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# Effect of Slow Stretch & Hold, Ballistic, And Propioceptive Neuromuscular Facilitation Methodon Hamstring Flexibility

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**Abstract**: Present investigation was underwent on the 30 male subjects, in order to scrutinize the effect of Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring Flexibility. The subjects were selected from the Department of Physical Education, Sri Guru Granth Sahib World University, Fatehgarh Sahib, Punjab. Only a single variable named as Hamstring flexibility was selected for the purpose of the study. The treatment i.e. Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method was randomly assigned to all the groups (Group A, Group B, Group C). To scrutinize the effect of treatment Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring flexibility "Sit and Reach Test" (AAHPERD, 1984) was induced to the subjects. Before the final commencement of the protocol on each alternate day, the subjects were asked to do proper warm up for 10 -15 minutes, followed by the active warm-up exercise from top to bottom. The subjects underwent the experiment protocols with three different Flexibility programmes i.e. Slow Stretch & Hold, Ballistic, and Proprioceptiveneuromuscular facilitation method, dispersed by a gap of alternate days in a week in the evening session for six weeks. The subjects were allowed to go through the same daily routine classes as per their curriculum on alternate day.The exercises included in Flexibility programmes were controlled in the terms of their intensity by fixing their number of repetition or duration of exercise. The obtained data was analyzed by applying Analysis of Covariance (ANCOVA), the technique was applied just to neutralize the effect of covariate (Pre-test, the results indicates that, a significant difference was found among the Slow Stretch & Hold, Ballistic and PNF Method), further to find out the critical difference s between the groups Post Hoc LSD test was employed.

***Keywords:*** *Hamstring Flexibility, Slow Stretch & Hold, Ballistic and PNF Method.*

## Introduction:

Sports performance is the result of the interplay of various mental and physical factors. One of the main factors to improve and maximize athletic performance is the development of physical abilities. The capabilities of fitness are strength, speed, endurance and flexibility (American College of Sports Medicine, 1995). Muscular flexibility is an important aspect of normal human function. Limited flexibility has been shown to predispose a person to several musculoskeletal overuse injuries and significantly affect a person's level of function (Bandy



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and Sanders, 2001), several stretching techniques have been described in the literature. Three common stretching techniques include static stretching, active self-stretching, and Proprioceptive neuromuscular facilitation (PNF) (Kisher and Colby, 2002). The ability of an individual to move smoothly depends on his flexibility, an attribute that enhances both safety and optimal physical activities. The hamstrings are example of muscle groups that have a tendency to shorten (Turner et al, 1988). A tight hamstring causes increased patella femoral compressive force, which may eventually lead to patella femoral syndrome. Several sit-and-reach tests (SRs) are commonly used in health-related and physical fitness test batteries to evaluate the hamstring and lower back flexibility (Jackson & Baker, 1986; Hoeger et al, 1990; Hui and Yuen, 2000). Such field measures are only moderate indicators of hamstring extensibility. Present investigation was under went on the 30 male subjects, in order to scrutinize the effect of Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring Flexibility.

**Methodology:**

Selection of Subjects- Present investigation was underwent on the 30 male subjects, in order to scrutinize the effect of Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring Flexibility. The subjects were selected from the Department of Physical Education, Sri Guru Granth Sahib World University, Fatehgarh Sahib, Punjab.

Selection of Variables-Only a single variable named as Hamstring flexibility was selected for the purpose of the study. The treatment i.e. Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method was randomly assigned to all the groups (Group A, Group B, Group C).

To scrutinize the effect of treatment Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring flexibility “Sit and Reach Test” (AAHPERD, 1984) was induced to the subjects.

The information about the characteristics of the participants is provided in table below.

| Subject’s Characteristics | Mean±SD values |
|---|---|
| Age | 19-23years |
| Height | 171± 5 cm |
| Weight | 71±5 kg |



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**Orientation of Participants to the Experimental Procedure:**

A day before the commencement of experimental procedures, the subjects were assembled on the University 400 mts. Track. Proper instructions regarding the objectives of study and procedure to perform the protocol were demonstrated and the quires of the subjects if any were solved graciously by the researchers.

