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The Effect of Two Different Stretching Programs on Some Physical Variables of Taekwondo Female Players

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Abstract:
The research aims to Design a muscular stretching program using the static stretching method and the Proprioceptive Neuromuscular Facilitation (PNF) for Taekwondo female juniors. Identify differences between the effect of each of the static stretching and (PNF) on the improvement rates in the range of motion and some physical skills variables in Taekwondo. The researcher used the experimental method by designing two experimental groups with pre and post measurements each. The Sample consisted of Taekwondo female juniors players. The PNF method gave higher improvement rates than the static stretching method in the range of motion variables and gave higher improvement rates than the static stretching method in the specific physical variables of the Taekwondo female players. Recommendations: The importance of using the PNF stretching method in the muscular stretching programs for Taekwondo female players in different age stages.

Introduction and problem of the research:

Taekwondo depends on legs kicks when performing kicks and strikes that depend on contracting thighs joints or increasing their extension during performing any of their kills indicating the importance of the thighs joints motor range through the full elasticity of the working muscles within the joint's full range of motion. That appears when performing the circular back kick, there must be flexibility at the backbone so the movement performed in a suitable manner, as well as performing the kick from top to bottom (Nara Chagi) which requires elasticity of the thigh's back muscle and other skills that require high degree of flexibility of the pelvis and thigh. (17: 185)

Muscular stretching has considerable importance in preventing injuries and developing skills and physical abilities, in addition to the rapid recovery. Narrow-range of motion in the joint leads to impede the level of revealing power, speed and coordination of sportsmen, also lead to the low level of neuro-coordination between muscle fibers within the muscle that lead to a decrease in the economical performance. Moreover, it is often a cause for muscles and ligaments injury. (1:97) (8:23) (19:34-39)

Taekwondo coaches and players mostly tend to use the motor stretching and the static stretching methods, where the motor stretching uses rhythmic movements, regressive jumps, and swinging. Its defective is not allowing sufficient time for tissues to adapt to stretching leading to the occurrence of involuntary reflected action of stretching but it is less monotonous than other methods of stretching.(8:28), (15:185)

Concerning the static stretching, its exercises are associated with the posture that the joint reaches during the range of motion along with the stability of the joint in this posture and the slow rhythm of the stretching exercise. (4:260-262)

Michael J. Alter (2006) refers that the stretching method by the Proprioceptive Neuromuscular Facilitation (PNF) aims to benefit from the reflected nervous acts to achieve the muscular relaxation, so that the muscles stretched under the best possible conditions. This method considered one of the best stretching methods as it increases the positive flexibility and help building basis for motor coordination. Moreover, it also uses several neuro-physiological mechanisms such as mutual reciprocal innervations and the inverse mitotic

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reflex. This method requires more information and high technical awareness by the coach to avoid injuries risks.

This type of exercises has several methods, while the most spread method is the contract-relax-stretch method (CRS). The nervous receptors plays a crucial role in the muscular contraction and stretching, where many studies referred to the Golgi tendon (GT) members sensitivity when performing both of the muscular contraction and stretching. When the muscle contracts a static contract, this contraction creates inverse acts that will help relaxing these members. Michael j. Alter (2006) explains this phenomenon that static contraction accompanied by the increase in the muscle spindles response for stretching, reduces the rate of nervous scintillation incoming to these receptors, thus increases the joint's range of motion by reducing the resistance to stretching. In addition, when the moving muscles works in the static contraction, the receptors works to curb the inverse muscles (responsible of stretching), thus reducing its tension; meaning that the incoming nervous signals to the moving muscles accompanied by an increase in its tension and at the same time reduces the inverse muscles tensions.(14:186-190)

The research problem revealed through noting the Taekwondo coaches and players lack of interest to the flexibility exercises and its developing programs to commensurate with its importance, where Taekwondo highly depends on legs in performing, as usually flexibility exercises are not used in its place by inadequate doses within the warming up part in the training unit. By reviewing literatures, it has noted the rare existence of researches comparing between the effects of different stretching methods on the range of motion of the Taekwondo female players. That provoked the researcher to conduct this experiment, which aims to design two muscular stretching programs one uses the static stretching and the other uses the Proprioceptive Neuromuscular Facilitation (PNF), and identifying the effect of both the static stretching and the Proprioceptive Neuromuscular Facilitation (PNF) on motor range improvement rates and some skills abilities of Taekwondo female players.

