RESEARCH ARTICLE

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Journal of Ecophysiology and Occupational Health, *Vol 24(4), DOI: 10.18311/jeoh/2024/44107, 373-377, December 2024*

ISSN (Online) : 0972-4397
ISSN (Online) : 0974-0805

Efficacy of Static Stretching Versus Proprioceptive Neuromuscular Facilitation (PNF) Stretching on Hip Adductor Flexibility in Recreational Football Players

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Abstract

Adductor strain is most commonly seen in football players. To help ease groin pain and improve the flexibility of muscles, stretching techniques like ballistic stretching, static stretching, etc can be used. Static hip adductor stretching and Proprioceptive Neuromuscular Facilitation (PNF) stretching, which is relatively new, are two effective techniques to increase muscle flexibility. This study examines the effects of these two stretching techniques on tight hip adductors. **Method**: Fifty people were chosen based on the inclusion criteria. There were two groups of subjects. PNF and static adductor stretching were administered to Group A. Group B received adductor stretching. These methods were used for three different days. Using a goniometer, the abduction range of motion was measured before the start of the first session and at the conclusion of the last one. Flexibility was measured before the first session and at the end of the previous treatment session by groin flexibility test. The inter-group analysis for Range of Motion (ROM) between Group A versus Group B showed a statistically significant difference by using an unpaired 't' test. **Results:** Group A's post-intervention flexibility values were 17.23, whereas group B's were 13.5. There was a sizeable difference between Group A and Group B in the intergroup analysis of flexibility. The unpaired "t" test was used for this purpose. **Conclusion:** It is concluded that PNF stretching exercises had a statistically significant effect on the abduction range of motion and groin flexibility scores.

Keywords: Adductor Tightness, Flexibility, Groin Pain, Hip Abduction, Proprioceptive Neuromuscular Stretch

1. Introduction

The primary purpose of recreational sports is participation, along with the goals of improving physical fitness, fun and social involvement. Recent studies have established that recreational football, carried out as a small-sided game can be characterised as having a high aerobic component with mean heart rates of 80-85 % of maximum heart rate, which is similar to values observed for elite football players. Stretching procedures are used to improve flexibility and avoid tightness. Stretching promotes the growth of muscles[1,2]. When stretching, force is applied without regard to the tissue's voluntary motion[3]. Football players frequently have groin pain from adductor strain, which progresses to degenerative arthropathy of the pubic symphysis in its severe stages. In sports like football, groin strains are frequently seen in players with a history of hip adductor injuries, reduced

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Article Received on: 20.05.2024 Revised on: 10.06.2024 Accepted on: 11.06.2024

ROM, an imbalance in the strength of the hip adductor compared to the abductor or diminished performance[4,5]. Static, ballistic and PNF stretching are the three most common stretching methods[6-8]. The procedure of static stretching involves stretching a muscle (or a muscle group) to the furthest point. This position is maintained for a definite period[9]. Static stretching which is the most common method[10] comprises the gradual lengthening of a joint to an elongated position before the start of pain. A static stretch is usually held for a 30-second duration. To perform the static stretch, the protocol which needs to be followed is that the stretch should be in a slow, gradual manner and held at the end range just before the point of discomfort[11]. This static stretching is energy efficient over any other stretching method as it requires less energy to perform along with low injury risk. PNF is a new form of stretching technique which takes the help of proprioceptive stimulation and aids neuromuscular responses. To increase the joint range ROM, different combinations of alternating contraction and relaxation of the agonist and antagonist muscle groups are used[11,12]. The agonist, or prime mover is passively moved in the muscle which needs to be elongated and is taken up to end-range and contracted isometrically. This is then followed by a contraction which is eccentric to the antagonist muscle[13]. Football as a sport requires skills like a rapid change of direction and speed several times to dodge the opponent and gain better control over the ball. This action implies a lot of stress on the adductor muscles as the player has to apply force rapidly on the ground[14,15]. This force which is required during a sudden lateral change of directions, which helps enable a player to position himself in a better manner during the gameplay is absorbed by the adductor muscle[16]. Strengthening adductor muscles improves the player's performance along with reducing eccentric stress. The chances of sustaining a groin injury are also reduced as these injuries often result in prolonged standing pain and tenderness in the groin and thigh region, affecting the play time and also leading to a long time absence from the game[17]

