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RESEARCH ARTICLE
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EFFECT OF A BALLISTIC AND STATIC STRETCHING EXERCISE ON MAXIMAL STRENGTH OF HAMSTRING AND QUADRICEP MUSCLES AMONG COLLEGE STUDENTS

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ABSTRACT

Introduction: Static stretching and ballistic stretching are two different types of stretches that can be done before or after a workout to increase your flexibility and strength. Pulling a section of the body to lengthen the muscle and maintaining it in that posture for a certain period of time, generally 10-30 seconds, are the two steps involved in this exercise. College students were recruited for the research to examine the effects of a ballistic and static stretching exercise on hamstring and quadriceps maximum strength.

Materials & Methods: 60 people participated in the research. According to the inclusion and exclusion criteria, participants were screened. A signed permission form was obtained from each participant before to the trial, which ensured that all individuals had been given a thorough description of the study's objective, risks, and benefits. There were two separate divisions. Static stretching will be performed by Group A, while ballistic stretching will be performed by Group B. The subject's pretest was done using 1 RM squat. Both the groups underwent Stretching for 4 weeks. Post data was also collated using 1 RM squat test.

Results: The result of the study of college students' subjects has shown significant changes in the 1 RM scores as for Group A at 0 Day score was 30.62±1.54 which after the session of stretching changes in at 14th days the result was 35.12 and the after the session of stretching at 28th days the result was 41.50 ±1.011. Group B at 0 days score shows the scores as 31.01±1.02 and scores after the stretching at 14th day the result shows 37.56±1.92 and the after the stretching session at 28th days the result shows as 43.32±1.92 the with P value $P<0.05$. By calculating the mean difference, we can say that there is a significantly Higher effects in Group B as compared with group A.

Conclusion: According to the findings of the research, we discovered that there were effects noticed in both groups, however the Group B (Ballistic stretching) showed much larger effects when compared to the Static Stretching group. Additional research is required on the subject of the general population.

Key words: Static stretching, ballistic stretching, IRM.

INTRODUCTION

The hamstrings are a group of three muscles that extend from the hip to the knee in the human body (from medial to lateral: semimembranosus, semitendinosus and biceps femoris). The hamstring injury seems to be a prevalent one. There is just one major tendon located in the hamstring, which is located

behind the knee, in quadrupeds[1]. There are three muscles that work together to flex (straighten) the knee: The semitendinosus, semi-membranous, and long/short heads of biceps femoris. Flexion and extension of the knee and hip are controlled by the hamstring muscles that cross across these joints. Due to the fact that the small head of the biceps femoris only covers one joint, hip extension does not take place the knee[2]. Because of the several different origins and innervations that may be found in this muscle, the name "hamstring" is not always used in every circumstance. They are referred to as "biarticular" muscles due to the fact that they are able to perform their functions on both the hip and the knee at the same time. When the trunk is immobilized in this way, the semitendinous and semimembranous muscles contract to bend the knee and medially (inwardly) rotate the lower leg[3]. These movements are performed by the lower leg. Because the two heads of the femoris and biceps leg muscle act together to stretch the hip and knee joint, the leg is laterally rotated when the knee joint is bent. Hamstrings are responsible for our ability to walk, run, leap, and even govern some of the actions of our glutes. They perform their role as an antagonist to the quadriceps during the decelerating phase of knee extension[4].

There are four muscles in the quadriceps femoris muscle group that are most visible on the front of the leg (also known as the quadriceps extensor, quadriceps or quads). The lone extensor in the knee has a thick layer of flesh covering the front and sides of the femur. According to its name, this muscle has four heads located on each side of the femur it attaches[5]. There are four "heads" on the quadriceps femoris muscle; two of these heads are located on the trochanters and condyles of the femur, while the other three heads are situated farther within the muscle. The bigger rectus femoris of the thigh, which is located in the center of the leg, encloses the majority of this quadriceps muscle[6].

