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The effect of a training program using some methods of neuromuscular facilities and the digital level on the performance of backstroke swim players

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Abstract
The methods of neuromuscular facilities for the sensory receptors PNF are one of the modern training methods that have been used recently in developed countries. To examine the effect of PNF, 14 teenage swimmers (boys), aged from 14 – 16 years participated in the training program that included this type of stretching. 7 swimmers performed for six weeks, three times per week, two PNF exercises for muscles of the upper parts (shoulders with chest and triceps), the flexibility of the trunk, and monitoring strength of the upper body using medicine balls with total duration 90 minutes, while the other 7 swimmers were the control group (C) following only the swimming workout.
The test protocol was carried out and the post measurements were investigated after the 2nd, 4th and 6th weeks in the seasons 6, 12, and 18 for both PNF and C groups. The performance improved equally in both groups (PNF, C) and statistical analysis showed a significant effect of PNF on athletic performance. In conclusion,the use of the stretching (PNF) with flexibility and upper body strength exercises affect positively on the performance of backstroke swimmers of this study.
Keywords: *backstroke swimming, PNF, flexibility, upper body strength, digital level.*

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I. Introduction:

Sports training has witnessed large steps of progress in recent years, as efforts of specialists and those interested in this field have been multiplied in search of the best methods and training means for developing the physical and technical levels. The game of swimming has witnessed great development at the international level in recent times throughthe use of the best and most recent training methods that are based on scientific foundations. Therefore, the interest of trainers focuses on training these qualities and developing the level of training in the field.

The effect of PNF was studied on 23 swimmers (11 boys and 12 girls), aged 12-15 years, participated in a training program that included the extension of PNF. 11 swimmers (5 boys - 6 girls) performed for 8 weeks, 3times per week in addition to swimming training, six PNF exercises for the lower limbs with a total duration 10 minutes (PNF) while the other 12 swimmers (6 boys - 6 girls) (control group C) following only the swimming exercise. Results of this study showed that an eight-week swim training seems to help swimmers ages 12-15 improve their mobility and performance (Papadimitriou et al. 2017). Thus, thirteen young men were presented with three randomly selected experimental protocols as follows: (a) 50 m swimming front crawl test without the CTRL test; (b) static stretching (SS) (2 sets of 30 s); and (c) PNF (two sets of 30 s using the scientific stretching for sports method) for pectoral and quadriceps muscles (Costa E. Silva et al. 2014).

Mookerjee et al., 1995performed a few studies that show the effects of a warm-up combination in and out of water. These combinations are particularly related to kicking performance, with positive effects using the warm-up protocol with stretching and swimming content (Mookerjee et al. 1995).

The importance of using the sensory receptor action system is to take advantage of the reflexes resulting from the prolongation and the occurrence of the reflected actions that are done by both the muscular spindles and the tendon's Golgi members that respond to the response provided by muscle sensory receptors PNF.

Identifying the role of PNF exercises in developing the elasticity trait and its effect on technical performance and comparing it with the flexibility exercises used by many trainers in developing this trait. This research aims to prepare the exercises of the neuromuscular facilities PNF using the method of repeated contractility (RS) to develop flexibility and the technical performance of swimmers.

The development of the digital level and description of the optimal performance is the intended goal to be achieved. Coaches at the global level are making a lot of effort, time, and money in providing all the conditions available to serve that. In the recent period, general practitioners have been used in the field of sports training, in terms of neuromuscular interrogation of sensory receptors and their adoption in the development of physical fitness elements, where the importance of using sensory receptors to benefit from reactions resulting from prolongation (Candace et al. 2017).

Proprioceptive neuromuscular facilitation (PNF) and static stretching (SS) can be used to check the acute effect of two different stretching methods on strength performance in bench press exercise in a series (Souza et al. 2017)(Costa E. Silva et al. 2014). Thus, proving the effect of upper extremity PNF combined with elastic resistance bands on respiratory muscle strength: a randomized controlled trial (Areas et al. 2013). PNF stretching training program for 6-week of the lower leg muscle increases dorsiflexion range of motion (RoM) and affects the tendon structure by reducing stiffness, while the muscular structure and passive resistive torque (PRT) of the muscle and joint complex observed in this study unchanged (Konrad, Gad, and Tilp 2015).

