Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

European Journal of Experimental Biology, 2013, 3(1):246-249

ISSN: 2248 –9215
CODEN (USA): EJEBAU

The effects of MVIC durations in PNF training on muscular performances in non-athlete women

Ardeshir Zafari[1], Saeed Sedaghati[2], Sanaz Mirzayan Shanjani[2], Abdolali Banaeifar[3] and Yaser Kazemzadeh[2]

[1]Department of Physical Education and Sport Sciences, Zanjan Branch, Islamic Azad University, Zanjan, Iran
[2]Faculty of Physical Education and Sport Sciences, Islamshahr Branch, Islamic Azad University, Tehran, Iran
[3]Faculty of Physical Education and Sport Sciences, Islamic Azad University – South Tehran Branch, Tehran, Iran

---

ABSTRACT

*Proprioceptive Neuromuscular Facilitation (PNF) training (Contraction - Relaxation method), in compared to the other methods of static and dynamic stretching exercises; has higher and safer effects on enhancement of hamstring muscle's flexibility, strength and endurance. Achieving the optimal combination of contraction and stretching phases in PNF training that can increase these factors of physical fitness is controversial. Therefore, this quasi-experimental study was conducted to determine and compare of the effects of combined phases of 10, 15, and 20 seconds of maximum voluntary isometric contraction and 15 seconds of passive stretching (up to pain threshold) in PNF training (Contraction - Relaxation method) on flexibility, strength, and endurance of hamstring muscle in non-athlete women. Sixty women were selected from 75 non-athlete volunteer women of 20-30 years old eligible. The participants were divided into 4 groups, each with 15 women. The training was performed three times a week for 8 weeks, and each session lasted one hour according to the progressive overload principle. Muscle strength was measured by using One Repetition Maximum (1RM) test. Muscle endurance was measured by using number of repetitions with 70% of 1RM (70%*1RM) of hamstring muscle. Flexibility of hamstring muscle was measured with modified SRT (Sit & Reach Test). Within group's comparison were done with two tailed paired sample t-test. Between groups comparison were done with one-way ANOVA and Tukey Post Hock test. All tests significant level was set at $P \leq 0.05$. Between group's differences of muscle strength and endurance were significant in post-test ($P \leq 0.001$*). Within group's difference of muscle strength were significant in 10 sec ($P \leq 0.001$*), 15 sec ($P \leq 0.001$*), and 20 sec groups ($P \leq 0.001$*). Within group's difference of muscle endurance was significant in 15 sec ($P \leq 0.001$*) and 20 sec groups ($P \leq 0.001$*). Between group's differences of flexibility was not significant in post-test ($P = 0.172$). Within group's difference of flexibility were significant in 10 sec ($P \leq 0.001$*), 15 sec ($P \leq 0.001$*), and 20 sec groups ($P \leq 0.001$*). Therefore, this training can increase the flexibility, strength, and endurance of hamstring muscle in non-athlete women.*

Key Words: Strength, Endurance, Flexibility, PNF Training.

INTRODUCTION

Proprioceptive Neuromuscular Facilitation (PNF) training can enhance muscular strength and endurance with developing flexibility of joints and range of motion due to combining phases of Maximum Voluntary Isometric

Contraction (MVIC) and Passive Stretching (PS). There are various methods of contracting and stretching exercises in PNF training with different sequences, frequency and times of stretching, contraction, and relax phases [1, 2]. Results of the previous studies have shown that performing PNF training (Contraction - Relaxation method), in compared to the other methods of static and dynamic stretching exercises; has higher and safer effects on enhancement of hamstring muscle's flexibility [3-7], strength and endurance [8-10]. Results of the previous studies about introducing the best method of combination of contraction and stretching phases in PNF training that can increase different factors of physical fitness are scattered and controversial.