The ilium is the point of genesis for everything. As a result of this, people often refer to it as a "straight way." This muscle is located on the aspect of the femur that is turned away from you (i.e. on the outer side of the thigh). One of the muscles is called the vastus medialis, and it's located on the inside of femur (i.e. on the inner part thigh). The vastus intermedius is a muscle that may be found on the front or top of the thigh, in the space that is created between the vastus medialis and the vastus lateralis[7]. Dissecting the rectus femoris is necessary in order to see the structure. Ballistic training, which is also often referred to as power training, entails throwing and leaping with heavy weights in order to increase an individual's explosive power. Ballistic training consists mostly of activities that aim to improve acceleration while simultaneously reducing slowing down. When compared to more conventional weight lifting exercises, in which the barbell slows down and comes to a stop at the conclusion of each repetition, the hyper acceleration caused by tossing a medicine ball causes the barbell to accelerate to such a degree that it could be considered an example of the phenomenon bench press[8]. The acceleration of the weight is increased to its maximum when an athlete jumps while grasping a trap bar, in contrast to the normal trap bar deadlift, which causes the weight to decelerate. Stretching is the intentional flexing or stretching of a particular muscle or tendon in order to improve the muscle's perceived flexibility and attain a comfortable muscular tone. Stretching exercise also help prevent injuries.

Physical stamina, range of motion, and adaptability will all improve as a direct consequence of stretching[9]. Stretching is one of the most common relaxation techniques, and it has a number of benefits, including the alleviation of muscular cramps and the improvement of everyday tasks by improving range of motion[9]. Stretching is a motion that comes naturally and instinctually post exercise. Athletes stretches before and after a workout in the hopes of reducing the risk of injury and improving their overall performance. If it is not done properly, stretching may be quite dangerous. There are several methods available to stretch the body; however, some of these methods may have unintended negative effects on certain muscle groups. Injuries to the ligaments and tendons may range from being mild to being severe, and they could even be permanent in certain cases[10]. In light of these results, concepts about the advantages of stretching as well as the physiological underpinnings of stretching are being investigated. Research released in January 2020 by the Scandinavian Society of Clinical Physiology and Nuclear Medicine shows that pre-exercise static stretching reduces overall muscular strength as well as maximum performance in an individual[10]. According to this study, the

impact is consistent independent of factors such as an individual's age, gender, or level of training. As a result of this, it is advised that before engaging in physical activity, a dynamic warm-up be performed rather than a static stretch [11].

STATEMENT QUESTION

Is there anyEffect of a Ballistic and Static Stretching Exercise on Maximal Strength of Hamstring and Quadricep muscles among college students**?**

AIMS AND OBJECTIVES OF THE STUDY

To find out the effect of a Ballistic and Static Stretching Exercise on Maximal Strength of Hamstring and Quadricep muscles among college students.

HYPOTHESIS

NULL HYPOTHESIS:

There is no significant effect of a ballistic and static stretching Exercise on maximal Strength of Hamstring and Quadricep muscles among college students

RESEARCH HYPOTHESIS:

There is significant Effect of a ballistic and Static Stretching Exercise on maximal strength of Hamstring and Quadricep muscles among college students

METHODOLOGY

- STUDY DESIGN: An observation study
- Research setting- The study was performed in Greater Noida.
- STUDY LOCATION: Galgotias University hostel, India.
- Duration - Duration of the study was of 4 weeks.
- Consent and Ethical Consideration-Ethical approval has been taken from the institute to conduct the research and informed consent has been taken from each participant were included into the study
- Population- 60 subjects.
- Sample Size : 60 individuals were taken by random sampling.
- Sampling method- Random sampling has been done on the basis of inclusion and exclusion criteria.
- Sample size -60 subjects has been included on the basis of inclusion and exclusion criteria.

