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Acute effect of stretching before power force exercises

Abstract

The aim of this study was to investigate the effects of static stretching, warming up through slow running, stretching combined with slow running without any physical stimulus (control group) and its effects on the power strength measured using a protocol. horizontal jump, where the average results presented were 160.56±15.60 cm without any physical stimulus (control=G1); 153.75±15.88cm with 10 minutes of passive stretching (G2); 169.39±20.69 cm with 10 minutes of slow running for warm-up (G3) and 164.60 ±17.59 cm with 5 minutes of slow running and 5 minutes of passive stretching (G4). It has been shown that stretching performed before exercise where power is required can be counterproductive and warming up through slow running is important in performing motor actions that require this type of strength.

Keywords: power strength, static stretching, warm up, horizontal jump, physical training

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Introduction

Historically, man has always tried to understand more and more how the human body responds to the stimuli received, how to adapt it, modify it and make it increasingly strong, resistant, agile and, why not, beautiful. Physical exercises play an important role in this process and a common and easy practice that is recommended worldwide is stretching exercises.

Muscle stretching is often performed before or at the end of exercise or in both situations by professional or amateur athletes, often in order to reduce the risk of injury and improve physical performance. However, the use of stretching before exercise sessions generates controversy in the scientific literature. Shrier,[1] when developing a critical review, found that in 32 reviewed studies none indicated that stretching was beneficial for performance in events related to strength, torque and jump. Other studies point out that acute and prolonged stretching performed before exercise can reduce the ability to produce strength.[2] To explain these findings, it is speculated that neural and mechanical factors would be involved in the temporary reduction of muscle activity and strength.[2,3]

Flexibility is characterized by the ability of a single joint or series of joints to move with range of motion, comfortably, free from pain and restraint, while a set of components-connective tissue, tendon, ligaments, joint capsule, muscle and skin-stretch.[4,5]

Proper mobility of soft tissues and joints is a major factor in injury prevention. The main soft tissues that can restrict joint mobility are muscles, connective tissue and skin. Shortening is characterized by loss of soft tissue extensibility, ie partial reduction of the length of a healthy musculotendinous unit, resulting in limitation of joint mobility.[3]

Stretching is one of the most widely used techniques for increasing range of motion, but there is no consensus on the frequency and length of stretching required to realize gain in flexibility,[4,5] as well as the ideal moment of stretching, even be performed, ie if before, during and after physical activity.

Research shows that static stretching performed before exercise can temporarily compromise the muscle's ability to perform and generate maximum strength and power.[3,6,7]

However, it is important to understand the mechanisms that are stimulated when we subject the human body to certain situations, such as static stretching exercises.

In the muscles are found receptors that provide the central nervous system with information about body posture, balance and movement.

There are two kinds of receptor groups to convey this information: the Golgi tendon organs and the muscle spindles. These receptors are also called proprioceptors. The flow of information flows from the receptors, through the spinal cord, to the respective parts of the brain, where this information is assimilated. In this way, the brain is supplied with information on: muscle contraction, muscle tension, muscle extension, tendon tension, joint activity, changes in body position and tension, and speed of muscle modification. This information is necessary for the execution and maintenance of coordinated muscular actions, as well as for the evolution of movements and the maintenance of body posture.[8]

More spindles are observed in muscles that exert antigravity action, with predominance of oxidative fibers, than in muscles with preponderance of glycolytic fibers.[9] The muscle spindles are responsible for the muscle extension control system. Its sensory endings inform the central nervous system about: muscle extension, modification of muscle extension, speed of contraction, and size of contraction.[9]

Muscle spindles contain in a spindle-shaped connective tissue capsule some fibril-rich, plasma-rich muscle fibers: intrafusal fibers or spinous fibers. In turn, these are differentiated into: nuclear bag fibers and nuclear chain fibers. Nuclear chain fibers are thin fibers, profusely nucleated in the form of a chain and, even though lacking the ability to contract, are responsible for static sensitivity. Nuclear pouch fibers, in contrast, are thicker fibers, the center of which resembles a lump-filled pouch which, when the muscle is stretched, is pulled and excites the nerve terminals called the spiral annulus termination that are tangled in them. They are responsible for dynamic sensitivity.[8,9]

