Comparison of Static vs Ballistic Stretching Combined with Basket Ball Play on Flexibility and Vertical Jump

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Abstract

BACK GROUND: Little is known about the effectiveness of performing static stretching prior to a power play such as basket ball sport. Evidence for ballistic stretching effectiveness is documented. Studies done to compare Static Stretching and Ballistic stretching combined with Basketball play on Flexibility and Vertical Jump are limited.

OBJECTIVE: To determine the two different stretching effects for basket ball players.

STUDY DESIGN: Quasi Experimental

METHODOLOGY: 50 male basketball players (18-23yrs) (BMI: 22-23.5kg/m 2) were recruited and randomly allocated onto 2 groups. Group A: Static Stretching Group combined with 20 minutes of basketball play B: Ballistic stretching combined with 20 minutes of basketball play for both Group A and B. The programme was carried out 3days /week for 6 weeks. Box test for Flexibility (4.27) and Sergeant Jump test for Vertical Jump (286.12) were assessed at baseline; end of every week and after six weeks.

RESULTS: Improvement for the flexibility (8.94) and vertical jump (300.96) were greater in ballistic stretching, whereas difference in static stretching on flexibility (6.66) and vertical jump (295.88) was not significant.

CONCLUSION: The study indicates that ballistic stretching combined with 20 minutes basketball play may be superior to static stretching with 20 minutes basketball play for improving flexibility and vertical jump in basketball players.

Keywords: **Ballistic and static stretching; Basketball play; Vertical jump and flexibility**

I. INTRODUCTION

Flexibility is an important component to many athletic movements that should not be overlooked. Adequate flexibility requires that muscles and joints perform through a functional range of motion, in general athletes incorporated the stretching in their pre activity schedule which may lead to a decreased risk of injury, delayed onset of muscle soreness and improvements in performance. Stretching exercises have traditionally been incorporated into warm-up routines before training sessions and sport events. Static stretching can be done individually, by moving the joint to its maximum endpoint before the pain arises, and by increasing the muscle fibers, tendon which results in increased force transmission capacity to preventing the musculoskeletal injuries and improving coordination. But, still, there was no definite evidence to conclude that static stretching before the exercise to reduce the injury risk.

Evidence suggest that as the musculotendinous unit lengthens there will be increased compliance , and actin and myosin filaments, were contracted over longer distance with more force which in turn resulted in decreased in performance parameters like maximal force production, jump height, sprint speed, balance and reaction time has been reduced. This has made the players to change to more dynamic warm up session before getting in to the play, like incorporated skipping, directional running, shuffling, and various calisthenics of increasing intensity that will simulate the movement patterns of a particular sport. Recent reports suggest that Ballistic stretching improves performance by simulated movement patterns, and it has been documented in sports activities which include sprinting, jumping and peak force generating capacity.

Hence the purpose of the study is to compare the static and ballistic stretching with basket ball play on jump height and flexibility.

II. METHODOLOGY

Total of 50 subjects (all men) were taken by convenient sampling and divided in to two groups with 25 participants in each. All the subjects were explained about their condition and mode of assessment and prior to testing; informed consent obtained from all players, Total 50 Men Samples were selected based on the inclusion criteria off season player's athletes from men's Basketball players from both the genders with age range 18-23 years and they were divided in to Group A – 25, Group B – 25, with BMI – normal (22-23.5)Exclusion Criteria: Athletes with history of any acute and chronic musculoskeletal injuries and concussions for at least 3 months before enrolment in the study; Athletes, who are not willing to continue the study for any personal and professional reasons.

III. PROCEDURE

Both the groups were performed eight minutes of static stretching and ballistic stretching (respectively) preceded by warm up period of five minutes which includes light jogging, and then followed by twenty minutes of basketball play, for 2/week for six weeks, vertical jump height and flexibility were measured before and after the intervention.

Group A (Static Stretching)

Sit and Reach

Both the legs were straightened, with their feet upright position, and they were asked to flex their trunk in order to touch their toes with fingers, until they felt a discomfort at posterior thigh compartment, but not pain.

