction in hamstring flexibility in young population in their twenties, one main for this prolonged sitting hours and modification of sedentary life styles of students.

During rowing machine exercise, it consists of four phase, both upper and lower body muscles are activated in rowing exercise, but throughout the four phase lower body muscles are activated efficiently like calves, hamstrings, and gastronomies.

Rowing machine are also very good to do upper and lower body workouts, helping the built muscles strength and its endurance capacity. So its maintain the physical fitness and proper muscle properties, as well as it maintain the ROM of joints.

LIMITATIONS:

- Small sample size.
- Young Adults were only considered.
- Duration of the study was shorter.
- Only specific lower limb muscle was considered for the study.
- Other muscles activity was not included.

RECOMMENDATION:

- Targeting larger population.
- Long term effect of rowing exercise in various age group and population.
- Specific action potential of specific muscles involved in rowing for both upper body and lower body work outs can be considered.
CONCLUSION:
The current study concludes that there is a significant improvement in hamstring flexibility and in enhancing the muscle action potential after rowing exercise in young adults with hamstring tightness.

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