The importance of research:

The importance of this research returns to determining the variables of two muscular stretching training programs and determining the suitable stretching method that will give greater improvement rates in the range of motion of Taekwondo female players and help promoting performance of some Taekwondo skills.

Aims of the research: the research aims to:

1. Design a muscular stretching program using the static stretching method with its types (passive – positive) for Taekwondo female juniors.
2. Design a muscular stretching program using the Proprioceptive Neuromuscular Facilitation (PNF) for Taekwondo female juniors.
3. Identify differences between the effect of each of the static stretching and (PNF) on the improvement rates in the range of motion and some physical and skills variables in Taekwondo (Momtong Trigi, Arae Mäkki, and Ap chagi).

Hypothesis of the research:

1. There are statistical significant differences between the pre and post measurements in favor of the post-measurement for each of the static stretching and the Proprioceptive Neuromuscular Facilitation (PNF) groups in the range of motion measurements and some physical and skills measurements.
2. There are statistical significant differences between both post measurements in favor of the post-measurement for the Proprioceptive Neuromuscular Facilitation (PNF) group in the range of motion measurements and some physical and skills measurements.
3. There are differences between the static stretching and the Proprioceptive Neuromuscular Facilitation (PNF) groups in the improvement rates in favor of the Proprioceptive Neuromuscular Facilitation (PNF) in the range of motion measurements and some physical and skills measurements.

Hypothesis of the research:

The research method:

The researcher used the experimental method by designing two experimental groups with pre and post measurements each.

Sample of the research:
The sample of the research of Taekwondo female juniors purposively selected from El-Tawfikia club and 6 October club, included (20) players has been divided into two experimental groups.
Table (1) illustrates the distribution of the sample of the research.

Table (1)
The research sample distribution

Category	Experimental group	Age	Club	Number	Stretching method
Juniors	First	17-18	El-Tawfikia	20	PNF
	Second		6 October		Static

Measurements of the research:
The pre-measurement took place on Sunday 3 August 2008, while the post-measurement took place on Sunday 2 November 2008. Both contained two main measurements measuring the muscular stretching and the specific physical abilities, where measuring the muscular stretching conducted using the linear units (centimeters) of the front and back legs, chest, shoulders and trunk muscles and the specific physical abilities (explosive power and motor speed) by stopwatch.

The training program of muscular stretching:

Scientific principles taken into account when designing the stretching training program in terms of using the principles of the practical application of overload, gradient, adaptation, individual response to training, specificity of activity type and of each body joints. Each of Michael J. Alter (2006) and Sales D. (1991) indicated that muscular stretching are used at the very beginning of the training unit to warm up, and also can be used at the end of the training unit to relaxation. The researcher considered conducting the muscular stretching program in a separate training unit after the daily training unit with the aim of increasing the range of motion. The muscular stretching program of both groups conducted for eleven weeks as three training units per week with thirty-three training units in total during the period of applying the training program. (14:187) (16:97)
The muscular stretching training program variables are different from the variables of designing the training program of the other physical abilities, in the training intensity and load. The maximum stretching development (intensity) conducted -in some references called the maximum range of motion- as the pre-measurement of the muscular stretching is the first stage in developing and training muscular stretching. Accordingly, stretching intensity training 100% considered the full range of motion (FROM) during the entire training program. The duration of exercise was 10 seconds for PNF program, and 30 seconds to the static stretching program. Along with three groups to each exercise performed, this is so-called the training volume muscular stretching. The rest periods ranged from 10s between groups of PNF program and 30s for the static stretching program. The number of exercises ranged from 10 to 15 exercises in the training unit in order to develop the range of motion.
The PNF program of group applied on Sunday 10.8.2008 using only one of PNF methods, contract-relax-stretch (CRS). Both Michael J. Alter (2006) and Ferber et al. (2002) indicated that using contract-relax-stretch method (CRS) is one of the best PNF methods to develop the joint's range of motion. (14:186) (11:392)
The two stage method starts with the preliminary stage (positive stretching) where muscles are subjected to the influence of positive stretching for the maximum range of motion allowed by the player, followed by the basic stage (stretching with static resistance) from the colleague and the player. This stage divided into three gradual steps in the range of motion level, where the first step starts from the end of the preliminary stage, as follows:
1-a- From the posture reached at the preliminary stage, the player conducts a static muscular contraction (resistance) for 10 seconds without any change in the length of the muscle or any movement in the joint to confront the colleague's resistance and stabilization (static contract).