Lunge – Knee Bent

The one leg is moved forward, with knee exactly in line with ankle, with opposite leg is still on the floor, now the player was asked to lower the hip of the leg which is placed forward.

Standing Heel Cord with Extended knee – Players was asked to place one foot on the stair, and the other at the end of the stair, which consider as back leg, making it straight and placed on the floor, and pushing it back at maximum, till pain starts.

Standing Heel Cord with Flexed knee - Players was asked to place one foot on the stair, and the other at the end of the stair, which consider as back leg, which placed on the floor, by bending it at the knee level and pushing it back at maximum, till pain occurs.

These stretching's should be in holding for 30 seconds with 15 seconds rest period between them.

Group B (Ballistic Stretching)

The same exercise was performed for the ballistic stretching as well, but bouncing the movements beyond the end range of motion. A metronome was set to 60 b-min-1 and subjects bounced to the beat.

IV. DATA ANALYSIS AND INTERPRETATION

The collected data were tabulated and analyzed using descriptive and inferential statistics. The date was analyzed using statistical package for social science (SPSS 17) to present the finding of the study.

Paired' test was performed to find out the difference within the group, and the Independent't' test was performed to know the difference exists in parameters among the groups.

V. RESULTS

According to table 1, the pre test mean value of flexibility of group A was 4.27 and post test value was 6.66. The pre and post mean value of Vertical jump of Group A was 286.12 and 295. 88 respectively. The $P < 0.05$, which shows statistically significant difference in flexibility measures because of static stretching.

According to table 2, the pre test mean value of flexibility of group B was 4.57 and post test value was 8.94. The pre test mean value of Vertical jump was 284.16 and post test mean value was 300.96. In this $P < 0.05$, which is also statistically significant, it means athletes in this group also showed improvement in flexibility and vertical jump because of ballistic stretching. The vertical jump P for values is significant for both groups but more significant for group B.

According to table 3, the post test mean value of flexibility measure for group A was 6.66 and post test mean value of flexibility measure of group B was 8.94 In this $P < 0.05$ which shows significant difference between Post-test value of flexibility measure in Group A and Group B but group A is more statistically significant than Group B.

According to table 4, the post test mean value of vertical jump was 295.88 for group A with and post test mean value of vertical jump was 300.96 for group B, In this $P < 0.05$ which shows significant difference between Post-test values of vertical jump in Group A and Group B, but group A is more statistically significant than Group B.

TABLE-1

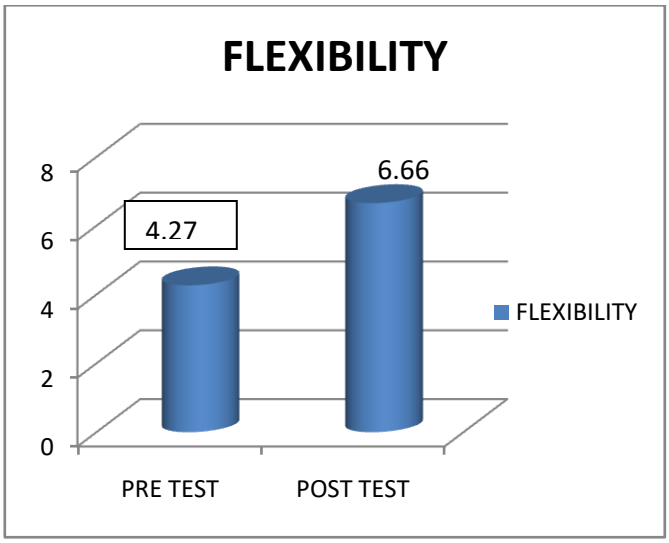
PRE AND POST TEST VALUES OF FLEXIBILITY AND VERTICAL JUMP OF GROUP A

Group-A	Pre Test		Post Test		t-value	Significance (P)
	Mean	SD	Mean	SD		
FLEXIBILITY	4.27	1.967	6.66	2.495	7.328	0.000
VERTICAL JUMP	286.12	11.545	295.88	8.054	4.344	0.056