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Investigation of the effect of mid-term on the different severity of PNF stretching on improving hamstring flexibility. Seventy-five male students between the ages of 18 and 26 years were selected randomly and divided into five groups: the first group was the control group, and the second, third, fourth, and fifth groups did the maximum consecutive muscle contractions in 20, 40, 60, and 80 ratios. Experimental groups participate in a 5-day (relaxation contract PNF) training. The results showed that there were significant differences between the experimental groups compared to the control group after CR PNF training, but no significant differences between the experimental groups in the flexibility range (Khodayari and Dehghani 2012).

Furthermore, determine the effect of two stretching training (static or PNF) on high-velocity running where eighteen league players were rated for maximum sprinting velocity. They were randomly divided into two stretch training groups: PNF and static. Each group trained 4 days a week for 5 weeks. Pre- and post-training subjects filmed during playback at 80% of top speed (Caplan et al. 2009).

The effect of PNF stretching on musculotendinous unit (MTU) stiffness of the ankle joint was examined where twenty active women were randomly distributed in an experimental group (n = 10) and a control group (n = 10). The experimental group performed PNF stretching on the ankle joint 3 times per week for 4 weeks, with physiological testing performed before and after the training period. After training, the experimental group significantly increased ankle range of motion (7.8%), maximal isometric strength (26%), rate of force development (25%), and MTU stiffness (8.4%) ($p <0.001$). Four weeks of PNF stretching contributed to an increase in MTU stiffness, which occurred concurrently with gains to ankle joint range of motion (Rees et al. 2007).

The important role of flexibility in athletic performance is going on to understand the effects of different types of expansion and determine the most appropriate to maximize performance. PNF expansion techniques are commonly used in sporty settings to improve engine performance for an increased range of motion. Besides, the benefits of PNF technologies can be obtained and preserved if implemented with accuracy and consistency (Kaya 2018).

The importance of this study emerges from the results that are useful in helping trainers to improve the education and training processes and the level of skill performance, providing important information that helps planners for swimming in building and preparing appropriate training programs and plans for players to achieve the best results. Alsoit is possible to obtain and maintain the benefits of PNF techniques if they are performed accurately and identifying to what extent it can consistentlybe applied.

II. Materials And Methods

Participants

The sample consisted of 14 healthy athletic swimmer's teenage boys aged (15 ± 1.4 years old, 57 ± 2.1 kg, 163 ± 0.7 cm, and 4.0 ±1.5 year training experience). Homogeneity, means, and standard deviations were performed for each sample for the descriptive characteristics of the participants in the variables of weight, length, and training age are presenting in Table 1. The participants were randomly assigned to a non-stretching control group (n=7) and do not record any stretching protocol just their swimming training and to a PNF stretching group (n=7) were making two PNF stretching exercises, before their swimming training in the water. All players and their parents' consent has been obtained after informing them of the purpose of the study and its potential risks before participating.

All tests were conducted at Namaa Sports Club and its pool in Gaza for both PNF and control groups after giving the specifications for how to conduct the tests and their sequence, where the researcher conducted the pretests specified in the research on Wednesday 16/10/2019 at four o'clock in the evening.

Table 1.The characteristics of the participants (x ± SD)

Items	Control group n=7	PNF group n=7
Length (cm)	160.2 ±2.2	161.2 ±1.3
Weight (kg)	54.2 ±3.5	54.8 ±3.0
Age (yr)	13.2 ±1.1	13.1 ±1.5
Training age (yr)	4.0 ±1.1	4.0 ±1.5
Pre 50 m backstroke swimming (s)	33.1 ±2.0	32.9 ±1.8

Experimental procedure

A pre and post-test study design were used to examine the purpose of this study. The program implemented over 6 weeks 3 training units per week on Saturday, Monday, and Wednesday, with approximately 90 minutes per training unit for a total of 18 training sessions. The two PNF exercises were performed from the stretching group, the first exercises for the shoulder and chest muscles, and the second exercise for the triceps muscle.