2. Materials and Methodology

For this study, the source population was college students. 60 healthy male recreational football players, who were willing to participate after signing an informed consent form were eligible for this study. Age between 15-25 years and subjects not undergoing any hip adductor stretching program were the inclusion criteria. Subjects who had a history of previous muscle injury over 6 weeks, any recent surgery or lower limb fractures or had problems related to bones, joints or muscles which could limit stretching were excluded. All 60 players fulfilled the pre-requisites and inclusion criteria and completed the study. The subjects were divided into two equal groups by simple randomisation. Throughout the trial, there were no observed dropouts from any of the groups. Krishna Institute of Medical Sciences is the main data source. considered to be Karad University (KIMSDU), This kind of research is an experimental study. Study design: a comparative prospective observational study, Sample size: sixty, determined by applying Cochran's formula (n=z2pq/d2). Method of sampling: random sampling. Four weeks were spent studying. Flexibility was measured with a groin flexibility test. In this test, participants had to sit on the floor and try to pull their feet as close as they could to the body, The ROM was measured by a standard goniometer.

2.1 Procedure

The KIMSDU Institutional Ethical Committee approved the project. The consent form was required from the subjects on the first visit. Two sets of subjects were randomly selected based on the inclusion criteria. **Group A** was given static adductor stretch and PNF Adductor stretch was given to **Group B**, The techniques were performed on individuals for three days alternatively. Before the first session, and at the end of the last session, the abduction range was measured with the help of a goniometer. Flexibility was measured at the start of the first session and the end of the last treatment session by groin flexibility test. **Group A**: On the treatment table, static stretching was administered while the patient's second leg was propped up at a 90-degree angle outside the table. One hand was put on the knee's medial side and the other on the medial portion of the foot. The leg was then abducted to its greatest ROM and maintained there for 30 seconds. Four sets of this were performed, with a 30-second break in between each set[17]. **Group B**: Group B received a PNF technique. In the supine position, lying on the treatment table, the subject was positioned. While the other leg rested outside the table with the knee positioned at 90 degrees. The affected leg was stretched for 10 seconds passively, then against resistance, an active muscle

contraction for 10 seconds was imposed by the evaluator at the inner thigh region. At the final stage, hip muscles were extended for another 10 seconds. With separation by 30-second intervals, 4 sets were performed. The Abd-ROM was measured both before and after the operation using a conventional 360-degree goniometer[18,19]. The subject was placed in a supine posture and the pelvis was stabilised with the use of a mobilisation belt. Using a goniometer, the imaginary line connecting the Anterior Superior Iliac Spine (ASIS) and the stationary arm was aligned. The moveable arm was positioned across the femur's midline, with unilateral ASIS serving as the fulcrum's centre of mass. The contralateral leg was maintained on the couch's edge during the hip abduction[18]. The values for the dominant and the non-dominant leg were evaluated. Before the beginning of the study on day 1, the pre-intervention values of all the outcome measures were noted in the subjects. This intervention was carried out for 4 weeks. After 4 weeks the post-intervention measures were taken and both the values were compared on the last treatment day.

All of the pre-and post-treatment values of the parameters were noted and compared for both intra- and intergroup analysis. The sample size was determined based on the requirement for a minimal clinical change and a level of significance of less than 10% was assumed. The power standard deviation and standard error were computed to compile the data and do analysis. Less than that threshold was regarded as significant and the p level was maintained at 0.05. The analysis was conducted using the instant program.

MS Excel was used for drawing various graphs with given frequencies and for the master chart.

