

Combined Effect of PNF Stretching and Plyometric Exercises on Explosive Power and Flexibility among Football Players

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Abstract

The aim of this study was to find out the combined effect of PNF stretching and plyometric exercises on explosive power and flexibility among football players. 80 inter collegiate level football players in the age group of 19 to 23 were randomly selected as subjects for this study. The subjects were randomly divided into four groups, experimental group I- high intensity plyometric training group, experimental group II- combined group, experimental group III- PNF stretching and control group-IV consisting of 20 subjects in each group. The subjects were measured of their explosive strength using vertical jump test, flexibility using sit and reach test, which formed initial scores. After the experimental period of 12 weeks on the respective training, all the subjects were measured of their explosive power and flexibility which formed post test scores. The results proved that high intensity plyometric training improved vertical jump highest (4.05 cm), followed by combined group (3.95 cm) and then PNF stretching (3.00 cm). In flexibility, the combined group was found to improve flexibility most (2.80 cm), followed by PNF stretching (2.55 cm) and then high intensity plyometric training (2.20cm). These differences were not significant at any level between the three treatment groups. However, compared to control group, all the three groups significantly improved vertical jumping ability and flexibility of the football players. It was concluded that both PNF stretching and high intensity plyometric exercises can be used to improve vertical jumping ability and flexibility of the football players. And further researchers of required to find out the effect of combination of different exercises for the benefit of vertical jump and flexibility.

KEYWORDS: PNF Stretching, Plyometrics, Combined Exercises, Explosive Power, Flexibility.

INTRODUCTION

Sports is an institutionalized competitive activity that involves physical exertion or the use of relative complex physical skills by individuals whose participation is motivated by a combination of the intrinsic satisfaction associated with the activity itself and the external rewards earned through participation. (Anaheim, 1987) Sports training is a planned, systematic and scientific process of preparation of sports persons for high performances. The process of scientific observation, experimentation, analysis and synthesis is an important characteristic of sports training in modern age. Sports training, therefore, are a continuous process of perfection, improvement and creation of means and methods of improving sports performance and factors of performance (Uppal, A.K., 2001).

Proprioceptive Neuromuscular Facilitation (PNF) stretching techniques are commonly used in the athletic and clinical environments to enhance both active and

passive range of motion (ROM) with a view to optimizing motor performance and rehabilitation. PNF recognizes that all physical conditioning depends primarily on neuromuscular processes involving sensitive receptors (proprioceptors) in the muscles, tendons and joints which enable a person to stabilise and move the body and its parts in space and time. Appropriate recruitment of the various stretch reflexes of the body, therefore, forms a vital part of PNF conditioning. The contemporary view proposes that PNF stretching influences the point at which stretch is perceived or tolerated. The sudden "vulnerability" of the muscle and its increased range of motion by using the period of time immediately following the isometric contraction to train the stretch receptors were to get used to this new, increased, range of muscle length. This is what the final passive (or in some cases, dynamic) stretch accomplishes. (Otto, J.M.J., 2005) The mechanism(s) underpinning the change in stretch perception or tolerance are not known, although pain modulation has been suggested (Westerterp,1999)

Plyometric is based upon the belief that a rapid lengthening of muscles just prior to the contraction will result in much stronger contraction. The added contraction strength is believed to be due to strength of muscle spindles involving the reflex and resulting in an increase frequency of motor unit discharge. Depth jump is one of the many plyometric exercises. In depth jumping, the athlete stands on a shelf generally 2 mtr of height above the ground stepping of the self they immediately perform a maximum effort vertical or horizontal jump after consing on the ground Plyometric training is one of the best methods of developing explosive power in sports. Basically plyometrics provide a method of training for the optimum relationship between strength and speed which will ultimately manifest in self as explosive power. (Chu, Donald (1998)