Inclusion Criteria:

- Age of 18 -25 years old.
- Height of 155 cm to 180 cm.
- weight of 45 kg to 75 kg,
- Healthy college-going students

Exclusion Criteria:

- past or present musculoskeletal conditions affecting neurological disorders,
- Not involve in any physical activity.
- No any type of injury, no any surgical procedure done

Tools used:

- Stop watch
- Consent form
- Assessment form
- Pen & paper

A grand number of 60 students took part in the investigation. According to the inclusion and exclusion criteria, participants were screened. All volunteers were required to sign a written permission form

before the experiment began. They were given appropriate information about the procedure, its goal, and any potential risks or advantages at that time. Two factions were formed.

1. Group A- Performed the static stretching
2. Group B – Performed the ballistic stretching

The subject's pre-test was done using 1 RM squad test. Both groups were stretched for 4 weeks. Post-data was also collated using 1 RM squad test.

DATA ANALYSIS

The data analysis was carried out using the Social Science Packaging Software (SPSS) 26.0 edition of the software. Readings were analyzed using a paired t-test. This is a graphical depiction created using Microsoft Word 2021.





Fig 1 and 2- Performing the hamstring stretching



fig-3. Performing squat

RESULTS

Description: The data you provided appears to be a summary of descriptive statistics for four variables: Age, Height, Weight, and BMI. Here's a breakdown of the description:

Sample Size (N): There are 60 participants in the sample for each variable.

Age:

Mean Age: 21.82 years

Standard Deviation: 1.829 years. This means that most participants' ages are within 1.829 years of the mean age of 21.82.

Height:

Mean Height: 5.91 feet

Standard Deviation: 1.003 feet. This indicates that the height values typically deviate by 1.003 feet from the mean of 5.91 feet.

Weight:

Mean Weight: 61.98 kg

Standard Deviation: 2.752 kg. This means the weight of participants varies by an average of 2.752 kg from the mean weight.

TABLE NO 1: Demographic Descriptive Statistics.

Variables	AGE N=60	HEIGHT N=60	WEIGHT N=60	BMI
Mean	21.82	5.91	61.98	18.5
Std. Deviation	1.829	1.003	2.752	

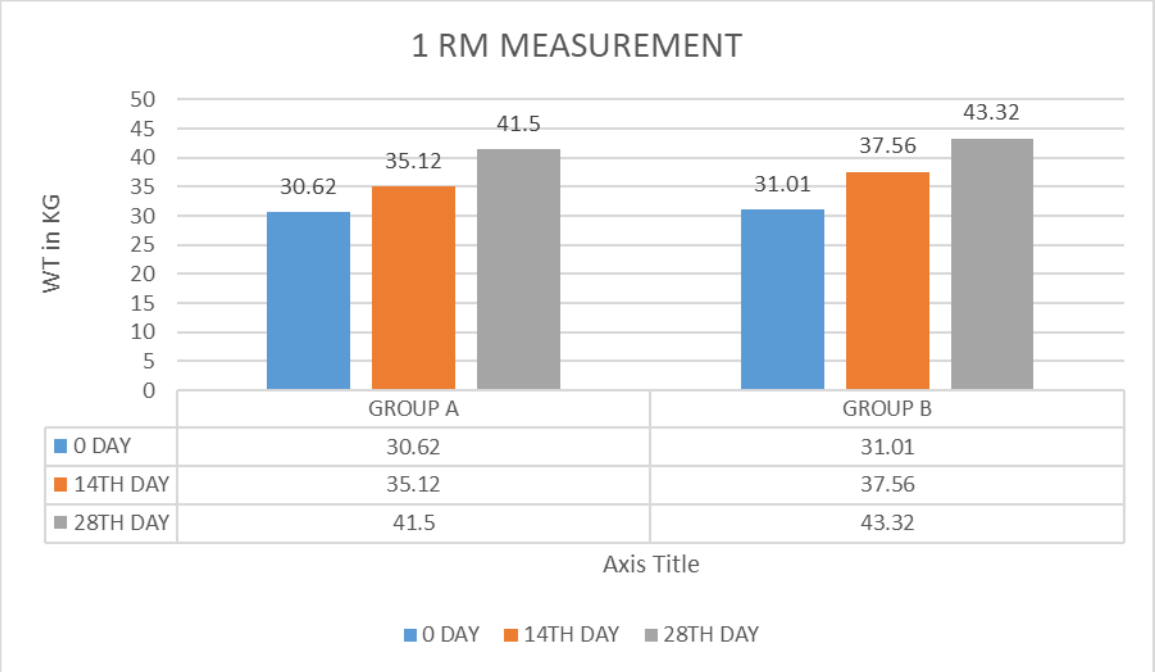
The result of the study collage students' subjects has shown significant changes in the 1 RM scores as for Group A at 0 Day score was 30.62±1.54 which after the session of stretching changes in at 14th days the result was 35.12 and the after the session of stretching at 28th days the result was 41.50 ±1.011. The p value of paired t test was P<0.05 which shows that significant difference was seen the subjects. Group B at 0 days score shows the scores as 31.01±1.02 and scores after the stretching at 14th day the result shows 37.56±1.92 and the after the stretching session at 28th days the result shows as 43.32±1.92 with P value P<0.05. By calculating the mean difference, we can say that there is a significantly Higher effects in Group B as compared with group A.