Nelson and Cornelius (1991) showed that the effects of maximum voluntary isometric contraction for 3, 6, and 10 sec. in PNF training on range of motion were not different, although all the MVIC durations increased the range of motion significantly [11]. Schmitt et al. (1999) indicated that the effects of static maximum voluntary isometric contraction for 6 and 12 sec. on flexibility of hamstring muscle were not different, although all the MVIC durations increased the flexibility significantly [12]. Rowland et al. (2003) found that the effects of 6-week PNF training with 5 and 10 sec. of maximum voluntary isometric contraction on range of motion of hip joint were significantly different and the range of motion in the experimental group with 10 sec. of contraction was significantly more than 5 sec. of contraction [13]. Results of Feland and Marin (2004) showed that all different intensities of voluntary isometric contraction in PNF training (Contraction - Relaxation method) were effective on the flexibility of hamstring muscle, but no differences observed between intensities [3]. Bonnar et al. (2004) showed that maximum voluntary isometric contraction for 3, 6, and 10 sec. in PNF training had positive effect on flexibility of hamstring muscle; however, there was no difference between all the MVIC duration's [14]. Therefore, different times of maximum voluntary isometric contraction in PNF training have increased flexibility of the experimental groups, although no differences have been observed between different MVIC durations. Moreover, most of the studies have examined flexibility and have paid less attention to the effect of different times of maximum voluntary isometric contraction in PNF training on strength and endurance of hamstring muscle. Regarding the results of the previous studies, introduction of the best method for combination of contraction and stretching phases that can efficiently increase flexibility, strength, and endurance will be required of more studies. Therefore, this study was conducted to determine and compare of the effects of combined phases of 10, 15, and 20 seconds of maximum voluntary isometric contraction and 15 seconds of passive stretching (up to pain threshold) on flexibility, strength, and endurance of hamstring muscle in non-athlete women.

MATERIALS AND METHODS

This quasi-experimental study was conducted to determine and compare of the effects of combined phases of 10, 15, and 20 seconds of maximum voluntary isometric contraction and 15 seconds of passive stretching (up to pain threshold) in PNF training (Contraction - Relaxation method) on flexibility, strength, and endurance of hamstring muscle of non-athlete women. 60 women were selected from 75 non-athlete volunteer women of 20-30 years old eligible for the experiment using simple random sampling. The participants were divided into 4 groups, each with 15 women. The independent variable was execution of 8-week PNF training using Contraction - Relaxation method according to the progressive overload principle. The training was performed three times a week for 8 weeks, and each session lasted one hour. In the first and second weeks, two sessions were run in three repetitions (2*3) without relaxation; in the third, fourth, and fifth weeks, three sessions were run in three repetitions (3*3) with one min relaxation between sets; and in the sixth, seventh, and eight weeks, three sessions were run in four repetitions (3*4) with one minute relaxation between sets. Muscle strength was measured by using One Repetition Maximum (1RM) test [15]. Muscle endurance was measured by using number of repetitions with 70% of 1RM (70%*1RM) of hamstring muscle [15]. Flexibility of hamstring muscle was measured with modified Sit & Reach Test [15]. The normality of the distribution and homogeneity of variances in variables was examined using Kolmogorov - Smirnov and Levene statistical tests. Within group's comparison were done with two tailed paired sample t-test. Between groups comparison were done with one-way ANOVA and Tukey Post Hock test. All tests significant level was set at $P \leq 0.05$.

RESULTS AND DISCUSSION

Between group's differences of age were not significant [F (3, 56) = 0.76, P = 0.442]. Between group's differences of body mass index were not significant in pre-test [F (3, 56) = 2.15, P = 0.087] and post-test [F (3, 56) = 2.19, P = 0.091]. Within group's difference of body mass index were not significant in 10 sec [t (14) = 0.86, P = 0.373], 15 sec [t (14) = 0.22, P = 0.815], 20 sec [t (14) = -1.65, P = 0.105], and control groups [t (14) = 0.83, P = 0.416]. Between group's differences of body mass were not significant in pre-test [F (3, 56) = 2.15, P = 0.083]. However, between group's differences of body mass were significant in post-test [F (3, 56) = 3.91, P = 0.021*]. Mean difference of body mass was significant between 10 sec and control groups (P = 0.017*). Within group's difference of body mass were not significant in 10 sec [t (14) = -0.95, P = 0.358], 15 sec [t (14) = 0.480, P = 0.550], 20 sec [t (14) = -1.45, P