In this table, there is a statistically significant difference in group A between pre test and post test at **p <0.05.**

GRAPH 1

GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF FLEXIBILITY AND VERTICAL JUMP OF GROUP A



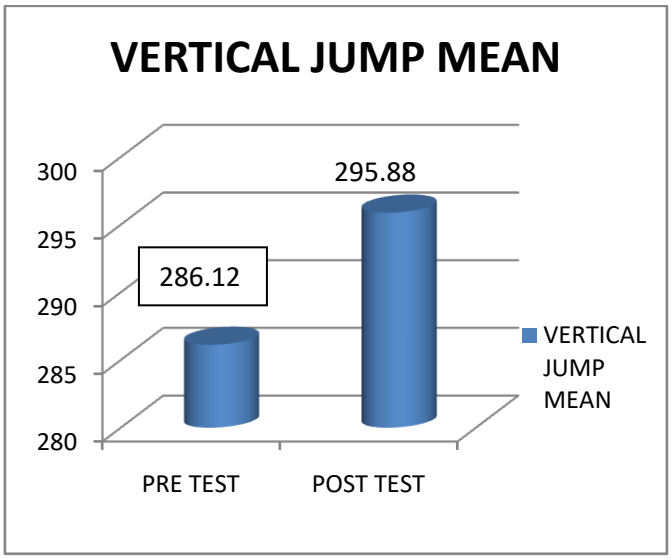


TABLE - 2

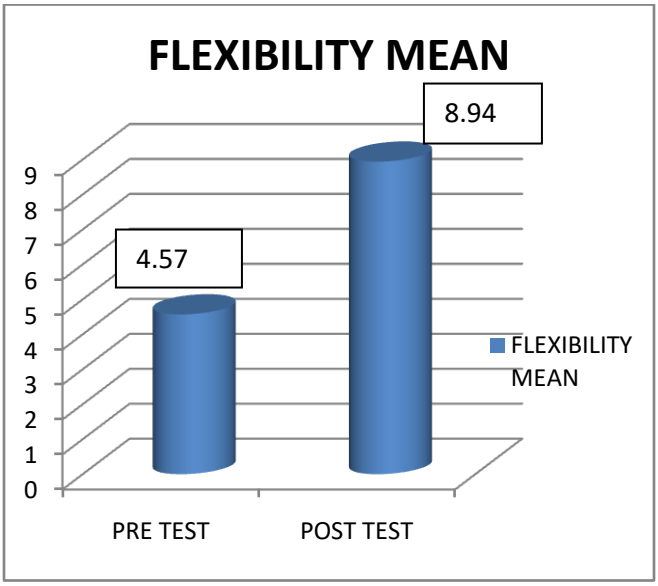
PRE AND POST TEST VALUES OF FLEXIBILITY AND VERTICAL JUMP OF GROUP B

Group-B	Pre Test		Post Test		t-value	Significance (P)
	Mean	SD	Mean	SD		
FLEXIBILITY	4.57	1.862	8.94	1.732	20.056	0.000
VERTICAL JUMP	284.16	12.931	300.96	2.700	7.031	0.022

In this table, there is a statistically significant difference in group A between pre test and post test at **p <0.05.**