Golgi's tendon organs are in the transition from muscle to tendon and consist of fluid-filled capsules equipped with few muscle fibers and fast-conducting nerve endings. As muscle tension increases, the tendon fibers contract and thus the fluid-filled capsules are compressed causing an increase in pressure at the nerve endings, causing the muscles to relax as soon as the physiological limit value is reached. Prevent overload on the tendons and consequently permanent damage.[8–10]

Therefore, this study aimed to investigate whether static stretching, with the body warmed through slow running, slow running plus static stretching and with the body without any stimulus (control group), ie without warming up and without stretching , has influence on the physical activities that require the power force. Thirteen male subjects underwent a horizontal impulsion test under four conditions:

i. without any kind of stimulus, that is, with the body without heating and without stretching (control group=G1);

ii. Preceded by ten minutes of static stretching exercises (G2);

iii. Ten minutes of warm up with slow running (G3) and

iv. With slow running combined with static stretching exercises lasting five minutes each (G4).

All subjects were part of the four procedures mentioned, and the stretches were the same for all individuals who maintained the posture for twenty seconds each until completing the established time of ten minutes. Stretches were concentrated in the lower limbs, where the following muscle groups were stretched: quadriceps, hamstrings, adductors, abductors and sural triceps. The tested subjects performed three jumps each with a three-minute interval for each horizontal jump that, according to Chandler & Brown[11] post-exercise creatine phosphate resynthesis occurs during two and three minutes of recovery, by transport energy of it.

Materials and methods

The sample included 13 male academics, attending the second level of the Bachelor of Physical Education course at the University of Passo Fundo with an average age of 23.1 years. The average weight was 73.69 kg. The average height was 175.5 cm. The mean BMI (Body Mass Index) was 23.86, which is in the normal range. All subjects in the sample were physically active and performed the horizontal jump to quantify, through the distance achieved, the effects of the procedures mentioned above. The jump was measured with a 10 meter long metal tape measure that was extended on the ground and fixed by tape to avoid dislocation during the test run. Survey participants performed the non-thrust jump of the upper limbs by placing their hands on their hips and with their feet parallel.

The final measurement was marked with a ruler perpendicular to the measuring tape and to the back of the foot. Three jumps of each subject of the sample were performed in each of the protocols followed (without stimulus (G1), with stretching (G2), with heating (G3) and with stretching plus warming (G4)). The duration of the test was two weeks where, on interleaved days, ie, with a 24-hour interval between one test and another, the subjects performed the jump respecting the suggested protocol for the day. The subjects who participated in the test had no history of recent lower limb joint injury or any other neuromuscular problems and were informed of the possible discomforts and risks that the test involved.

Results

a. The average results presented by each group, as shown in Table 1, were as follows:

b. Without heating/stretching: 160.56±15.60 cm (group 1);

c. With 10 minutes of passive stretching: 153.75±15.88 cm (group 2);

d. With 10 minutes of heating: 169.39±20.69 cm (group 3);

e. With 5 minutes of warm-up plus 5 minutes of passive stretching: 164.60±17.59 cm (group 4).

Table 1 Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Group1	11	137,67	183,50	16,05,591	15,56,919
Group 2	12	126,00	171,50	15,37,492	15,88,369
Group 3	11	136,50	200,43	16,93,909	20,69,361
Group 4	13	142,33	199,50	16,46,031	17,58,880
Valid N (listwise)	10				

Figure 1 shows, when comparing between groups, that there were no significant differences between them through ANOVA (p=0.1892).

