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The effect of 10-sec of maximal voluntary isometric contraction and 10-sec of passive stretching on strength, endurance and flexibility of hamstring muscle

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ABSTRACT

PNF training (C-R method) has a safe and better effect on hamstring muscle's flexibility, strength and endurance. To achieve the best combination and time in contracting and stretching process in PNF training for increment of several factors that can make simultaneously and effectively physical fitness, is controversial. The aimed of this semi-quasi study was determine and compare of the effect of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching on strength, endurance and flexibility of hamstring muscle in non-athletes men. 20 non-athletes eligible male's subjects (20-25 yrs) were randomly divided in two groups. Independent variable, the implementation of six-week PNF training includes combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching phases and 5 seconds rest in hamstring muscle. Dependent variables including strength, endurance and flexibility of the hamstring muscle. Data compared with paired and independent t test ($p \leq 0.05$). Means differences of flexibility, strength and endurance in comparison of pre and post test of training group and post test of two groups were significant. These results indicate that implementation of six-weeks of PNF training (C-R method) based on the overload principle with the combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, increased flexibility, strength and endurance of hamstring muscle in non-athletes male.

Key Words: flexibility, strength, endurance, hamstring muscle, PNF training.

INTRODUCTION

PNF training (C-R method) has a safe and better effect on hamstring muscle's flexibility, strength and endurance. To achieve the best combination and time in contracting and stretching process in PNF training for increment of several factors that can make simultaneously and effectively physical fitness, is controversial. Stretching exercises manner to facilitate neuromuscular through deep receptors (PNF) due to the combination process of maximum voluntary contraction and passive stretch; addition to the development of flexible joints and range of stretching muscles, it can be increase strength and muscle endurance [2,3]. The results of the previous study show that implementation of PNF stretching exercises with CR method, compared to other methods of stretching exercises, such as static and dynamic, has more, better and safer effective, on the development of hamstring muscle flexibility [4,5,10,14,15] and can increase the power and strength of hamstring muscle [7-9]. PNF training methods with different frequency and different stages of time, stretching, contraction and relaxation has been introduced [2,3]. Previous findings regarding the introduction of a superior method with the best combination of time and contracting procedures that are able to pull together several factors and physical fitness and skill to increase effectively and simultaneously, controversy has scattered.

Nelson and Cornelius (1991) showed that the effects of 3, 6 and 10 seconds static maximum voluntary contraction training in PNF method on the motion was not different, although all three time periods significantly increased range of motion [11]. Schmidt (1999) showed that the effect of two periods of 6 and 12 seconds static maximum voluntary contraction of hamstring muscle; despite a significant increase in the flexibility of both methods was not significant [13]. Roland (2003), showed that the effect of six weeks PNF training with two periods of 5 and 10 seconds static maximum voluntary contraction of hip joint motion was different; so that in addition to significant differences between these groups with control group, 10 seconds in the experimental group significantly was more than experimental group 5 seconds of contraction [12]. Feland (2004) showed that different intensity of static contraction in PNF stretching with CR method was effective on hamstring muscle tension and there is no difference between this intensity [4]. Bonnar (2004) showed that 3 and 6, and 10 seconds at static maximum voluntary contraction in PNF has a positive effect on hamstring muscle flexibility, but no difference observed among the three times above observed [1]. Thus different times of static contraction in PNF stretching increases flexibility and development than the control group, but differences were observed between different times. On the other hand, most research has been done, Studied the flexibility factor has been less attention on different times and static voluntary contraction in PNF stretching on hamstring muscle strength and endurance factors. Summarized the results of previous studies showed that introducing a superior method regarding the timing and composition of the contraction process and the factors that can increase hamstring muscle strength and flexibility and effectively increased survival and higher cause it requires the design and implementation of further research. This study intends to determine the combined effect of 10-Sec of Maximal Voluntary Isometric Contraction and 10-Sec of Passive Stretching on strength and endurance factors and hamstring muscle flexibility in non-athletes men.

MATERIALS AND METHODS

The aimed of this semi-experimental study was determine of the effect of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching on strength, endurance and flexibility of hamstring muscle in non-athletes men and compare them with the control group. 20 non-athletes eligible male's subjects (20-25 yrs) were randomly divided in two groups. Independent variable, the implementation of six-week PNF training includes combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching phases and 5 seconds rest in hamstring muscle. Dependent variables including strength, endurance and flexibility of the hamstring muscle. PNF training was three repetitions that each session was performed based on the principle of progressive over load training. Exercise program was for six weeks, three sessions a week and each session run one hour such that the first and second weeks, once with three repetition (1*3) and without rest; third and fourth weeks, two times with three repetition (2*3) and one minute rest between sets and six and the fifth week, three times with three repetition (3*3) and one minute rest between sets were implemented. Strength of hamstring muscle measured with one repetition maximum (1RM) standard test per Kg by moving dynamic knee flexion machines. Endurance of hamstring muscle measured with the number of repetitions at 70% of one repetition maximum (%70* 1RM) by moving dynamic knee flexion machines. Flexibility of hamstring muscle measured with the modified SRT test. All tests and procedures in pre and post test were similar. The normality of distribution and homogeneity of variances measured by Kolmogorov - Smirnov and Levine tests, respectively. Mean differences in pre and post test in groups were compared with paired sample t-test, and between groups were compared with independent t-test ($P \leq 0.05$).