GRAPH 2

GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF FLEXIBILITY AND VERTICAL JUMP OF GROUP B



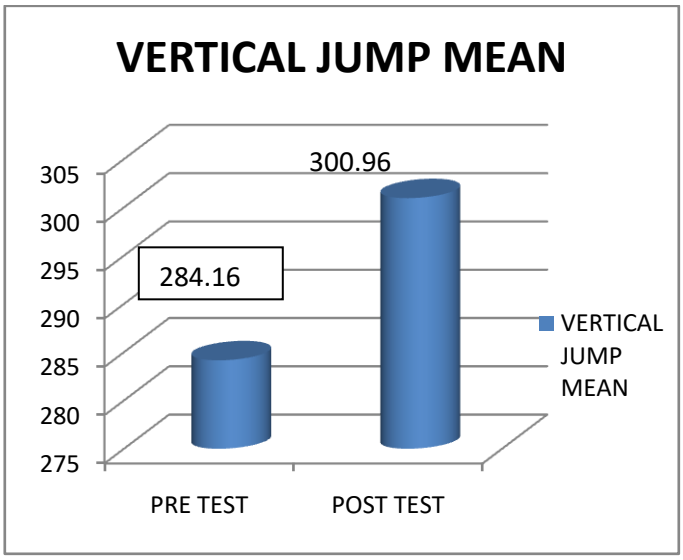


TABLE-3

POST TEST VALUES OF FLEXIBILITY MEASURMENT FOR GROUP A AND GROUP B.

Post Test Values	Mean	S.D	t- value	Significance
Group A	6.66	2.495	3.754	0.01
Group B	8.94	1.732	3.754	

In this table, **p<0.05**, there is a significant difference between Post-test values of flexibility measure in Group A and Group B subjects.

GRAPH 3

GRAPHICAL REPRESENTATION OF POST TEST VALUES OF FLEXIBILITY FOR GROUP A AND GROUP B**.**

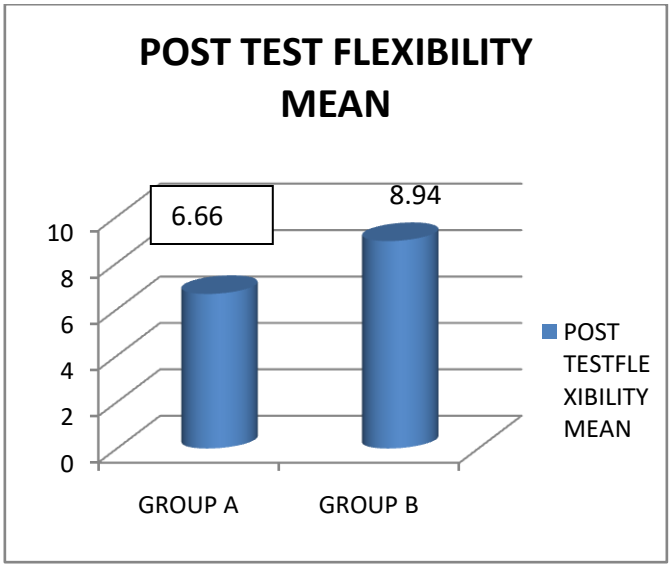


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TABLE-4

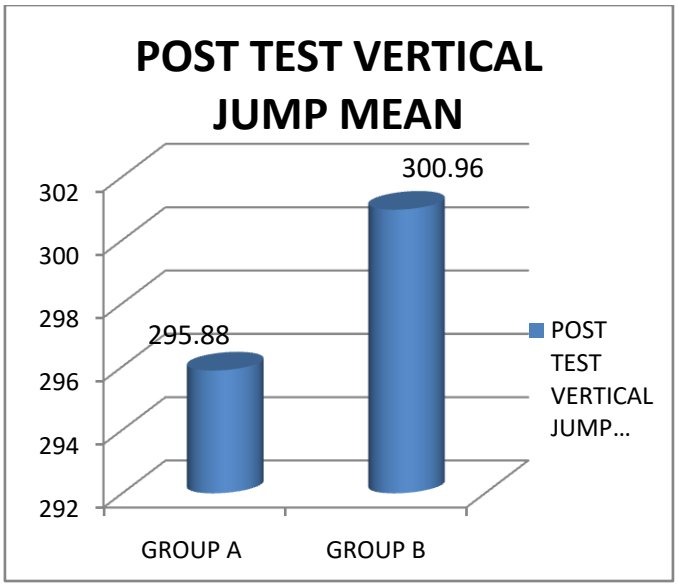
POST TEST VALUES OF VERTICAL JUMP IN GROUP A AND GROUP B.

Post Test Values	Mean	S.D	t- value	Significance
Group A	295.88	8.054	2.990	0.004
Group B	300.96	2.700	2.990	

In this table, **p<0.05**, there is a significant difference between Post test values of vertical jump in Group A and Group B.

