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The effect of 15-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-experimental study was determine of the effect of 15 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching on strength, endurance and flexibility of hamstring muscle in non-athletes men. This study performed with comparing method and designed in training and control groups with pre-test and post test. 20 non-athletes eligible male's subjects (20-25 yrs) were randomly divided in two groups. Independent variable was the implementation of six-week PNF training includes combination of 15-sec of maximal voluntary isometric contraction and 10-sec of passive stretching phases and 5 seconds rest in hamstring muscle. Dependent variables were the strength, endurance and flexibility of the hamstring muscle. Data compared with paired and independent t test ($p \leq 0.05$). 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 15-sec of maximal voluntary isometric contraction and 10- sec of passive stretching, can increase flexibility, strength and endurance of hamstring muscle in non-athletes male.

Key Words: Flexibility, Strength, Endurance, 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 showed 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, 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 15-Sec of Maximal Voluntary Isometric Contraction and 10-Sec of Passive Stretching on strength and endurance and flexibility of hamstring muscle in non-athletes men and compared with the control group.

MATERIALS AND METHODS

The aimed of this semi-experimental study was determine of the effect of 15seconds 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. This study performed with comparing method and designed in training and control groups with pre-test and post test. 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 15 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 replications that each session was performed based on the principle increasing load. 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 replicates (1 * 3) and without rest; third and fourth weeks, two times with three replicates (2 * 3) and one minute rest between turns and six and the fifth week, three times

with three replications (3 * 3) and one minute rest between turns were implemented. Dependent variables were consisted of strength, endurance and flexibility of hamstring muscles in the top foot of non-athletes men standard test repetition maximum (1RM) per kg and the number of repetitions at 70% one repetition maximum (%70* 1RM) muscle Dynamic hamstring knee flexion with weight control and body building machines for moving knee flexion strength test in the modified SRT pretest and post test were measured. The normality of distribution and homogeneity of variances evaluated by Kolmogorov - Smirnov and Levine tests, respectively. Mean differences in pre and post test in group were compared with paired sample t-test. Mean differences between groups were compared with independent t – test ($P \leq 0.05$).

RESULTS AND DISCUSSION

Difference of age between training (21.90 ± 1.19 years) and control (22.60 ± 2.17 years) groups was not significant (P=0.384). Difference of body mass index between training (22.76 ± 3/08 kg/m^2) and control (23.43 ± 1.60 kg/m^2) groups was not significant (P=0.552). Mean difference of range of motion in pre test (31.00 ± 5.67) and post test (38.60 ± 6.32) of training group was significant (t (9) =8.593, $p \leq 0.001$**). Mean difference 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 difference of range of motion in pre test of training group (31.00 ± 5.67) and control group (32.50 ± 4.70) was not significant (t (18) =0.644, p=0.528). Mean difference of range of motion in post test of training group (38.60 ± 6.32) and control group (33.10 ± 4.10) was significant (t (18) =2.308, p=0.033*). Mean difference of muscle strength in pre test (16.00 ± 2.45) and post test (20.00 ± 3.33) of training group was significant (t (9) =7.746, $p \leq 0.001$**). Mean difference 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 difference of muscle strength in pre test of training group (16.00 ± 2.45) and control group (14.30 ± 2.45) was not significant (t (18) =1.551, p=0.138). Mean difference of muscle strength in post test of training group (20.00 ± 3.33) and control group (15.00 ± 3.33) was significant (t (18) =3.354, p=0.004**). Mean difference of muscle endurance in pre test (90.50 ± 32.70) and post test (177.00 ± 24.51) of training group was significant (t (9) =12.660, $p \leq 0.001$**). Mean difference 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 difference of muscle endurance in pre test of training group (90.50 ± 32.70) and control group (123.50 ± 31.10) was significant (t (18) =2.313, p=0.033*). Mean difference of muscle endurance in post test of training group (177.00 ± 24.51) and control group (108/00 ± 32.60) was significant (t (18) =5.350, $p \leq 0.001$**).

Mean difference of range of motion in pre test and post test of training group was significant. Mean difference of range of motion in pre test and post test of control group was not significant. On the other hand, mean difference of range of motion in pre test of training group and control group was not significant. Mean difference of range of motion in post test of training group and control group was significant. These results indicate that six weeks of PNF stretching training (CR method) with the combination of 15seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop range of motion and can increase flexibility of hamstring muscles in non-athletes men. Obviously this result due to the implementation of passive stretching exercises based on the principle of pain threshold increased 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 difference of muscle strength in pre test and post test of training group was significant. Mean difference of muscle strength in pre test and post test of control group was not significant.

On the other hand, mean difference of muscle strength in pre test of training group and control group was not significant. Mean difference of muscle strength in post test of training group and control group was significant. These results indicate that six weeks of PNF training (C-R method) with the combination of 15 seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop muscle strength and can increase strength of hamstring muscles in non-athletes men. Obviously this result due to implementation of 15seconds 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 difference of muscle endurance in pre test and post test of training group was significant. Mean difference of muscle endurance in pre test and post test of control group was not significant. On the other hand, mean difference of muscle endurance in pre test of training group and control group was not significant. Mean difference 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 15seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, develop muscle endurance and can increase endurance of hamstring muscles in non-athletes men. Obviously this result due to implementation of static exercise maximum voluntary contraction for 15 seconds based on the principle of progressive overload training in PNF and research results is consistent with Kokkonen (1995) and Kofotolis (2006) and Corbin (2010). 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 15seconds of maximal voluntary isometric contraction and 10 seconds of passive stretching, can increase 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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