Table 1 represents average age for Group 1 is 21years and Group 2 is 21.23 years, standard deviation for Group 1 and Group 2 is 2.754 and 2.775 respectively. Average height for Group 1 is 1.7203 meters and Group 2 is 1.7136 meters' so the standard deviation for Group 1 and Group 2 is (2.553 and 2.526). And according to weight criterion average weight for Group 1 is 69.26 Kgs and Group 2 is 70 Kgs as standard deviation is 4.299 and 4.034 respectively. BMI of Group 1 is 23.38 and Group 2 is 23.80 and both groups shows standard deviation of 0.8918 and 0.7697 respectively.

Table 2 represents the pre-interventional values of ROM of the right and left side were 38.2 and 37.8 respectively of Group A and Group B's right and left sides were 38.23 and 38.36 respectively, whereas the post-intervention values of ROM of the right and left side were 41.2 and 41.5 respectively of Group A and of Group B right and left side were 44.5 and 44.8 respectively. The inter-group analysis for ROM between Group A versus Group B showed a statistically significant difference. This was done by using an unpaired 't' test.

Table 3 represents the pre-intervention values of flexibility were 20.63 in group A and 20.66 in group B respectively, whereas the post-intervention values

Table 1. Statistics for the characteristics of the subjects

Characteristics	Group	Mean	SD
Age (Years)	1	21	2.754
	2	21.23	2.775
Height (m)	1	1.7203	2.553
	2	1.7136	2.526
Weight (Kgs)	1	69.26	4.299
	2	70	4.034
BMI	1	23.38	0.8918
	2	23.80	0.7697

Table 2. Abduction of the subjects on two occasions in both static and PNF groups: Descriptive statistics. (n=30) range of motion values

		Group A		Group B		
	Mean Sd	't'	P Value	Mean SD	't'	P Value
Pre Test RIGHT	38.2±1.518	137.86	>0.10	38.23±1.547	135.40	0.0219
LEFT	37.8±1.627	127.22	0.0350	38.36±1.497	140.40	0.0003
Post Test RIGHT	41.2±2.041	110.57	<0.0001	44.5±0.6297	387.05	<0.0001
LEFT	41.5±1.697	133.96	<0.0001	44.8±0.4068	603.14	<0.0001

Table 3. Outcome measure groin flexibility score values

Groin Flexibility	Group A		Group B	
	Pre	Post	Pre	Post
Mean	20.63	17.23	20.66	13.5
SD	1.790	1.775	2.057	1.137
't'	63.120	53.17	55.039	65.025
P Value	0.0024	0.0074	0.0198	0.0027

of flexibility were 17.23 in Group A and 13.5 in Group B respectively. The inter-group analysis for flexibility between Group A versus Group B showed a statistically significant difference. This was done using an unpaired 't' test

3. Results

From the comparison between the two stretching groups, both Static Stretching and PNF Stretching exercises showed improvement in abduction range and hip adductor flexibility in recreational football players, however the results showed that: PNF stretching exercises had a statistically significant effect on the abduction range of motion and groin flexibility scores. It can be concluded that PNF stretch training considerably increased the range because the average ROM after PNF stretching (44.6) was compared to the mean ROM before PNF stretching (38.2).

4. Discussion

Performing structured exercise has been included by athletes and recreational participants, both young and old. This is partly because of the interest of participants and the availability of recreational resources[20]. As participation in sports like hockey, soccer, skiing, basketball, football, gymnastics, dance and martial arts increases, it requires a high-performance criterion[20,21]. A large amount of hip mobility is required for these sports as the participants require high mobility skills like sudden changes in direction that could increase the risk of hip adductor strains[22,23]. The comparative study of both interventions has not been attempted earlier on hip adductors for recreational football players. There is evidence according to the available literature that shows the effect of stretching on hip adductor tightness. When given for subacute duration the result can be compared with conventional stretching protocols. The values of pre-treatment and post-treatment were analysed. The statistically significant technique when compared with the other group was the PNF stretching technique. According to Bradley PS *et al.* static, light ballistic PNF stretching affected strength performance[24]. The other form of stretching enhances strength performance as does the PNF stretch, because muscle inhibition is initiated while doing the PNF stretch[24]. According to Sady *et al.*, the static and PNF stretching techniques were compared for the flexibility of the hamstring. To measure the ROM, a Leighton flexometer was used. The PNF group had an increase in flexibility as compared to the control group[25]. Ligaments that are the external supporting structures of the hip, restrict flexibility[26-28]. The pubo femoral ligament is important for providing stability at the hip joint by inhibiting abduction and an extension past normal ROM[28] which is limited to hip abduction in individuals who have a shorter ligament.