= 0.143], and control groups [t (14) = -0.47, P = 0.643]. Between group's differences of body fat percent were not significant in pre-test [F (3, 56) = 2.43, P = 0.072]. However, between group's differences of body fat percent were significant in post-test [F (3, 56) = 4.17, P = 0.011*]. Mean difference of body fat percent was significant between 10 sec and control groups (P = 0.015*) and 10 sec and 20 sec groups (P = 0.023*). Within group's difference of body fat percent were not significant in 10 sec [t (14) = -2.95, P = 0.063], 15 sec [t (14) = -1.84, P = 0.091], 20 sec [t (14) = -1.52, P = 0.110], and control groups [t (14) = 0.91, P = 0.255].

Between group's differences of flexibility were not significant in pre-test [F (3, 56) = 0.28, P = 0.850] and post-test [F (3, 56) = 1.63, P = 0.172]. Within group's difference of flexibility were significant in 10 sec [t (14) = 5.18, P ≤ 0.001*], 15 sec [t (14) = 5.01, P ≤ 0.001*], and 20 sec groups [t (14) = 7.15, P ≤ 0.001*]. However, within group's difference of flexibility was not significant in control group [t (14) = 0.72, P = 0.544].

Between group's differences of muscle strength were not significant in pre-test [F (3, 56) = 1.75, P = 0.194]. However, between group's differences of muscle strength were significant in post-test [F (3, 56) = 8.13, P ≤ 0.001*]. Mean difference of muscle strength was significant between 10 sec and control groups (P = 0.001*), 15 sec group and control groups (P = 0.001*), and 20 sec and control groups (P = 0.004*). Within group's difference of muscle strength were significant in 10 sec [t (14) = 7.34, P ≤ 0.001*], 15 sec [t (14) = 6.18, P ≤ 0.001*], and 20 sec groups [t (14) = 6.44, P ≤ 0.001*]. However, within group's difference of muscle strength was not significant in control group [t (14) = 0.78, P = 0.511].

Between group's differences of muscle endurance were not significant in pre-test [F (3, 56) = 2.21, P = 0.216]. However, between group's differences of muscle endurance were significant in post-test [F (3, 56) = 6.17, P = 0.001*]. Mean difference of muscle endurance was significant between 10 sec and control groups (P = 0.039*), 15 sec and control groups (P = 0.008*), and 20 sec and control groups (P=0.001*). Within group's difference of muscle endurance was not significant in 10 sec [t (14) = 1.95, P = 0.084], and control groups [t (14) =-1.55, P = 0.283]. However, within group's difference of muscle endurance was significant in 15 sec [t (14) = 6.65, P ≤ 0.001*] and 20 sec groups [t (14) = 11.92, P ≤ 0.001*].

Eight week PNF training (Contraction - Relaxation method) combined phases of 10, 15, and 20 seconds of maximum voluntary isometric contraction and 15 seconds of passive stretching (up to pain threshold) according to the progressive overload principle did not make a differences in values of body mass, body fat percent, and body mass index in non-athlete women of experimental groups.

This training increased flexibility of hamstring muscle in non-athlete women of experimental groups. Mean of muscle flexibility in 10 sec, 15 sec, and 20 sec groups were increased 25.15%, 22.93%, and 25.40%, respectively; but no differences was observed between groups. Furthermore, a muscle flexibility change in control group was 1.57%. It is obvious that, these results are due to the performance of the 15 seconds passive stretching up to pain threshold in PNF training in all experimental groups. These results support the results of Schmidt, et al. (1999), Feland, et al (2001), Spernoga, et al. (2001), Roland, et al. (2003), Schuback, et al. (2004), Bonnar, et al. (2004), Feland, et al. (2004), and Marek, et al. (2005).

