

Comparing Two Different Methods of Stretching on Improvement Range of Motion and Muscular Strength Rates

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Abstract: This study compared between the effect of two methods of stretching (static and PNF stretching) on a range of motion and muscle strength between juniors and seniors volleyball, basket ball and swimming players. The study sample contained 72 players divided into 4 experimental groups, 44 juniors (age 11 to 13 years) and 28 senior (age 20 to 33). Muscle stretching was measured by using the linear units (centimeter) while muscles strength used the 10 RM. The different two stretching programs were performed in four groups for 12 weeks in three days per week. The PNF technique was stretch-relax-contract. Stretching intensity was 100% from the full range of motion. Results suggested higher rates of improvement for PNF method range of motions. Higher rates of improvement were achieved for range of motion and strength testes for juniors more than seniors.

Key words: Stretching % Proprioceptive Neuromuscular Facilitation (PNF) % Static stretching % Strength training

INTRODUCTION

Muscular stretching has a great importance in preventing injuries and developing skills and physical abilities, in addition to speed of recovery, removing the muscular pain and improving the range of motion of different body joints to reach the player's distinguished performance in many skills and motor abilities [1, 2]. Moreover the narrow range of motion leads to difficult and slow performance of motor skills that may represent a decrease in the performance level in the competition and hinders the smooth performance of the movement [3, 4]. Many references indicated to the existence of many muscular stretching methods, such as dynamic stretching (Ballistic), static stretching and stretching by the Proprioceptive Neuromuscular Facilitation (PNF) [5, 6].

The Dynamic stretching are conducted using rhythmic movements, ballistic jumping and swinging, defected by not allowing enough time to the tissues to adapt to stretching and leads to occurring of the involuntary reflected action of stretching but with less monotonous than other stretching methods. Concerning the static stretching, its exercises are related to the position which the joint can reach within its range of motion with consistency in this position and the slow

rhythm of stretching training, where the static stretching consists of combination of several forms (negative, positive and with assistance). The negative static stretching is conducted under the influence of the coach or colleague where the joint is moved to the required range of motion by the act of external force and in this kind of performance the positive static stretching depends on the muscular work without assistance and the joints often reaches lesser extent than the static stretching. The positive negative static stretching depends on external force only in the beginning of the movement and then the athlete starts attempting to fix the joint's limb in the reached position by the static contraction for several seconds, while the positive negative static stretching with assistance is conducted through a positive action where the athlete tries to reach the maximum degree of the joint movement freedom degrees and then the coach begins to assist the moving limb to achieve a greater range of motion, this method assists the motivated muscle and achieves the highest degrees of coordination between the working muscle groups on a certain joint [7-9].

The PNF method aims to take advantage of the reflected neural actions to achieve the muscular relaxation, so muscles could be stretched under the best possible

conditions. This method is considered of the best stretching methods as it increases the positive flexibility and helps to build a base for the motor coordination; moreover it uses several neurophysiology mechanisms such as reciprocal nervous influence and the inverse myotatic reflex muscular relaxation [10, 11]. This type of exercise has several methods, the contract-relax-stretch (CRS) is the most common method. The sensory receptors plays a crucial role in the contraction and muscular stretching where many studies indicated the sensitivity of the Golgi tendon organs (GT) when performing each of stretching and muscular contraction, when muscles statically contracts leads to the reveal of inverse actions help relaxing these organs. Alter [9] explained this phenomenon as the static contraction along with the accompanied increase in the muscle spindle response to stretching reduces the nervous flashes inflow rate of these receptors thus increasing the joint's range of motion through reducing the resistance to stretching, in addition the receptors works to curb the antagonistic muscles (concerned to strength) when the motivated muscles starts to statically contract therefore reduces its tension, meaning that the inflow nervous signals of the motivated muscles are accompanied by an increase in these muscles tension and in the same time reduce in the tension of the antagonistic muscles.

The research problem revealed through the researchers' observing to the lack of interest of many coaches and players in different sports activities of exercises and stretching development programs according to their priorities, usually stretching exercises are misplaced and used with insufficient doses among the warm up section in any training unit, using different programs and methods of muscular strength without effective determination and awareness of every method that commensurate with the specialized activity and using the same method of strength exercises of different age stages without considering the age. That made the researchers eager to conduct this experiment, which aims to design two muscular stretching programs one by using the method of PNF and the other by using the method of static stretching and its types (negative, positive and with assistance) for the two stages of juniors under 14 years and first degree players in different sports activities (Volleyball, Basketball and Swimming) to identify the effect of both the muscular stretching program by using the PNF and the muscular stretching program by using the static stretching on the improvement rates in the range of motion and muscular strength for the selected age stages and sports activities.