1-b- The player takes 10 seconds rest (muscular relaxation).
2-a- The player stretches the same muscular group to the level reached in (1-a), as increasing stretching starts by the colleague (passive stretching) and here starts the player's resistance to her colleague and keeps that good posture for 10 seconds.
2-b- The player takes 10 seconds rest (muscular relaxation).
3-a- The player stretches the same muscular group to the level reached in (2-a), as increasing stretching starts by the colleague (passive stretching) and here starts the player's resistance to her colleague and keeps that good posture for 10 seconds.
3-b- The player takes 10 seconds rest (muscular relaxation).
4- Starting from the new stretching posture, the muscle are statically contracted for 7-10 seconds again.
5- During the muscular relaxation stage following the static contraction, stretching increased again for 10 seconds by external force (the colleague), thus performance sequence will be contract-relax-stretch (CRS). (6:32) (8:31)

Table (2)
Stretching training program variables of Proprioceptive Neuromuscular Facilitation the (PNF) using the Contract-Relax-Stretch method (CRS)

Session period	Range of Motion (intensity)	Week	Training volume					Rest
			Duration (Seconds)	Repetitions (level)			Number of groups	
				First	Second	Third		
General Preparation	100% of Full Range of Motion	1	10	3	3	3	3	30s
		2	10	3	3	3	3	30s
		3	10	3	3	3	3	30s
		4	10	3	3	3	3	30s
Specific Preparation	100% of Full Range of Motion	5	10	3	3	3	3	30s
		6	10	3	3	3	3	30s
		7	10	3	3	3	3	30s
		8	10	3	3	3	3	30s
Pre-competition	100% of Full Range of Motion	9	10	3	3	3	3	30s
		10	10	3	3	3	3	30s
		11	10	3	3	3	3	30s

The static stretching program of the first group applied using a combination of the static stretching types (positive and passive stretching) during various periods of the season (general preparation, specific preparation, and before competition). The training intensity was stable as 100% of the full range of motion (FORM) during the entire training program. The duration of exercise was 30 seconds for three groups with 10 to 15 exercises in the training unit and intervals as resting periods of 30 seconds between groups. The training unit of developing the range of motion lasts for 60 minutes.

Table (3)
Static stretching training program variables (positive and passive stretching)

Session period	Stretching type	Range of Motion (intensity)	Week	Training volume			Rest
				Duration (Seconds)	Repetitions (level)	Number of groups	
General Preparation	Positive stretching	100% of Full Range of Motion	1	30	3	3	30s
			2	30	3	3	30s
			3	30	3	3	30s
			4	30	3	3	30s
Specific Preparation	Passive stretching	100% of Full Range of Motion	5	30	3	3	30s
			6	30	3	3	30s
			7	30	3	3	30s
			8	30	3	3	30s
Pre-competition	Positive stretching	100% of Full Range of Motion	9	30	3	3	30s
			10	30	3	3	30s
			11	30	3	3	30s

Presentation of the results:

Table (4)
Significant differences indications between both the research post-measurements in the physical and skills measurements. N1=N2=10

Test			Post-measurements of PNF		Post-measurements of the static stretching		Differences between two averages	"T" value
			AM	SD	AM	SD		
Thigh range of motion measurements	Back thigh	Right	102.5	4.378	95.900	3.342	7.00	5.573
		Left	102.9	3.871	95.100	4.280	7.800	4.761
	Back thigh	Right	17.00	2.211	25.800	4.516	8.800	5.486
		Left	16.900	3.381	26.400	5.081	9.500	8.423
Arms range of motion measurements	Arms back	Right	33.300	2.312	37.300	4.165	5.000	3,682
		Left	33.500	3.333	36.600	3.169	3.100	3.408
	Arms front	Right	23.800	2.347	34.00	5.249	10.200	4.747
		Left	21.900	2.378	26.900	3.446	5.100	4.437
	Both arms	Back	15.200	1.814	8.500	1.900	9.500	3.747
Trunk range of motion measurements	Sitting		4.600	1.264	7.400	1.264	2.800	4.332
	Lifting trunk	Upward	37.500	3.100	42,000	3.432	4.500	2.505
Explosive power	Mont Trigi	Right	12.400	1.265	15.800	1.873	3.400	4.295
		Left	10.400	1.955	16.000	3.197	5.60	6.078
	Ab chagi 10s	Right	11.100	2.378	15.800	1.932	4.700	7.870
		Left	11.300	2.945	15.100	2.183	3.800	2.988
Motor speed	Ari Mäki	Right	13.200	3.521	18.200	2.616	5.00	2.404
		Left	12.100	2.923	16.900	2.470	4.800	3.560
	Ab chagi 15s	Right	12.00	3.829	18.200	4.077	6.565	4.294
		Left	12.800	4.392	19.300	4.620	6,5	3.058