This training increased strength of hamstring muscle in non-athlete women of experimental groups. Mean of muscle strength in 10 sec, 15 sec, and 20 sec groups increased 24.20%, 31.60%, and 26.15%, respectively; but no differences was observed between groups. Furthermore, a muscle strength change in control group was 3.40%. It is obvious that, these results are due to the performance of the maximum voluntary isometric contraction on the basis of progressive overload principle in PNF training. These results support the results of Nelson, et al. (1991), Kokkonen, et al (1995), Schmitt, et al. (1999), Feland, et al. (2004), Bonnar, et al. (2004), Kofotolis, et al. (2006), and Corbin, et al. (2010).

This training increased endurance of hamstring muscle in non-athlete women of experimental groups. Mean of muscle endurance in 10 sec, 15 sec, and 20 sec groups increased 28.10%, 55.40%, and 85.90%, respectively; but no differences was observed between groups. Furthermore, a muscle endurance change in control group was -10.95%. It is obvious that, these results are due to the performance of the maximum voluntary isometric contraction on the basis of progressive overload principle in PNF training. These results support the results of Kokkonen, et al. (1995), Kofotolis, et al. (2006), and Corbin, et al. (2010).

It seems that the maximum voluntary isometric contraction must be done in a longer time (20 sec in this study) in order to achieve greater muscular endurance, and it is better to perform the maximum voluntary isometric contraction for 15 sec (based on the results of the present study) if the purpose is to increase muscular strength. In this respect, the maximum voluntary isometric contraction must be performed for 20 sec to increase muscular strength and endurance simultaneously.

CONCLUSION

Therefore, according to this study, PNF training (Contraction - Relaxation method) are recommended when the training programs designed to increase flexibility, strength, and endurance of muscles; but more studies are required to clarify the optimal effects of PNF training and the best method in PNF training with different times of maximum voluntary isometric contraction, different times of passive stretching, and different combinations of these phases.

REFERENCES

[1] Brooks, A., Fahey, T. D., Baldwin, K. M. **2005**. *Exercise Physiology*, MC G.H.
[2] Corbin, C., Lindsey, R., Welk, G. **2010**. Concepts of fitness and wellness. MC G.H.
[3] Feland, B., Marin, H. N. **2004**. *Br J Sports Med*; 38: el8
[4] Feland, B., Mirer W., Schlthies, S., Measom, W. **2001**. *Physiotherapy*; 81: 1100-1117.
[5] Marek, M., Cramer, J. T., Fincher, A. l., Massey, L. L. **2005**. *J Ath Train*; 40:94-103.
[6] Schuback, B., Hooper, J., Salisbury, L. **2004**. *J Physiotherapy*; 90: 151-7.
[7] Spernoga, G., UhI, L., Arnold, L., Gansneder, M. **2001**. *J Athl Train*; 36: 44-8.
[8] Kofotolis N, Kellies E. **2006**. *Phys Ther*; 86:1001.
[9] Kofotolis, N., Vrobas, S., Papanikolaou, A. **2005**. *Br J Sport Med*; 39: ell.
[10] Kokkonen, G., Lauritzen, S.**1995**. *Medicine sciences in sport and Exercise*; No; 11.
[11] Nelson, K. C., Cornelius, W. L. **1991**. *J Sports Med Phys Fitness*; 31: 385-8.
[12] Schmitt, G. D., Pelham, T. W., Holt, L. E. **1999**. *Clin kinesiology*; 53: 16-21.
[13] Roland, A. V., Marginson, V. F., Lee, J. **2003**. *Res Qua Exe sport*; 47-51.
[14] Bonnar, P., Deirrt, G., Gould, E. **2004**. *J Sport Med Phys Fitness.* Sep: 44(3): 258-61.
[15] Huger, W., Huger, S. **2006**. Principles and labs for fitness and wellness, Thomson Wads Worth; 8th Ed.