5. Conclusion

PNF stretching exercises had a substantial impact on the abduction ROM, according to research on the benefits of static stretching and PNF stretching exercises for hip adductor flexibility in recreational football players.

6. References

1. Weerapong P, Hume PA, Kolt GS. Stretching: mechanisms and benefits for sports performance and injury prevention. Phys Ther Rev 2004; 9(4):189-206. https://doi.org/10.1179/108331904225007078
2. He L, Yan X, Li J, Guan B, Ma L, Chen Y, *et al*. Comparison of 2 dosages of stretching treatment in infants with congenital muscular torticollis: A randomized trial. Am J Phys Med Rehabil 2017; 96(5):333-40. https://doi.org/10.1097/PHM.0000000000000623 PMid:27820728.
3. Madding SW, Wong JG, Hallum A, Medeiros J. Effect of duration of passive stretch on hip abduction range of motion. J Orthop Sports Phys Ther 1987; 8(8):409-16. https://doi.org/10.2519/jospt.1987.8.8.409 PMid:18797037.
4. Ibrahim A, Murrell GAC, Knapman P. Adductor strain and hip range of movement in male professional soccer players. Journal of Orthopaedic Surgery. 2007; 15(1):46-9. https://doi.org/10.1177/230949900701500111 PMid:17429117.
5. Bohannon RW. Effect of repeated eight-minute muscle loading on the angle of straight-leg raising. Phys Ther 1984; 64(4):491-7. https://doi.org/10.1093/ptj/64.4.491 PMid:6709713