****The indexed "T" value at the significant level of 0.05 and freedom degree 18= 2.101***

Table (4) illustrates that there are statistical significant differences between the static stretching group and PNF group of CRS method in the post-measurements in all research variables in favor of the post-measurements of the PNF group of CRS method.

Table (5)
Improvement rates between both post-measurements for static stretching and the Proprioceptive Neuromuscular Facilitation (PNF) groups N=N=20

Test			Improvement rates of the post measurements of the static stretching	Improvement rates of the post measurements of PNF	Differences between the improvement rates
Thigh range of motion measurements	Back thigh	Right	9.268%	16.579%	7.312%
		Left	8.454%	16.508%	8.055%
	Back thigh	Right	14.117%	41.085%	26.968%
		Left	11.243%	39.393%	28.15%
Arms range of motion measurements	Arms back	Right	7.807%	18.231%	10.424%
		Left	7.761%	11.748%	3.987%
	Arms front	Right	11.344%	38.823%	27.479%
		Left	7.762%	17.472%	9.71%
	Both arms	Back	12.5%	94.117%	81.617%
Trunk range of motion measurements	Sitting		26,086%	43.243%	17.157%
	Lifting trunk	Upward	3.466%	12.619%	9.153%
Explosive power	Mont Trigi	Right	20.161%	40.667%	20.506%
		Left	21.153%	45.625%	24.472%
	Ab chagi 10s	Right	26.126%	44.937%	18.811%
		Left	1.769%	45.695%	43.926%
Motor speed	Ari Mäki	Right	15.909%	34.065%	18.156%
		Left	12.396%	30.769%	18.394%
	Ab chagi 15s	Right	21.666%	43.956%	22.29%
		Left	25.781%	49.740%	23.959%

Table (5) illustrates the improvement rates between both post-measurements of the static stretching group and PNF group.

The previous table illustrates that the improvement rates of the range of motion variables for the static stretching group reached (3.466%) as the least improvement rate in stretching lifting trunk muscles, while the highest improvement rate reached (26.086%) in sitting variable. Concerning the (PNF) group, the least improvement rate reached (11.748%) in the laying arms backward variable of the left arm, while the highest improvement rate reached (94.117%) in the both arms backward variable.

The changing rate of the specific physical abilities of the static stretching group reached (1.769%) as the lowest rate of improvement in the explosive power (Left Ab Chagi), while the highest improvement rate reached (26.126%) in the explosive power (right Ab Chagi). Concerning the PNF group the lowest improvement rate reached (30.769%) in the motor speed variable (left Ari Maki), while the highest improvement rate reached (49.740%) in the motor speed variable (left Ab Chagi).

Discussing the results:

Table (4) illustrates that there are statistical significant differences between the static stretching group and the PNF group in the post-measurements in all research variables in favor of the post-measurement of the PNF group of CRS method. The researcher returns that surpass due to the PNF exercises performance using the Contract-Relaxation-Stretching method (CRS), where the static contraction is followed by muscular relaxation, thus isolating the effect of the sensitive receptors (Muscle Spindles and members of golgi tendons) that lead to reduce resistance to stretching, though increasing the range of motion. Michael j. Alter (2006) explains the phenomenon that static contraction in the PNF accompanied by the increase in the muscle spindle response for stretching reduces the rate of nervous scintillation incoming to these receptors, thus increases the joint's range of motion by reducing the resistance to stretching. Moreover, Ferber et al. (2002) confirmed that using the contract-relax-stretch method (CRS) is one of the best PNF methods to develop the joint's range of

motion. Many researches indicated that PNF is the best stretching method and has several benefits in improving flexibility and the range of motion. The studies of Mohamed Ali Hassan (2006), Sohier El-Gendy (2008), Young W, and Elliott S (2001), confirmed that. Moreover, it is consistent with the study of Atef Rashad (2010), where PNF method gave higher improvement rates than the static stretching method in the range of motion variables (juniors under 14 years and first-class players) and the role of PNF have a great effect on reducing the differences between the range of motion. (14:186) (11:392) (7) (3) (20) (10)