The exercises of the control group involved only normal long warming involved normal flexibility and swimming exercises involved the digital level. PNF exercises that were performed with short, simple and special warm-up before and used only the working muscles in backstroke swimming depends on the upper part muscles (arms, back, shoulder, chest, triceps, and trunk) and flexibility exercises, the total duration was about 10 minutes and all exercises were performed once. On the other hand control group (C) did not perform these exercises. The control group was satisfied with regular warm-up and swimming exercises

PNF stretching is always done in the same pattern and there are a few variations you can use depending on flexibility and comfort level. The second stretch should be deeper than the first and the total period for each exercise included the transfer time to the next exercise.

PNF stretching was performed for the shoulders and major pectoral muscles in one exercise. The player sits with maintained both shoulders with elbows bent in the occipital zone. Then the researcher slowly and gradually performed the horizontal abduction movement of the shoulders as illustrated in **Fig. 2A**. In the second exercise of PNF stretching of the triceps muscle as the participant maintained elbow flexion with the abduction and lateral rotation of the shoulder, and the hand was directed to the contralateral shoulder region. Then the researcher snatched the shoulder to the maximum extent of discomfort as shown in **Fig. 2B** (Souza et al. 2017). First putting a muscle in a stretched position and holding for a few seconds. Contracting the muscle without moving, such as pushing gently against the stretch without actually moving. Each exercise lasted for one minute, when the reflex is triggered and there is a 5s to 20s stretch, 5s isometric contraction and then stretch, steady expansion of the same joint, until the swimmers did not feel pain, 60 seconds relaxation for the joint that was receiving constriction, then stretching again. The flexibility of the trunk of training swimmers was assayed using the flexible trunk box which was designed for this purpose, where a gradient (-30 cm to + 30 cm) as shown in **Fig .3**.

Monitoring upper body strength using medicine balls, as athletes throw a 3-kg medication ball during bending first, then extending the shoulders and elbows. Training swimmers to throw the ball in the air, left and toward several situations. This test provides information about being able to benefit from a decentralized cycle. The upper body strength measured by along sitting position and throwing the ball forward and reporting the data is shown in **Fig. 4**. A 3– 5 minutes positive rest period was provided between each lift. Figure 1 illustrates the experimental procedures described above.

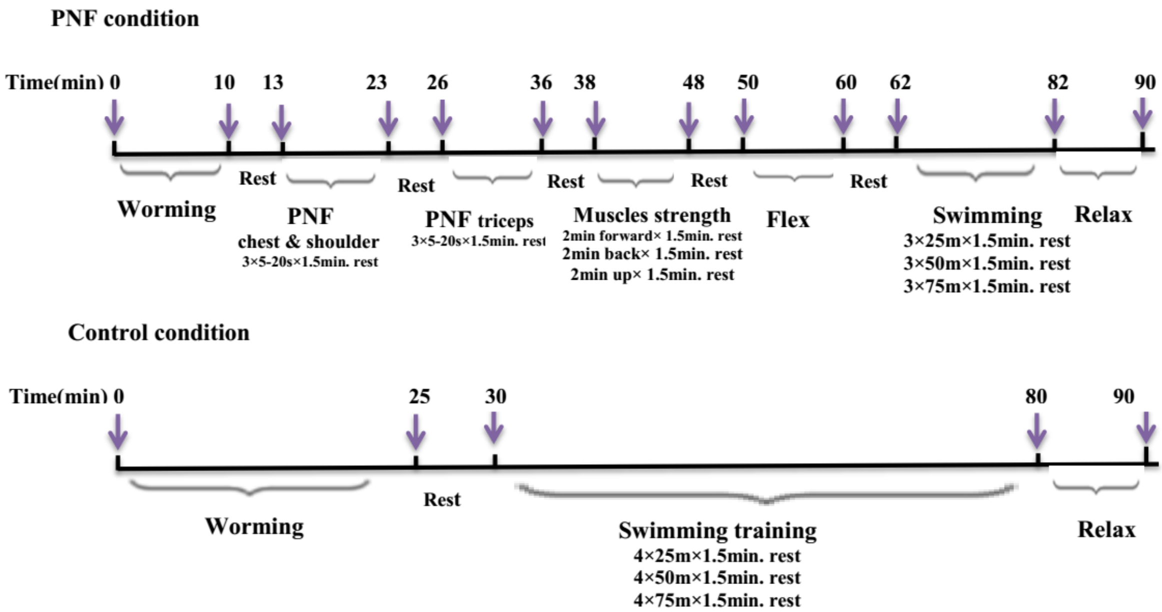

Figure 1. Study experimental design. Source: The author.