GRAPH 4

GRAPHICAL REPRESENTATION OF POST TEST VALUES OF VERTICAL JUMP FOR GROUP A AND GROUP B**.**



VI. DISCUSSION

In this study, the results were supported by other evidence that, both the stretching exercises were benefit the players, but static has more effect, when compare to ballistic stretching in terms of flexibility and vertical jump height. Evidence by Unick et al., supported that there wouldn't be any reduction in performance of jump, that too particular in trained women followed by ballistic stretching. But, Nelson and Kokkonen in their study concluded, that during knee flexion and extension, the muscle strength has been reduced and it does not impair performance of jumping, irrespective of gender and their training.

Fowles et al., concluded that changes in neuromuscular and mechanical properties of muscle, after fifteen minutes of static stretching, will lead to reduction of peak torque, because there, was an impaired mechanical function from deformation in the supporting structures of the muscle. Paul Bradley et al., concluded that, atleast before 15 minutes of performance, the stretching activities (PNF or Static) should be encouraged, not to be done immediately prior to a performance. In this study, they proved that both the flexibility and vertical jump height has shown significant difference in static stretching, when compared to ballistic stretching, might be due to basketball play combined with the stretching activities.

Church et al., concluded that after PNF stretching activity, there was reduction in vertical jump height, but there was no change in vertical jump height followed by static stretching protocol.

Young and Elliot found that, following static stretching, there was reduction in drop jump performance, but there was no change after PNF stretching. All the above studies were suggesting, different conclusion, as it concluded only, the acute effects of stretching, but also there was no significant difference exists between the static and ballistic stretching. These results differed from several previous that found a decrease in vertical jump as a result of stretching. However, the cause for this difference is unknown but can be speculated. Although the design of this study. These results differed from several previous studies that found a decrease in vertical jump as a result of stretching. However, the cause for this difference is unknown but can be speculated. Although the design of this study did not examine the mechanisms involved with this type of stretching, a few reasons can be theorized as to why decreases in vertical jump performance were not found as they were in other studies.

A review of the clinical evidence strongly suggests that pre-exercise stretching decreases force production and velocity of contraction for at least part of the range of motion (ROM), and that running economy is improved. Overall, the evidence strongly suggested that regular stretching increases isometric force production and velocity of contraction. There were 2 studies suggesting neither an improvement nor a diminished performance. Both of these studies were randomized cross-over studies, and both examined economy of motion.

Five studies of nominally moderate quality that stretching before or after exercising has no effect on delayed onset muscle soreness. Two further studies on army recruits undergoing military training strongly suggest that muscle stretching before exercising does not pro- duce meaningful reductions in the risk of injury. Not enough research has been done to draw conclusions about the effects of stretching on athletic performance. In this study, there were certain limitations like sample size was small; there was no control group in the study. All measurements for a given subject in the study were measured by the same individual. This study consisted of a short course of intervention over a mean period of 6 weeks. Off season players mostly were injured and hence it was difficult to get more samples. Further studies were should sample size was low we can add more population for further studies. This study was done in male players we can recommend for female players, has to be done to find the effectiveness of static stretching and ballistic stretching with longer duration.

VII. CONCLUSION

In this study both static and ballistic stretching were showed significant results, but highly significant in static stretching group, based up on those results we conclude that static stretching is effective in basketball players.

REFERENCE

[1]. Behm, D.G., A. Bambury, F. Cahill, And K. Power. Effect Of Acute Static Stretching On Force, Balance, Reaction Time, And Movement Time. *Med. Sci. Sports Exerc.* 36:1397–1402. 2004.

[2]. Mandy T. Woolstenhulme, Christine M. Griffiths, Emily M. Woolstenhulme, And Allen C. Parcell. Ballistic Stretching Increases Flexibility And Acute Vertical Jump Height When Combined With Basketball Activity. Journal Of Strength And Conditioning Research, 2006, 20(4), 799–803

[3]. Church, J.B., M.S. Wiggins, F.M. Moode, And R. Crist. Effect Of Warm-Up And Flexibility Treatments On Vertical Jump Performance. *J. Strength Cond. Res.* 15:332–336. 2001.