MATERIALS AND METHODS

The researchers used the experimental method with a four experimental groups design, with the pre and post measurements for each. The research sample of 72 players was deliberately selected, where the first and second experimental groups included 44 junior aged between 11-13 years old in the volleyball, basketball and swimming activities, while the third and fourth experimental groups included 28 players aged between 20-33 years old in the volleyball and basketball activities. The first and second groups used the PNF method while the third and fourth groups used the static stretching method.

The pre-measurements of the research were conducted on Saturday, June 3rd, 2006 while the post-measurements took place on Sunday, September 3rd, 2006. Both measurements included two main measurements muscular stretching and muscular strength. The muscular stretching was measured by using the linear units (centimeter) of the front and back legs, chest, shoulders and trunk, while the maximum repeated weight for 10 repetitions (10RM) was used in measuring the muscular strength of the front and back legs muscles, chest, shoulders, front and back arms, abdomen and back. This type of measurement suits both men and juniors as to avoid exposing juniors to the maximum intensity when measuring the muscular strength [12].

The stretching exercises were used before, during and at the end of the daily training unit all week long, while the muscular stretching program was implemented in order to increase the motor range in daily separated training units after the daily training unit. The muscular stretching program of the four groups was implemented for 12 weeks as five weeks of the main preparation period, four weeks to the specific preparation period and three weeks for the pre-competition period, by the rate of 3 weekly training units with a total of 36 training units during the training program applying period [9]. The muscular stretching training program variables differentiate than designing the other physical abilities training program variables in intensity and volume of the training load, where the maximum stretching (intensity), which in some references is called the maximum range of motion is developed. The pre-measurement of the muscular stretching is the first stage in developing and muscular stretching therefore the training intensity of stretching is 100% of the joints Full Rang of Motion (FROM) throughout the training program.

Following up measurement has been conducted at the end of both the main preparation and specific preparation periods to modify the intensity of stretch training in the preparation and pre-competition periods, so that training and development of stretching in the full range of motion is maintained, the duration of stretching exercise is 10 seconds in the PNF program, while it lasted for 30 seconds in the static stretching program, with three sets of each exercise performed and this so-called training volume of the muscular stretching. The interval rests ranged from 10 seconds between groups for the PNF program while it reached 30 seconds to static stretching program and the number of the performed exercises ranged from 10 to 15 exercises in the single training unit for developing the range of motion [2, 13, 14].

The PNF program was applied for the first and third experimental groups using only one method of PNF, contract - relax - stretch (CRS), which is considered one of the best PNF methods in developing the joint's range of motion [15, 16]. The static stretching program of both the second and fourth experimental groups was applied using a combination of static stretching types (positive stretching then negative stretching and finally stretching with assistance) during the season different periods, where the positive stretching was used during the first preparation period while negative stretching was used during the specific preparation period. In addition to

using stretching with assistance during the pre-competition period, the training intensity of the static stretching was 100% of the joint's full range of motion throughout the training program. While the exercise duration was 30 seconds in three sets for a number of exercises ranging from 10 to 15 exercises with an interval rest period of 30 seconds between sets. The training unit of developing the range of motion lasts for sixty minutes [4, 17-19].

RESULTS AND DISCUSSION

Figure 1 illustrates that the improvement rates in the variables of range of motion of the PNF group ranged between 19.69% and 308.6%, while it was between 6.72% and 168.48% in favor of the static stretching group.

Figure 2 illustrates that the improvement rates in the variables of muscular strength of the PNF group ranged between 80.95% and 180%, while was between 55.10% and 122.22% in favor of the static stretching group.

Figure 3 illustrates that the improvement rates in the variables of range of motion of the PNF group ranged between 21.80% and 185.19%, while was between 7.59% and 71.87% in favor of the static stretching group.

Figure 4 illustrates that the improvement rates in the variables of muscular strength of the PNF group ranged between 45.11% and 94.29%, while was between 50.55% and 115.38% in favor of the static stretching group.