Football is a sport that requires a multitude of athletic abilities, such as explosive acceleration and fast sprinting speed; muscular endurance and strength in the lower body; muscular balance and high levels of neuromuscular co-ordination, body awareness and agility, the ability to know where the body is, and be able to move it; good flexibility to avoid injury and correct balance between the quadriceps and hamstrings, as well as strength imbalances between the left and right leg. Thus, every footballer is interested to improve their motor abilities, strength, endurance, speed, flexibility and coordination. The resulted effects influences the skills performed by the football players. Many athletic trainers employ proprioceptive neuromuscular facilitation (PNF) exercises method and utilize its immediate assistance in enhancing flexibility. (Otto, J.M.J, 2005). Plyometric training is an another mode of effective training methods that contributes for vertical jumping ability, sprinting ability and lower body power which are required for efficient performance of football skills. This research is aimed at finding out which of the training method is better than the other one and to find out the effect of combination of PNF and HIP on vertical jumping ability and flexibility among college level football players.

METHODOLOGY

80 inter collegiate level football players in the age group of 19 to 23 were randomly selected as subjects for this study. The subjects were randomly divided into four selected into four groups, experimental group I, experimental group II, experimental group III and control group consisting of 20 in each. The subjects were measured of their

explosive strength using vertical jump test, flexibility using sit and reach test, which formed initial scores. After the experimental period of 12 weeks on the respective training, all the subjects were measured of their explosive power and flexibility which formed post test scores. To test statistical significance ANCOVA was used.

RESULTS

Tab I: Descriptive Statistics Showing the Mean, Standard Deviation, Adjusted Means and Mean Difference between Pre and Post Test Scores due to PNF, HIP and Combined Training

VERTICAL JUMP								
	PNF Trg Group		High Intensity Plyometrics Group		Combined Training Group		Control Group	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ
Pre Test Mean (A)	49.65	5.23	47.90	8.43	50.65	5.21	51.3	5.53
Post Test Mean (B)	52.65	6.10	51.95	6.64	54.60	5.07	49.9	5.41
Adjusted Post Test Mean	52.85		53.69		53.92		48.6	
Mean Diff (A-B)	3.00		4.05		3.95		-1.40	
FLEXIBILITY								
	PNF Trg Group		High Intensity Plyometrics Group		Combined Training Group		Control Group	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ
Pre Test Mean (A)	17.90	3.91	16.90	2.69	16.15	3.83	16.9	4.81
Post Test Mean (B)	19.55	4.06	19.10	2.71	18.95	3.46	17.1	5.06
Adjusted Post Test Mean	19.30		18.95		19.50		16.9	
Mean Diff (A-B)	2.55		2.20		2.80		0.20	

The results presented in Table I proved that there were mean differences due to PNF stretching, high intensity plyometric training and combination of both PNF and plyometric training on vertical jumping ability and flexibility among football players. The results on statistical significance is presented in Table II.

Table II: ANCOVA Results on Vertical Jump and Flexibility due to PNF Stretching, High Intensity Plyometreic Training and Combined Training

VERTICAL JUMP				
Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Between	131.65	3	43.88	1.06
Within	3155.10	76	41.51	
Between	225.85	3	75.28	2.21
Within	2590.10	76	34.08	
Between	358.37	3	119.46	62.35*
Within	143.69	75	1.92	
FLEXIBILITY				
Between	9.34	3	3.11	0.21
Within	1146.15	76	15.08	
Between	70.05	3	23.35	1.52
Within	1165.50	76	15.34	
Between	82.58	3	27.53	12.91*
Within	159.95	75	2.13	

Required $F_{(0.05), (df 3,116)} = 2.73$; Required $F_{(0.05), (df 3,115)} = 2.73$

* Significant at 0.05 level of confidence

Since significant F values were obtained on adjusted means, the results were subjected to Post hoc analysis using Scheffe's post hoc interval test and results presented in Table III.

Table III: Multiple paired adjusted mean comparisons among PNF Stretching, High Intensity Plyometric, Combined and Control Groups.