6. Feland JB, Myrer JW, Schulthies SS, Fellingham GW, Measom GW 2001. The effect of duration of stretching of the hamstring muscle group for increasing range of motion in people aged 65 years or older. Phys Ther. 2001; 81(5): 1110-17. https://doi.org/10.1093/ptj/81.5.1110 PMid:11319936.
7. Magnusson SP, Simonsen EB, Aagaard P, Dyhre-Poulsen P, McHughMP, Kjaer M. Mechanical and physical responses to stretching with and without preisometric contraction in human skeletal muscle. Arch Phys Med Rehabil. 1996; 77(4):373-8. https://doi.org/10.1016/S0003-9993(96)90087-8 PMid:8607762.
8. Miyahara Y, Naito H, Ogura Y, Kawamoto S, Aoki J. Effects of proprioceptive neuromuscular facilitation stretching and static stretching on maximal voluntary contraction. J Strength Cond Res. 2013; 27(1):195-201. https://doi.org/10.1519/JSC.0b013e3182510856 PMid:22395281.
9. Sharman MJ, Cresswell AG, Riek S, Proprioceptive neuromuscular facilitation stretching Sports Med. 2006; 36(11):929-39. https://doi.org/10.2165/00007256-200636110-00002 PMid:17052131.
10. Weerapong P, Hume PA, Kolt GS 2004. Stretching: Mechanisms and benefits for sport performance and injury prevention. Phys Ther Reviews. 2004; 9(4):189-206. https://doi.org/10.1179/108331904225007078
11. Feland JB, Myrer JW, Merrill RM. Acute changes in hamstrings flexibility: PNF versus static stretch in senior athletes. Phys Ther Sport. 2001; 2(4):186-93. https://doi.org/10.1054/ptsp.2001.0076
12. Moore MA, Hutton RS. Electromyographic investigation of muscle stretching techniques. Med Sci Sports Exerc. 1980; 12:322-9. Google Scholar Crossref PubMed. https://doi.org/10.1249/00005768-198012050-00004
13. Sozbir K. The effects of two different stretching exercises together with plyometric training on EMG values and some physiological parameters. Master Thesis. Institute of Health Science. Bolu: Abant Izzet Baysal University; 2006.
14. Wessling KC, DeVane DA, Hylton CR. Effects of static stretch versus static stretch and ultrasound combined on triceps surae muscle extensibility in healthy women. Phys Ther. 1987; 67:674-9. Google Scholar Pub Med. https://doi.org/10.1093/ptj/67.5.674 PMid:3575424.
15. Andreas. Serner, Andrea Britt Mosler, Johannes L Tol, Roald Bahr. Mechanism of acute adductor longus injury in male football players: a systematic visual video analysis. Br J Sports Med. 2018; 53(3):099246. https://doi.org/10.1136/bjsports-2018-099246 PMid:30006458.
16. Harris NK, Cronin JB, Hopkins WG, Hansen KT. Squat jump training at maximal power load vs heavy loads: Effect on sprint ability. J Strength Cond Res. 2008; 22(6):1742-9. https://doi.org/10s.1519/JSC.0b013e318187458a PMid:18978632.
17. Rubini EC, Souza AC, Mello ML, Bacurau RF, Cabral LF, Farinatti PT. Immediate effect of static and proprioceptive neuromuscular facilitation stretching on hip adductor flexibility in female ballet dancers. J Dance Med Sci 2011; 15(4):177-81. https://doi.org/10.1177/1089313X1101500406 PMid:22687658.
18. Nussbaumer S, Leunig M, Glatthorn JF, Stauffacher S, Gerber H, Maffiuletti NA. Validity and test-retest reliability of manual goniometers for measuring passive hip range of motion in femoroacetabular impingement patients. BMC Musculoskelet Disord 2010; 11:194. https://doi.org/10.1186/1471-2474-11-194 PMid:20807405 PMCid: PMC2942800.
19. Verrall GM, Hamilton IA, Slavotinek JP, Oakeshott RD, Spriggins AJ, Barnes PG, *et al.* Hip joint range of motion reduction in sports-related chronic groin injury diagnosed as pubic bone stress injury. J Sci Med Sport 2005; 8(1):77-84. https://doi.org/10.1016/S1440-2440(05)80027-1 PMid: 15887904.
20. Roux A, Evenson K, McGinn A, Brown D, Moore L, Brines S, Jacobs D., Jr Availability of recreational resources and physical activity in adults. Am J Public Health. 2007; 93(3):493-9. https://doi.org/10.2105/AJPH.2006.087734 PMid:17267710 PMCid: PMC1805019.
21. Renstrom P, Peterson L. Groin injuries in athletes. Br J Sports Med. 1980; 4(1):30-6. https://doi.org/10.1136/bjsm.14.1.30 PMid:7378668 PMCid: PMC1858784.
22. Nicholas S, Tyler T. Adductor muscle strains in sport. Sports Med. 2002; 32(5):339-44. https://doi.org/10.2165/00007256-200232050-00005 PMid:11929360.
23. Young WB. The use of static stretching in warm-up for training and competition. Int J Sports Physiol Perform. 2007; 2(2):212-6. https://doi.org/10.1123/ijspp.2.2.212 PMid:19124908.
24. Bradley PS, Olsen PD, Portas MD. The effect of static, ballistic, and proprioceptive neuromuscular facilitation stretching on vertical jump performance. J Strength Cond Res. 2007; 21(1):223-6. https://doi.org/10.1519/00124278-200702000-00040 PMid:17313299.
25. Sady SM. Flexibility training: ballistic, static or PNF. Arch Phys Med Rehabil. 1982; 63(6):261-3.
26. Clippinger K. Dance anatomy and kinesiology. 2nd ed. Champaign, IL: Human kinetics; 2007.
27. Gajdosik R. Passive extensibility of skeletal muscle: Review of the literature with clinical implications. Clin Biomech. 2001; 16(2):87-101. https://doi.org/10.1016/S0268-0033(00)00061-9 PMid:11222927.
28. Levangie P, Norkin C. Joint structure and function: A comprehensive analysis. 4th ed. Philadelphia: The F.A Davis Company; 2005