Figure 2. PNF Stretching of the shoulders and major pectoral muscles (A), triceps muscle (B). Source: The author

Fig. 3. Measurement of the flexibility of a trunk using trunk flexibilitybox.

Fig. 4. Measurement of muscular capacity for the upper part using a medicine ball

Identifying the change effect on the digital level of 50 m backstrokes swim during the stretching training program. The post measurements were made after weeks 2, 4, and 6 in the seasons 6, 12, and 18 for both PNF and C groups. It measured the swimmer's speed of the digital level for the 50-m backstroke in using video analysis.

Statistical treatment of data

Statistical methods means and standard deviations were calculated to determine the relationship between swimming speed with the strength and muscular capacity and the flexibility of the upper part. The analysis was performed with SPSS version 20.0 for Windows.

III. Results

The focus during training is on the physical activity and physical characteristics that have a positive effect of PNF in swimming. Backstroke swimming depends on the upper part muscles (arms, back, shoulder, chest, triceps, and trunk) and the strokes of the feet. It mainly needs muscular endurance and muscle ability for swimmers. This study was concentrated on the upper part of the body especially the strength and muscular capacity and the flexibility of the upper part. The post measurements were made after weeks 2, 4, and 6 in the seasons 6, 12, and 18. The effect of design on the performance of youth swimmers should be part of their training (Barbosa et al. 2015). PNF stretching and flexibility of the shoulder and chest muscles showed significant progress as seen in **Fig .5** and **Table 2.** The first time starting at 5±0.1s and increasing to reach at 20±0.5s in the end time in the seasons 18 of week 6.

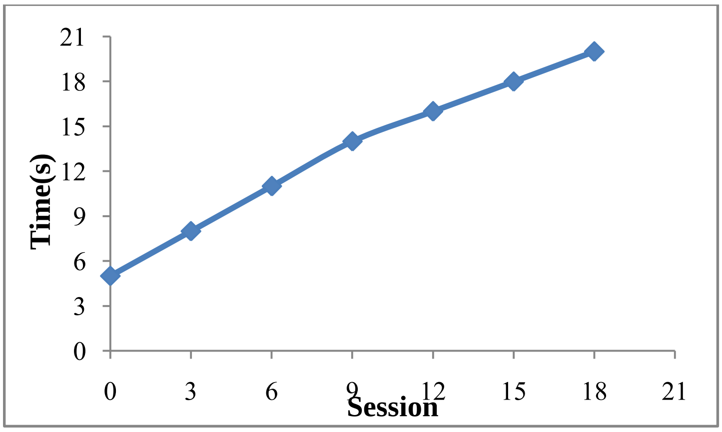

Fig.5.PNF stretching and flexibility the shoulder muscles during 6 weeks (18 sessions)

Training swimmers in the flexibility of the trunk using the flexible trunk box that was designed for this purpose, where a gradient (-30 cm to + 30 cm) is shown in **Fig .4**. The results of the PNF group showed a significant increase in from19±1.3 cm in pretest to 27±2.1 cm at the end of week 6 better than C group were accessed in **Table 2**.

The medicine ball training (weight 3 kg) was used to improve the strength and muscular capacity of the upper part, and this was done from the long sitting position and throwing the ball forward. The distance of the PNF group improved from 3.8±0.8 m in pretest to 5.2±0.9 m at the end of week 6 better than the C group as shown in **Table 2**.

Therefore, high values of upper-body strength are determined to succeed in competitive swimming. The muscle strength is important determinant of success in swimming, as strengthening essential muscles to improve the effectiveness of selected elements of swimmers (Karpiński et al. 2019).

The results of the digital level of the 50-m backstroke swim showed significant improvement from first to second and third measurement in the consumed time.The time of the digital level of the 50-m backstroke swimming of the PNF group significantly decreased more than the C group as shown in **Table 2**.