VERTICAL JUMP					
PNF Stretching Group	High Intensity Plyometric Training Group	Combined Training Group	Control Group	MEAN DIFF	C.I
52.85	53.69			0.84	1.25
52.85		53.92		1.07	1.25
52.85			48.65	4.20*	1.25
	53.69	53.92		0.23	1.25
	53.69		48.65	5.04*	1.25
		53.92	48.65	5.27*	1.25
FLEXIBILITY					

19.30	18.95			0.36	1.32
19.30		19.50		0.20	1.32
19.30			16.95	2.36*	1.32
	18.95	19.50		0.55	1.32
	18.95		16.95	2.00*	1.32
		19.50	16.95	2.55*	1.32
19.30	18.95			0.36	1.32

* Significant

DISCUSSIONS

The results presented in Table I proved that high intensity plyometric training improved vertical jump highest (4.05 cm), followed by combined group (3.95 cm) and then PNF stretching (3.00 cm). In flexibility, the combined group was found to improve flexibility most (2.80 cm), followed by PNF stretching (2.55 cm) and then high intensity plyometric training (2.20cm). The ANCOVA results Table II and post hoc results proved that these differences were not significant at any level between the three treatment groups. However, compared to control group, all the three groups significantly improved vertical jumping ability and flexibility of the football players. The findings of this study are in agreement with the findings of de Villarreal, et. al., (2009) who found that subjects with more experience in sport obtained greater enhancements in VJH performance ($p < 0.01$) and the findings of Thomas (2009) who found both depth jumps and counter movement jump plyometrics are worthwhile training activities for improving power and agility in youth soccer players. The findings were further in agreement with Cervantes SJ, and Snyder AR. (2011) who found effectiveness of different types of PNF stretching warm-up on college athlete performance measures such as vertical jump, agility, and sport-specific activities and Caplan, et. al., (2009) who found PNF training improved hip flexion (HF) RoM and running mechanics during high-velocity running

CONCLUSIONS

It was concluded that both PNF stretching and high intensity plyometric exercises can be used to improve vertical jumping ability and flexibility of the football players. And further researcher is required to find out the effect of combination of different exercises for the benefit of vertical jump and flexibility.

REFERENCES

- David Anaheim, D. (1987) **Essential of Athletic Training**. Saint Louis: Mosby College Publishing..
- Uppal, A.K. (2001) **Principles of Sports Training**. New Delhi: Friends Publications India.
- Jakicic Otto, J.M. (2005) "Re-examination of the Possible Role of Golgi Tendon Organ and Muscle Spindle Reflexes in Proprioceptive Neuromuscular Facilitation Muscle Stretching." **American Journal of Clinical Nutrition** 82.

- Westertep, K.P. (1999)“Proprioceptive Neuromuscular Facilitation Stretching Mechanisms and Clinical Implication.” **International Journal of Obesity Relative Metabolism disorder** 23
- Chu, Donald (1998). **Jumping into plyometrics** (2nd ed. ed.). Champaign, IL: Human Kinetics. pp. 1–4
- de Villarreal, E.S. et. al. “Determining Variables of Plyometric Training for Improving Vertical Jump Height Performance: A Meta-Analysis.” **Journal of Strength Conditioning Research** 23(2).
- Thomas, K. French, D. and Hayes, P.R. (2009) “The Effect of Two Plyometric Training Techniques on Muscular Power and Agility in Youth Soccer Players.” **Journal of Strength Conditioning Research** 23(1).
- Cervantes SJ, and Snyder AR. (2011), “The effectiveness of a dynamic warm-up in improving performance in college athletes.”, **J Sport Rehabil.** Nov;20(4):487-93
- Caplan,N. et. al. (2009), “The Effect of Proprioceptive Neuromuscular Facilitation and Static Stretch Training on Running Mechanics” **Journal of Strength Conditioning Research** 23(4), 1175-80.