**Experimental Protocol:**

Before the final commencement of the protocol on each alternate day, the subjects were asked to do proper warm up for 10-15 minutes, followed by the active warm- up exercise from top to bottom. The subjects underwent the experiment protocols with three different Flexibility programmes i.e. Slow Stretch & Hold, Ballistic, and Proprioceptive neuromuscular facilitation method, dispersed by a gap of alternate days in a week in the evening session for six weeks. The subjects were allowed to go through the same daily routine classes as per their curriculum on alternate day. The exercises included in Flexibility programmes were controlled in the terms of their intensity by fixing their number of repetition or duration of exercise. The test sits and reach involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for a one-two seconds while the distance is recorded. Make sure there are no jerky movements.

**Statistical Analysis:**

The obtained data was analyzed by applying Analysis of Covariance (ANCOVA), the technique was applied just to neutralize the effect of covariate (Pre-test), further to find out the critical difference s between the groups Post Hoc LSD test was employed (Verma,2013), The descriptive table for the obtained data is given below. In ANCOVA, the dependent variable is the post-test measure. The pre-test measure is not an outcome, but a covariate. This model assesses the differences in the post-test means after accounting for pre-test values. Prior to applying the “Analysis of Covariance” (ANCOVA), to begin with analyze the pretest among the different methods of flexibility, this may be done due to the reason that if there would be a significant difference found among the pre –test of different methods, than just to neutralize the effect of covariate (Pre-test), the Analysis of covariance (ANCOVA) would be


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the best technique to take up in this situation but if the results would not be insignificant among the pre –test of different methods, analysis of variance (ANOVA), would take up to analyze the effect of treatment on posttest.

**Table 1: Pre-Test Analysis Of Variance among Different Group for Hamstring Flexibility.**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 82.4 | 2 | 41.2 | 7.624 | 0.002 |
| Within Groups | 145.9 | 27 | 5.404 | | |
| Total | 228.3 | 29 | | | |

Table 1 above indicates that a significant difference was found in the Hamstring Flexibility among Slow Stretch & Hold, Ballistic methods and PNF methods as the P-value is .002, which is less than 0.05, so the null hypothesis of no difference among the means of three Flexibility methods was rejected at 5% level. Since F-value is significant (7.624), which is greater than Tabulated value. A significant difference was found among the Pre-Test in the Hamstring Flexibility of different groups of Stretching Methods to neutralize the effect of covariate (Pre-test), the Analysis of covariance (ANCOVA) would be the best technique to take up in this situation instead of Analysis of Variance (ANOVA).

**Table-2: Posttest Descriptive Statistics of Slow Stretch & Hold, Ballistic Methods and PNF Methods for Hamstring Flexibility.**

| Methods | Mean | Std. Deviation | N |
|---|---|---|---|
| Ballistics | 22.4 | 2.319 | 10 |
| Slow Stretch & Hold | 26 | 2.10819 | 10 |
| PNF | 30.1 | 3.17805 | 10 |
| Total | 26.1667 | 4.0521 | 30 |

Table 2 reveals that the Mean ± standard deviation of Hamstring Flexibility among Ballistic methods, Slow Stretch & Hold, and PNF methods were found to be 22.40 ± 2.31, 26.00 ± 2.10, 30.10 ± 3.17 respectively as the no. of subject in each group were N=10.


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**Table-3: Analysis of Co-Variance (ANCOVA) among Slow Stretch & Hold, Ballistic methods and PNF methods for Hamstring Flexibility.**

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Pre_Test | 137.233 | 1 | 137.233 | 84.818 | 0.000 |
| Methods | 54.203 | 2 | 27.102 | 16.75 | 0.000 |
| Error | 42.067 | 26 | 1.618 | | |
| Corrected Total | 476.167 | 29 | | | |

Table 5 represents the F value for comparing the three different flexibility methods (i.e. Slow Stretch & Hold, Ballistic methods and PNF methods) during post testing, since p- value for the F-statistics is 0.000, which is less than 0.05, it is significant. Thus, the null hypotheses of no difference among the means of three flexibility methods have been rejected at 5 % level of significance. Since the F-value is significant, to find out the critical differences among the three different flexibility methods (i.e. Slow Stretch & Hold, Ballistic methods and PNF methods) Post hoc test had been made, which is shown in table 5.