Table 2: Measures of muscular strength flexibility andDigital level in theCandPNFgroupsduring thepre and post-training protocol. Data presented as mean ± SD.

Group	C (n=7)				PNF(n=7)			
Week	0	2	4	6	0	2	4	6
Upper body strength (m) [a]	3.8.0±0.36	-	-	4.20±0.09	3.80±0.82	4.20±0.95	4.60±1.15	4.99±0.09
Flexibility of trunk (cm)[b]	19.0±1.33	-	-	23.00.±1.00	19.05±096	22.25±088	25.11±1.02	27.07±0.73
PNF of triceps muscle (s)	-	-	-	-	5.07±0.20	7.00±0.32	11.07±0.33	15.05±0.41
PNF of the shoulder &	-	-	-	-	6.05±0.18	10.14±0.26	15.02±0.35	20.08±0.62

[a] using a medicine ball (weight 3 kg), [b] using a trunk flexibilitybox.

Table 3 Summary statistics for both PNF andCgroups

variable	Group	No.	Mean	Std. Deviation	t	sig. level
Upper body strength (m)	Control	7	4.20	0.14	12.57	sig. at 0.01 [a]
	PNF	7	4.99	0.09		
Flexibility of trunk (cm)	Control	7	23.00	1.00	8.69	sig. at 0.01 [a]
	PNF	7	27.07	0.73		
Digital level 50m (s)	Control	7	32.50	0.87	6.92	sig. at 0.01 [a]
	PNF	7	30.04	0.37		

[a]t table value at df (12) and sig. level (0.01) = 3. 05&t table value at df (12) and sig. level (0.05) = 2.18

The mean changes in flexibility, muscular upper body strength, and digital level of the 50-m backstroke swim performance in C and PNF groups are shown in **Table 2**.However, results indicate that the value of (t) computed is smaller than (t) tabled in the test. This means that there are significant differences at ($\alpha \leq 0.01$) between the PNF and the control groupis presented in **Table 2.**Significant increases inthe flexibility of shoulder, chest, arms, and trunk occurred for both C and PNF in the upper body strength and flexibility. However, results showed the PNF group greater improved their strength and flexibility as compared to the C group.

There are statistically significant differences between the tests before and after the digital level for 50-m swimmers in favor of backstroke. It is evident from Table 2 that there are statistically significant differences between the tests (before and after), in favor of the post-test of the variable digital level of the distance of 50-m.

IV. Discussion

This study compared the effects of the PNF stretching group with the control group (C). The results demonstrate that statistically ($\alpha < 0.01$) improved their flexibility and muscle strength of upper part muscles for backstroke swimmers from posttest occurred for both PNF & C groups when compared to pretest. Comparing the results of PNF stretching effects with control results showed there are statistically significant differences ($\alpha > 0.01$) between groups.

The strength of the upper body muscles was expressed by the pectoral muscle, along with the shoulder muscle, the triceps muscle, and the trunk muscles. Higher performance was achieved for both similar age groups after training. A significant increase associated with the stretching effects of PNF was observed in the PNF group compared with the C group as well as on comparing Before versus After (Table 2)(Souza et al. 2017).

When the different stretching protocols were compared with the control protocol (C), a significant reduction was observed in performance in the 50-m front crawl swimming test (PNF: 30.04±0.37s vs. C: 32.50±0.87s, $\alpha < 0.01$).

When this PNF stretching technique is performed, it increased athletic performance post-exercise, along with flexibility and muscle strength of upper part muscles for backstroke swimmers.

V. Conclusion

This study tested 6-weeks of PNF stretching, flexibility, and muscle strength (upper body strength) on teenage swimmers. Two PNF exercises for the muscles of the upper part (shoulder with chest and triceps), the flexibility of the trunk, and monitoring upper body strength were achieved on the PNF group. The control group was satisfied with regular warm-up and swimming exercises.The results showed significant improvement of flexibility, upper body muscles strength and digital level of the 50-m backstroke swim performance in the PNF group vs. C group.