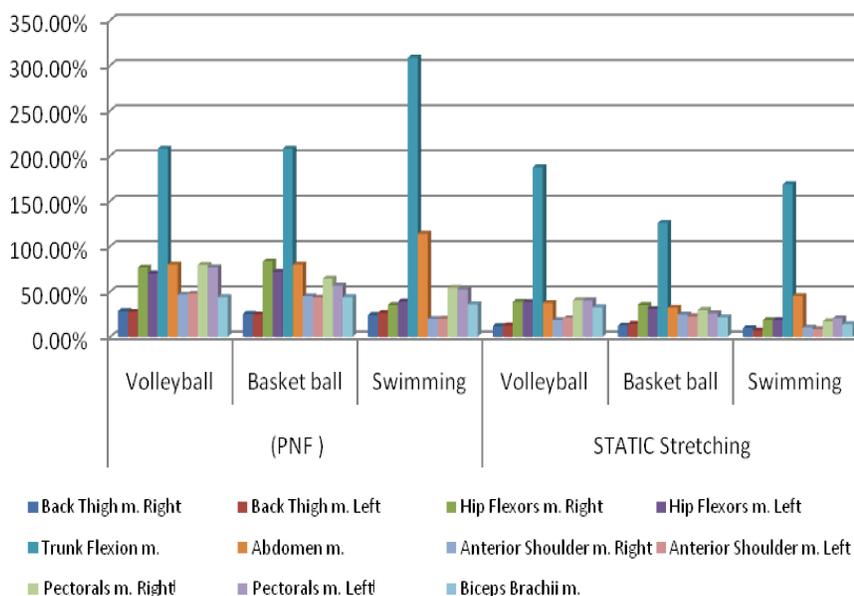


Fig. 1: The improvement rates between pre and post measurements of both PNF stretching groups and the static stretching of junior volleyball, basketball and swimming players in the range of motion variable

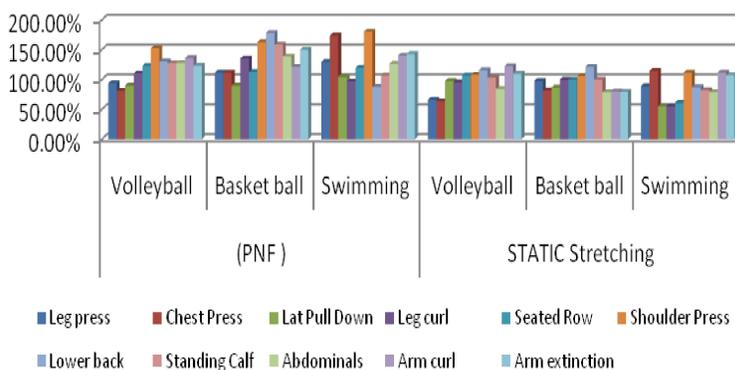


Fig. 2: The improvement rates between pre and post measurements of both PNF stretching groups and the static stretching of junior volleyball, basketball and swimming players in the muscular strength variable

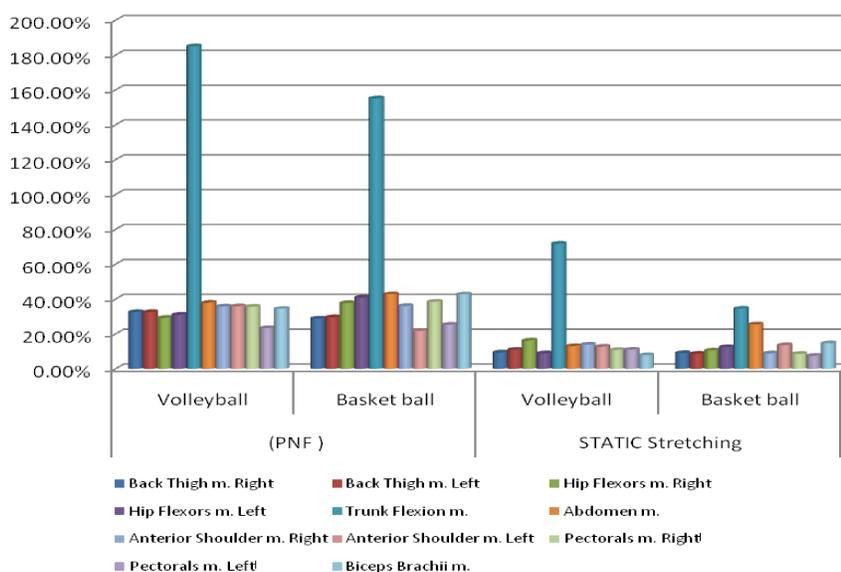


Fig. 3: The improvement rates between both post-measurements of PNF stretching groups and the static stretching of senior volleyball, basketball and swimming players in the range of motion variable