**Table-4: Univariate Statistics among Slow Stretch & Hold, Ballistic methods and PNF Methods for Hamstring Flexibility**

| (I) Methods (II) | (J) Methods | Mean Difference (I-J) | Sig.[a] |
|---|---|---|---|
| Ballistics | Slow Stretch & Hold | -1.078 | 0.100 |
| | PNF | -3.821* | 0.000 |
| Slow Stretch & Hold | Ballistics | 1.078 | 0.100 |
| | PNF | -2.742* | 0.000 |

Since, it is noted that the P-value of the ballistic method and PNF is 0.000 and Slow Stretch & Hold and PNF is also 0.000. Both the p- values are less than 0.05 and hence they are significant at 5% level of significance whereas an insignificant difference was found among the Slow Stretch & Hold and Ballistic methods as the p –value was found to be 0.100 which is more than 0.05 at 5% level of significance.


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**Figure-1: graphics mean comparison of hamstring flexibility among slow stretch & hold, ballistic methods and pnf methods.**

| | | |
|---|---|---|
| Ballistic | Slow Stretch & Hold | PNF methods |
| 22.40 | 26.00 | 30.10 |

"represents no significant difference among the means of Slow Stretch & Hold, Ballistic methods and PNF methods

**Discussion of Findings:**

Present investigation was under went on the 30 male subjects, in order to scrutinize the effect of Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring Flexibility. The results indicates that Proprioceptive Neuromuscular Facilitation Method was found to be significant in comparison to Slow Stretch & Hold and Ballistic method, this may be due to the reason that, It has been theorized that, Proprioceptive neuromuscular facilitation is the techniques , done with the help of some external force and it is a muscle inhibition techniques prior to the stretch, Also the Hamstrings are actually comprised of three separate muscles: the Biceps Femoris, Semitendinosus and Semimembranosus, Thus, the Hamstrings are primarily fast twitch muscles, responding to low reps and powerful movements. As the Proprioceptive neuromuscular facilitation (PNF) is common practice for increasing range of motion, though little research has been done to evaluate theories behind it. Little investigation has been done regarding the theoretical mechanisms of proprioceptive neuromuscular facilitation, though four mechanisms were identified from the literature. As stated, the main goal of proprioceptive neuromuscular facilitation is to increase range of motion and performance. (Kayla B. Hindle et al 2011). The PNF technique found to be better because of the reason that as we mentioned earlier that it is done with the help of some external forces where the capillaries passes more oxygen to the cells in relation to increase the hamstring flexibility whereas that much of stretch is not given in the ballistics and Slow Stretch & hold method. The more amounts of oxygen reaches at the muscles; it would lead to better flexibility of the muscles. Whereas slow stretch and hold method in used to avoid the injuries, mainly athletes take up in to the lead prior to the workout for warm up and after completion of the work out for cooling down the muscles.


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Thus, we performed the high intensity workout, the accumulation of the lactic acid is more into the hamstring muscles, so to counteract the effect of lactic acid slow stretch & hold method is taken into consideration. In the Ballistic Method, the movement is performed with a swing in a rhythmic way. The related joint is stretched with a swing. The stretching exercise can be performed rhythmically with a count. At each count, the joint is stretched to the maximum limit and then it is again flexed. This is stretching, or "warming up", by bouncing into (or out of) a stretched position, using the stretched muscles as a spring which pulls out of the stretched position. (e.g. bouncing down repeatedly to touch toes.) This type of stretching is not considered useful and can lead to injury. It does not allow your muscles to adjust to, and relax in, the stretched position. It may instead cause them to tighten up by repeatedly activating the stretch reflex. These investigations also take hold up to the findings of Ross (1999), which showed significant improvement in hamstring length during a 2- week stretching program. The investigation done by Moore (1960) also supports the findings of present investigation who found PNF inhibition techniques to be more effective than static stretching.

**Conclusion:**

Present investigation was under gone on the 30 male subjects, in order to dissect the effect of Slow Stretch & Hold, Ballistic, and Proprioceptive Neuromuscular Facilitation Method on Hamstring Flexibility. Thus, after analyzing the data, following conclusion can be drawn:

- There is a significant difference among the Slow Stretch & Hold and PNF Method.
- There is also a significant difference between Ballistic and PNF Method.

But an insignificant difference was found among the Slow Stretch & Hold and Ballistic methods as the p –value was found to be 0.100 which is more than 0.05 at 5% level of significance.


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