[4]. Cornwell, A., A.G. Nelson, G.D. Heise, And B. Sidaway. Acute Effects Of Passive Muscle Stretching On Vertical Jump Performance. *J. Hum. Movement Stud.* 40:307–324. 2001.

[5]. Young, W., And S. Elliott. Acute Effects Of Static Stretching, Proprioceptive Neuromuscular Facilitation Stretching, And Maximum Voluntary Contractions On Explosive Force Production And Jumping Performance. *Res. Q. Exerc. Sport* 72:273–279. 2001.

[6]. Young, W.B., And D.G. Behm. Effects Of Running, Static Stretching And Practice Jumps On Explosive Force Production And Jumping Performance. *J. Sports Med. Phys. Fitness* 43:21–27. 2003.

[7]. Smith, C.A. The Warm-Up Procedure: To Stretch Or Not To Stretch. A Brief Review. *J. Orthop. Sports Phys. Ther.* 19:12–17. 1994.

[8]. Unick, J., H.S. Kieffer, W. Cheesman, And A. Feeney. The Acute Effects Of Static And Ballistic Stretching On Vertical Jump Performance In Trained Women. *J. Strength Cond. Res.* 19:206–212. 2005.

[9]. Power, K., D. Behm, F. Cahill, M. Carroll, And W. Young. An Acute Bout Of Static Stretching: Effects On Force And Jumping Performance. *Med. Sci. Sports Exerc.* 36:1389–1396. 2004.

[10]. Reury Frank Pereira Bacurau, Gizele De Assis Monteiro, Carlos Ugrinowitsch,Valmor Tricoli, Leonardo Ferreira Cabral, And Marcelo Saldanha Aoki. Acute Effect Of A Ballistic And A Static Stretching Exercise Bout On Flexibility And Maximal Strength. Journal Of Strength And Conditioning Research,2009 , 23(1)/304–308

[11]. Bradley, Ps, Olsen, Pd, And Portas,Md. The Effect Of Static, Ballistic, And Proprioceptive Neuromuscular Facilitation Stretching On Vertical Jump Performance. J Strength Cond Res 21: 223–226, 2007.

[12]. Church, Jb,Wiggins, Ms, Moode, Fm, And Crist, R. Effect Of Warmup And Flexibility Treatments On Vertical Jump Performance. J Strength Cond Res 15: 332–336, 2001.

[13]. Cramer, Jt, Housh, Tj, Coburn, Jw, Beck, Tw, And Johnson, Go. Acute Effects Of Static Stretching On Maximal Eccentric Torque Production In Women. J Strength Cond Res 20: 354–358, 2006

[14]. Cramer, Jt, Housh, Tj, Weir, Jp, Johnson, Go, Coburn, Jw, And Beck, Tw. The Acute Effects Of Static Stretching On Peak Torque, Mean Power Output, Electromyography, And Mechanomyography. Eur J Appl Physiol 93: 530–539, 2005.

[15]. Cramer, Jt, Housh, Tj, Johnson, Go, Miller, Jm, Coburn, Jw, And Beck, Tw. Acute Effects Of Static Stretching On Peak Torque In Women. J Strength Cond Res 18: 236–241, 2004.

[16]. Egan, Ad, Cramer, Jt, Massey, Ll, And Marek, Sm. Acute Effects Of Static Stretching On Peak Torque And Mean Power Output In National Collegiate Athletic Association Division I Women's Basketball Players. J Strength Cond Res 20: 778–782, 2006.

[17]. Kokkonen, J, Nelson, Ag, And Cornwell, A. Acute Muscle Stretching Inhibits Maximal Strength Performance. Res Q Exerc Sport 69: 411– 415, 1998.

[18]. Kubo, K, Kanehisa, H, Kawakami, Y, And Fukunaga, T. Influence Of Static Stretching On Viscoelastic Properties Of Human Tendon Structures In Vivo. J Appl Physiol 90: 520–527, 2001.