RESULTS AND DISCUSSION

Differences of age between training (21.30 ± 1.33 years) and control (22.60 ± 2.17 years) groups was not significant (P=0.124). Differences of body mass index between training (22.65 ± 1.52 kg/m^2) and control (23.43 ± 1.60 kg/m^2) groups was not significant (P=0.552). Mean differences of range of motion in pre test (30.20 ± 10.30) and post test (37.40 ± 7.90) of training group was significant (t (9) =6.047, p ≤ 0.001**). Mean differences of range of motion in pre test (32.50 ± 4.70) and post test (33.10 ± 4.10) of control group was not significant (t (9) =0.514, p = 0.619). Mean differences of range of motion in pre test of training group (30.20 ± 10.30) and control group (32.50 ± 4.70) was not significant (t (18) =0.644, p=0.528). Mean differences of range of motion in post test of training group (37.40 ± 7.90) and control group (33.10 ± 4.10) was not significant (t (18) =1.527, p=0.144). Mean differences of muscle strength in pre test (16.50 ± 3.37) and post test (21.50 ± 3.37) of training group was significant (t (9) =6.708, p ≤ 0.001**). Mean differences of muscle strength in pre test (14.30 ± 2.45) and post test (15.00 ± 3.33) of control group was not significant (t (9) =0.651, p = 0.531). Mean differences of muscle strength in pre test of training group (16.50 ± 3.37) and control group (14.30 ± 2.45) was not significant (t (18) =1.668, p=0.113). Mean differences of muscle strength in post test of training group (21.50 ± 3.37) and control group (15.00 ± 3.33) was significant (t (18) =4.333, p ≤ 0.001**). Mean differences of muscle endurance in pre test (104.00 ± 56.60) and post test (164.00 ± 49.71) of training group was significant (t (9) =7.115, p ≤ 0.001**). Mean differences of muscle endurance in pre test (123.50 ± 31.10) and post test (108.00 ± 32.60) of control group was not significant (t (9) = -1.260, p = 0.239). Mean differences of muscle endurance in pre test of training group (104.00 ± 56.60) and control group (123.50 ± 31.10) was not significant (t (18) = 0.955, p = 0.352). Mean differences of muscle endurance in post test of training group (164.00 ± 49.71) and control group (108.00 ± 32.60) was significant (t (18) =2.979, p = 0.008**).

Mean differences of range of motion in pre test and post test of training group was significant. Mean differences of range of motion in pre test and post test of control group was not significant. On the other hand, mean differences of range of motion in pre test of training group and control group and post test of training group and control group were not significant. These results indicate that six weeks of PNF stretching training (CR method) with the combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop range of motion and increased flexibility of hamstring muscles in non-athletes men. Obviously this result due to the implementation of passive stretching exercises based on the principle of over load on the PNF exercise program and results of Schmidt (1999), Feland (2001), Spernoga (2001), Roland (2003), Schuback (2004), Bonnar (2004), Feland (2004) and Mark (2005) is consistent.
Mean differences of muscle strength in pre test and post test of training group was significant. Mean differences of muscle strength in pre test and post test of control group was not significant.

On the other hand, mean differences of muscle strength in pre test of training group and control group was not significant. Mean differences of muscle strength in post test of training group and control group was significant. These results indicate that six weeks of PNF training (CR method) with the combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop muscle strength and increased strength of hamstring muscles in non-athletes men. Obviously this result due to implementation of 10 seconds static maximum voluntary contraction training based on the principle of progressive overload training program is consistent with the results of Nelson (1991), Kokkonen (1995), Schmidt (1999), Feland (2004) , Bonnar (2004) and Kofotolis (2006) and Corbin (2010).

Mean differences of muscle endurance in pre test and post test of training group was significant. Mean differences of muscle endurance in pre test and post test of control group was not significant. On the other hand, mean differences of muscle endurance in pre test of training group and control group was not significant. Mean differences of muscle endurance in post test of training group and control group was significant. These results indicate that six weeks of PNF training (CR method) with the combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop muscle endurance and increased endurance of hamstring muscles in non-athletes men. Obviously this result due to implementation of static exercise maximum voluntary contraction for 10 seconds based on the principle of progressive overload training in PNF and results of Kokkonen (1995), Kofotolis (2006) and Corbin (2010) are consistent.

Means differences of stretching, strength and endurance in comparison of pre and post test of training group and post test of two groups were significant. These results indicate that implementation of six-weeks of PNF training (C-R method) based on the overload principle with the combination of 10 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, increased flexibility, strength and endurance of hamstring muscle in non-athletes male.

CONCLUSION

Therefore, the beneficial effects of exercise and optimal PNF manner and the development of flexibility, strength and endurance of hamstring muscle than the other exercises; training programs designed to increase flexibility, strength and endurance program Use of PNF exercise recommended. However, to achieve an optimal approach in these training and superior design and implementation require further study with different timing and combination of stretching and contraction process in different subjects and different experimental conditions is required.

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