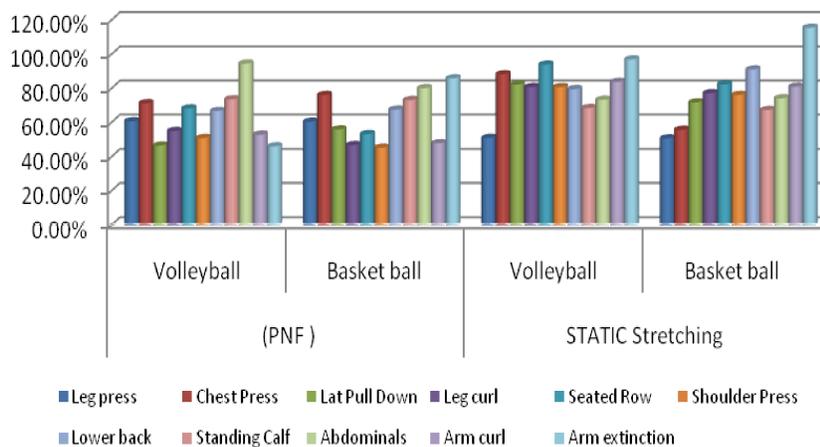


Fig. 4: The improvement rates between both post-measurements of PNF stretching groups and the static stretching of senior volleyball, basketball and swimming players in the muscular strength variable

Figures 1 and 2 illustrate that the improvement rate in the range of motion indicates the positive impact of both stretching programs. Moreover, it indicates surpass of the PNF method on the static stretching method in the improvement rate in the range of motion. The researchers refer this surpass to the method of contraction - relaxation - stretching (CRS) used in performing the PNF exercises where static contraction is performed followed by muscle relaxation and thus isolating the effect of the sensory receptors (muscle spindles and of the Golgi tendon organs) that lead to reducing the joint's range of motion which increases the range of motion [8]. PNF method aims to take advantage of the inverse nervous actions to achieve the muscular relaxation, so that muscles can be stretched under the best possible conditions. This method is of the best methods of stretching, as it increases positive flexibility, helps building a base for motor coordination; moreover it uses several neurophysiology mechanisms such as reciprocal nervous influence and the inverse myotatic reflex [9, 18]. This finding corresponds with the findings of Funk *et al.* [20] that the existence has a positive impact for both methods PNF and static stretching on the range of motion variable, as well as achieving an improvement rate of PNF method surpasses static stretching improvement rate in the range of motion.

The results indicated that the improvement rates in the junior's range of motion variables ranged between 6.72% and 308.6%, while the improvement rates in senior's range of motion ranged between 7.59% and 185.19%, this indicates the surpass of the junior's two sets (PNF and Static) than both senior's sets (PNF and Static). This surpass is explained as the junior's in this age stage under 14 years old are not yet completely grown up in terms of anatomy, in addition to the absence of high level of muscular strength and magnitude that hinders the improvement of range of motion, as well as they are characterized with high flexibility and when subjected to flexibility developing programs based on scientific fundamentals, flexibility increases in high rates due to the nature of the joints, connective tissues, muscles and tendons structural genesis and to the fact that the age stage of 9-12 years are a sensitive stage for flexibility training where the maximum level of flexibility can be achieved in this period and as age increases the range of motion are lesser according to the chemical and structural changes of in the connective tissues, muscles and tendons [8, 21].

The results also revealed that the improvement rate of strength indicates the positive impact of both programs PNF and static stretching to the muscular strength variable. The results also indicates the surpass of PNF method than the static stretching method in the muscular strength improvement rate, this surpass is attributed to the method of contraction, relaxation and stretching (CRS) used in performing PNF exercises which includes a static muscular contraction stage of the main motivating muscles against resistance that improves the muscular strength of these muscles and the PNF method works to increase the range of motion in the joint thus increasing the muscular strength caused by the muscular contraction where the scientific researches confirmed that the strength resulting from the working muscles contraction on a certain joint increases as flexibility increase [4, 8, 15, 22, 23].