TABLE NO 2: 1 RM squats test results (Pre -Post)

	0 DAY (kg)	14TH DAY	28TH DAY (kg)	P VALUE
GROUP A	30.62±1.54	35.12±0.936	41.50±1.011	P<0.05
GROUP B	31.01±1.02	37.56±1.021	43.32±1.92	P<0.05

GRAPH 1: 1 RM squats test results (pre- and post-stretching

1 RM squats test results (pre- and post-stretching)



DISCUSSION

It was shown that college students' Hamstring and Quadricep muscles were more flexible and stronger after they engaged in a ballistic and static stretching exercise. The 0, 14TH, and 28TH Days stretching findings for Group A were 30.62±1.54, 35.12±0.936, and 41.50±1.011, respectively, for the 1 RM scores of the study's colleges students participants. There was a statistically significant difference in the participants' paired t test p-values (P 0.05). Group B's at 0, 14th and 28th days are 31.01±1.02,

37.56±1.021, and 43.32±1.92 respectively, with a P value of 0.05. By computing the mean difference, we may conclude that Group B has a much higher influence than Group A.

Further investigation has shown that Georgios Lykesasa et al. 2020 are correct. Primary school children' agility, strength, static flexibility, and dynamic flexibility were studied using four distinct warm-up exercises. A total of 44 elementary school pupils took part in the event (19 males and 25 girls, 11.70.47 years old). Three minutes of running followed by five minutes static stretching was used on four separate days, as was an eight-minute exercise that included Greek traditional dances as well as the other three-minute jog/five-minute stretch combos. participants completed agility shuttle run (4x10m), long jump, sit and reach, and active straight leg raise after operations (dynamic flexibility). The static stretching routine resulted in significantly better static flexibility ratings in comparison to dancing and not stretching at all. Long jump performance was significantly improved by dynamic stretching compared to both static and no stretching at all. In terms of dynamic flexibility, there was no discernible difference between the four different warm-up strategies. When compared to static stretching, the dancing routine produced superior results in terms of agility. In the sit-and-reach test, girls did much better than men. It is suggested to use the static-stretch method for classes that need the greatest possible range of motion (flexibility). When the exercise focuses on building strength in the lower extremities, dynamic stretching appears to be the most effective kind of warm-up. It would suggest that the dance protocol is suited for the teaching of agile. The substance of the lesson should guide the stretching that teachers do.

CONCLUSION

According to the findings of the research, we discovered that there were effects noticed in both groups, however, Group B (Ballistic stretching) showed much larger effects when compared to the Static Stretching group. Additional research is required on the subject of the general population.

FUTURE SCOPE OF STUDY

More study can be done with higher sample size in the study which more protocoled to be done.

Conflict of interest: -None

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