Moreover, table (5) illustrates the improvement rates between both post-measurements of the static stretching group and PNF group. The researcher returns the existence of differences between the research two groups in favor of the PNF group, due to the improvement rate in the range of motion that indicates its surpass than the static stretching method in the improvement rate in the range of motion. That is consistent with Michael J. Alter (2006) where he referred that the stretching method by the Proprioceptive Neuromuscular Facilitation (PNF) aims to benefit from the reflected nervous acts to achieve the muscular relaxation, so that the muscles stretched under the best possible conditions. This method considered one of the best stretching methods as it increases the positive flexibility and help building basis for motor coordination. Moreover, it also uses several neuro-physiological mechanisms such as mutual reciprocal innervations and the inverse mitotic reflex. (14:189)

This is consistent with the findings of Funk et al. (2003) that both PNF and static stretching methods have positive effect on the range of motion variable. As well as achieving an improvement rate of PNF method surpasses the improvement rate of the static stretching methods in the range of motion improvement rate. (12)

The researcher believes that its better to use the sensitive receptors system which play a major role in muscle relaxation, thus increasing the joint's range of motion, where the researcher found that this result commensurate with the findings of Funk et al. (2003) that both PNF and static stretching methods have positive effect on the range of motion variable. Moreover, achieves an improvement rate of PNF method surpasses the improvement rate of the static stretching methods in the range of motion improvement rate. (12)

Using the static stretching program led to the increase in the improvement rates of the specific physical variables selected for the Taekwondo female players. The researcher returns this to it's the most used method by coaches and players in many sports, except for these exercises do not allow the practicing of the main moving muscles with a high degree of effectiveness, where narrow range of motion lead to difficulties and slow in performing the motor skills which may constitute a hinder to performance. It also hinders the movement's smooth performance, as the performance of many motor skills requires a high degree of flexibility in some body joints, and in case lack of flexibility in these joints the required movement cannot be perform in its full range of motion, and thus the sports skill level influenced. (8:116-120) (18:21-24)

The PNF group surpass in the improvement rates in the specific physical variables can be explained, as the nature of performance in Taekwondo includes many skills and changed attitudes, requiring the performance of different movements of kicks, blows, spinning, turning, jumping and changing direction, whereas most kicks depends on stretching and flexibility for performing in an effective feature. This requires increasing the joints flexibility and improving the range of motion. The exercises of PNF stretching program positively helped in increasing the range of motion, where these exercises develop the muscles and joints ligaments elasticity, leading to improve the physical and skills performance of the skills on topics. Moreover, increasing the range of motion led to relevance of simplicity, smooth and coordination in performance in the skills performance, it works to promote the agility level, therefore increases the motor speed. In addition, assists in developing the muscular power strength level due to the effective and positive effect of PNF program on the nervous mechanisms feeding the muscles in order to achieve the maximum contraction. (13:99-102) (2:262) (5)

Michael j. Alter (2006) indicates that flexibility cooperates with the rest of the physical elements

such as power, speed and coordination to reach the optimal performance. Moreover, confirmed by Atef Rashad (2010) where he indicates that the PNF method gave higher improvement rates than the static stretching method in muscular power variables of juniors under 14 years (15) (10), and Mohamed Ali Hassan (2006) indicated that the PNF methods role have a great effect in reducing the differences between passive and positive range of motion. (7)

Conclusions:

In light of this research, limits of the sample, and the suggested training programs, the researcher was able to reach the following:

1. The PNF method gave higher improvement rates than the static stretching method in the range of motion variables of the Taekwondo female players.
2. The PNF method gave higher improvement rates than the static stretching method in the specific physical variables of the Taekwondo female players.

Recommendations:

In light of the concluded results, and limits of the sample, the researcher recommends the following:

1. The importance of using the PNF stretching method in the muscular stretching programs for Taekwondo female players (juniors and youth) in different age stages
2. Including muscular stretching programs within the physical preparation programs of the different sports activities
3. The importance of using the scientific fundamentals which PNF method and static stretching established upon

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