The improvement rate in the muscular strength indicates the positive impact of both stretching methods on the muscular strength variable; static stretching method surpasses PNF method in the improvement rate in the muscular strength. The players used the static stretching method surpass those who used PNF method in the muscular strength. This can be explained that exercises depending on inverse nervous reflex may have obvious impact in affecting juniors than seniors, where these receptor's response ability could be developed in the early age stages leading to elevating the stimulation threshold for juniors than seniors as aging may affect the responses levels. Many scientific researches indicated that along with aging, essential changes in the biophysical occur in the collagen mechanical work in any connective tissue, the most important changes is the decrease of the minimum limit of the ability to stretch under the impact of any tension and therefore increases the reduction of movement with the increase of strength, it is also believed that aging increases the appearance of some extra bonds linking collagen cells nucleuses thus leading to greater coherence among them and thus resisting tension, leading to increase strength [3, 8, 16, 24].

The juniors two groups (PNF and static) surpasses the seniors two groups (PNF and static) in the strength improvement rates due to the juniors at the age stage under 14 years old are not subjected enough to the muscular strength programs compared to seniors, therefore when they are subjected to a regular strength program, a mutation in the strength improvement rate

occurs due to the non-saturation of junior's body muscles muscular strength, thus their muscular strength improvement rates will be greater than seniors, on the contrary, seniors may often reach the strength plateau, thus their muscular strength improvement rates are less than the juniors [2, 13, 21]. The results also indicated surpass of basketball players over the volleyball players and finally come swimming players in the range of motion variables improvement rates of the PNF group. Surpass of basketball players than the volleyball players and finally swimming players in the range of motion variables improvement rates of the static stretching group indicates that the PNF method surpasses the static stretching method in the improvement rate of all selected sports. The surpass of basketball and volleyball players than swimming players in the range of motion variables improvement rates is due to the different performance nature, as team games includes many skills and changing situations in the presence of an opponent, which requires performing many twisting, turning, running, jumping, taking off, changing direction and falling movements, this would indirectly lead to increase the different joints flexibility and improve its range of motion. This differs from the nature of performance in swimming as one of the sports with repetitive unique movements of a static technique, thus the involved joints in the performance may not reach its limits therefore indirect development may not occur as a result of performance.

The swimming players surpass than the basketball players and finally volleyball players in the muscular strength variables improvement rates of the PNF group, moreover the swimming players surpass than the basketball players and finally volleyball players in the muscular strength variables improvement rates of the static stretching group, that also indicates the surpass of PNF method than the static stretching method in the muscular strength improvement of all selected sports. The surpass of the swimming players than basketball and volleyball players may be due to the performance nature of swimming against the aquatic media resistors, leading to the increase in the muscular strength improvement rates for the muscular groups involved in the performance, thus swimming players excelled than the basketball and volleyball players by the existence of another sort of resistors not available to them, where the aquatic media exercises increases the muscular strength [25]. The basketball players surpass the volleyball players in the muscular strength variables improvement rates due to the nature of basketball as a game along with the

existence of physical contacts between opponents that appears in many situations and depends with a great deal on the muscular strength, such as suitable positioning under the baskets, recovery of the combined balls, hassles for defense or offense positioning or rebounding, all of that leads to indirect improving in the muscular strength, which is not available in volleyball.

CONCLUSION

PNF method recorded higher improvement rates than the static stretching method in the range of motion variables of both stages, juniors under 14 years and first degree senior players. The improvement rates in the range of motion and muscular strength variables of juniors under 14 years were higher than the improvement rates in the range of motion and muscular strength variables of the first degree senior players. The PNF method recorded higher improvement rates than the static stretching method in the muscular strength variables of the juniors under 14 year's stage. The static stretching method recorded higher improvement rates than the PNF method in the muscular strength variables of the first degree senior players. Concerning the improvement rates in the range of motion variables, basketball players came first followed by the volleyball players and at last came the swimming players when using the PNF and the static stretching methods. As for the improvement rates in the muscular strength variables, the swimming players came first followed by the basketball players and then the volleyball players came last when using the PNF and the static stretching methods.

Recommendations:

- C The researchers recommend the importance of using PNF method in the stretching programs for both juniors and seniors.
- C Using the static stretching method in the men's muscular stretching programs. It is also preferred to develop the muscular stretching programs in association with muscular strength programs within the physical preparation programs for various sports activities.
- C Using the scientific fundamentals where the PNF and static stretching programs were established, as well as conducting other research to other samples differ in age, gender, number and the practiced physical activity.

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