[19]. Little, Tandwilliams, Ag. Effects Of Differential Stretching Protocols During Warm-Ups On High-Speed Motor Capacities In Professional Soccer Players. J Strength Cond Res 20: 203–207, 2006.

[20]. Magnusson, Sp, Simonsen, Eb, Aagaard, P, Gleim, Gw, Mchugh, Mp, And Kjaer, M. Viscoelastic Response To Repeated Static Stretching In The Human Hamstring Muscle. Scand J Med Sci Sports 5: 342–347, 1995.

[21]. Jaggers, Jason R^1; Swank, Ann M^2; Frost, Karen L^3; Lee, Chong D. The Acute Effects Of Dynamic And Ballistic Stretching On Vertical Jump Height, Force, And Power. Journal Of Strength & Conditioning Research: November 2008 - Volume 22 - Issue 6 - Pp 1844-1849

[22]. Davis B Et Al., (2000), Physical Education And Study Of Sport, Iv^{th} Edition, Great Britain Harcourt Publisher Limited.

[23]. Mackenzie B, (2000), Sit And Reach Test, Journal Of Strength And Conditioning Research, Volume 27 Pp: 345-347.

[24]. Sargent D. A (1921), Physical Test Of A Man, American Physical Education Review, Volume 26, Pp: 188-194.

[25]. Fowlers J. R., Sale D. G., And Macdougall J. D., (2000), Reduced Strength After Passive Stretch Of The Human Plantar Flexors, Journal Of Applied Physiology, Volume 89 Pp: 1179-1188.

[26]. Renato Barroso, Valmor Tricoli, Saulo Dos Santos Gil, Carlos Ugrinowitsch, Hamilton Roschel (2012), Maximal Strength, Number Of Repetitions And Total Volume Are Differently Affected By Static, Ballistic And Proprioceptive Neuromuscular Facilitation Stretching. Journal Of Strength And Conditioning Research Volume 26(9) Pp: 2432-2437.

[27]. Reury Frank, Gizele De Assis Monteriro, Carlos Ugrinowitsch, Valmor Tricoli, Leonardo Ferreira Cabral, And Marcelo Saldanha Aoki (2009), Acute Effect Of A Ballistic And Static Stretching Exercise Bout On Flexibility And Maximal Strength. Journal Of Strength And Conditioning Research Volume 23 (1) Pp: 304-308.

[28]. Jason Reed Jaggers (2004), The Acute Effects Of Dynamic And Ballistic Stretching On Vertical Jump Height, Force, And Power. Journal Of Strengthg And Conditioning Research, Colume 22(6), Pp: 1844-1849.

[29]. Thacker S. B, Gilchrist J. Stroup D. F., And Kimset J. R. (2004), The Impact Of Stretching On Soprts Injury Risk: A Systematic Review Of The Literature. Medical Science And Sports Exercise Volume 36, Pp 371- 378.

[30]. Shrier. I (1999), Stretching Before Exercise Does Not Reduce The Risk Of Local Muscle Injury: A Critical Review Of The Clinical And Basic Science Literature. Clinical Journal Of Sport Medicine, Volume 9, Pp-221-227.

[31]. Patterson P, Wiksten D. L., Ray L., Flanders C., And Sanphy D., (1996), The Validity And Reliability Of The Back Saver Sit And Reach Test In Middle School Girls And Boys. Research Quartely For Exercise And Sport Volume 67 Pp-448-451.

[32]. Willams P. E., (1994), Use Of Intermittent Stretch In The Prevention Of Serial Sarcomere Loss In Immobilized Muscle. Journal Of Strength And Conditioning Research Volume 49 Pp-316-317.

[33]. Mcnair P.J. And Stanley S.N., (1996), Effect Of Passive Stretching And Jogging On The Series Elastic Muscle Stiffness And Range Of Motion Of The Ankle Joint. Journal Of Sports Medicine, Volume 30 Pp-313-318.