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References

[1]. Areas, Guilherme P. T. et al. 2013. "Effect of Upper Extremity Proprioceptive Neuromuscular Facilitation Combined with Elastic Resistance Bands on Respiratory Muscle Strength: A Randomized Controlled Trial." *Brazilian Journal of Physical Therapy* 17(6): 541–46. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-35552013000600541&lng=en&nrm=iso&tlng=en.

[2]. Barbosa, T. M. et al. 2015. "Hydrodynamic Profile of Young Swimmers: Changes over a Competitive Season." *Scandinavian Journal of Medicine & Science in Sports* 25(2): e184–96. http://doi.wiley.com/10.1111/sms.12281.

[3]. Candace, Wong YH et al. 2017. "Effect of a 4-Week Theraband Exercise with PNF Pattern on Improving Mobility, Balance and Fear of Fall in Community-Dwelling Elderly." *Journal of The Korean Society of Physical Medicine* 12(4): 73–82.

http://www.jkspm.org/journal/view.html?doi=10.13066/kspm.2017.12.4.73.

[4]. Caplan, Nicholas, Rebecca Rogers, Michael K Parr, and Philip R Hayes. 2009. "The Effect of Proprioceptive Neuromuscular Facilitation and Static Stretch Training on Running Mechanics." *Journal of Strength and Conditioning Research* 23(4): 1175–80. http://journals.lww.com/00124278-200907000-00018.

[5]. Costa E. Silva, G. et al. 2014. "Accute Effects of Static and Proprioceptive Neuromuscular Facilitation Stretching on Sprint Performance in Male Swimmers." 67: 119–28.

[6]. Karpiński, Jakub et al. 2019. "The Effects of a 6-Week Core Exercises on Swimming Performance of National Level Swimmers." *bioRxiv*: 2019.12.19.882126. http://biorxiv.org/content/early/2019/12/19/2019.12.19.882126.abstract.

[7]. Kaya, Fatih. 2018. "Positive Effects of Proprioceptive Neuromuscular Facilitation Stretching on Sports Performance: A Review." *Journal of Education and Training Studies* 6(6): 1. http://redfame.com/journal/index.php/jets/article/view/3113.

[8]. Khodayari, Behroz, and Yaghoob Dehghani. 2012. "The Investigation of Mid-Term Effect of Different Intensity of PNF Stretching on Improve Hamstring Flexibility." *Procedia - Social and Behavioral Sciences* 46: 5741–44. https://linkinghub.elsevier.com/retrieve/pii/S1877042812022446.

[9]. Konrad, A., M. Gad, and M. Tilp. 2015. "Effect of PNF Stretching Training on the Properties of Human Muscle and Tendon Structures." *Scandinavian Journal of Medicine & Science in Sports* 25(3): 346–55. http://doi.wiley.com/10.1111/sms.12228.

[10]. Mookerjee, Swapan, Khalid W. Bibi, Gregory A. Kenney, and Lee Cohen. 1995. "Relationship Between Isokinetic Strength, Flexibility, and Flutter Kicking Speed in Female Collegiate Swimmers." *Journal of Strength and Conditioning Research* 9(2): 71–74. http://journals.lww.com/00124278-199505000-00002.

[11]. Papadimitriou, Konstantinos, Dimitris Loupos, George Tsalis, and Vasiliki Manou. 2017. "Effects of Proprioceptive Neuromuscular Facilitation (PNF) on Swimmers Leg Mobility and Performance." 17: 663–68.

[12]. Rees, Sven S et al. 2007. "Effects of Proprioceptive Neuromuscular Facilitation Stretching on Stiffness and Force-Producing Characteristics of the Ankle in Active Women." *The Journal of Strength & Conditioning Research* 21(2): 572–77. https://journals.lww.com/nsca-jscr/Fulltext/2007/05000/EFFECTS_OF_PROPRIOCEPTIVE_NEUROMUSCULAR.49.aspx.

[13]. Souza, Daniel Vieira Braña Côrtes de, Arthur Coimbra Santana, Kleberson Barbosa Meireles, and Eurico Peixoto César. 2017. "Efeito Agudo de Diferentes Métodos de Alongamento Sobre o Desempenho Da Força Em Séries Sucessivas." *Journal of Physical Education* 28(1). http://periodicos.uem.br/ojs/index.php/RevEducFis/article/view/33537.

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