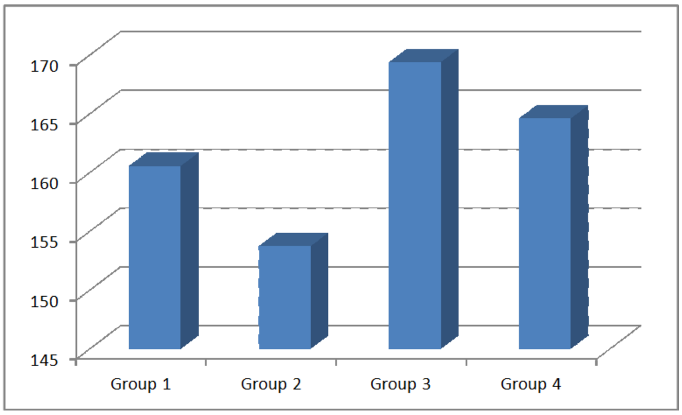

Figure 1 Comparison of the mean between the groups.

When comparing Group 1 with the other Groups through the t-Test, significant differences were obtained in Group 1 with Group 3 (p=0.004) and Group 1 with Group 4 (p=0.029).

It is observed that in the greater distance Group 3 obtained a percentage variation of 5.5% in relation to Group 1 without warming up/stretching.

When the groups were crossed, as shown in Table 2, the results found between Group 2 with Group 3 (p =0.014) and Group 2 with Group 4 (p=0.002) showing significant differences between them.

Tabel 2 Paired samples test

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% Confidence interval of the difference				
					Lower	Upper			
Pair 1	Group 2 – Group 3	-14,08,100	14,73,986	4,66,115	-24,62,526	-3,53,674	-3,021	9	,014
Pair 2	Group 2 – Group 4	-12,64,000	11,24,073	3,24,492	-19,78,202	-5,49,798	-3,895	11	,002
Pair 3	Group 3 – Group 4	1,34,455	9,98,524	3,01,066	-5,36,363	8,05,272	,447	10	,665

Discussion

The data obtained in this study indicated a reduction in muscle power when preceded by static stretching compared to warming up by running, as well as without any type of muscle stimulation (control) and running followed by stretching, ie with Static stretches the results were the worst. It also showed the importance of warming up before the jumps performed, when compared G1 with G3.

Regarding static stretching, the findings of the present study coincide with other researchers such as Fowles et al.[2] found a significant reduction when evaluating the maximum voluntary contraction strength of the plantar flexors after a 30-minute passive stretching session in this musculature.

Marek et al.[12] found a decrease in peak torque and isokinetic muscle strength when men and women performed static stretching and proprioceptive neuromuscular facilitation (PNF) protocols before strength tests, as well as Mahieu et al.[13] who investigated whether static and ballistic stretching programs would produce different effects on passive resistive torque measured during isokinetic passive motion of the ankle joint and tendon rigidity measured by ultrasound. The study results revealed that dorsiflexion range of motion increased significantly in all groups, but static stretching resulted in a significant decrease in passive resistive torque, but there was no change in calcaneal tendon stiffness. However, ballistic stretching had no significant effect on the passive resistive torque of the plantar flexors.

Avela et al.[14] analyzed the mechanical and neural responses of gastrocnemius and soleus after one hour of stretching, and observed a reduction in muscle activity of 10.4% and 7.6% in these muscles, respectively.

Junior et al.[15] compared the effect of flexibility training immediately before resistance training with 25 seconds of static stretching versus resistance training without flexibility training on maximal strength and cross-sectional area of the vastus lateralis muscle. Results showed that performing flexibility training immediately before resistance training decreased the number of repetitions, total volume and negatively affected muscle hypertrophy.

Tricoli & Paulo[16] concluded that, regardless of the mechanism involved, a static stretching session performed immediately before physical activity may cause a decrease in maximum strength yield.

On the other hand, Ruan et al.[17] demonstrated that static hamstring stretching significantly increased the height of the jump in a stop-jump test. The results suggest that hamstring stretching improved stop-jump performance due to decreased hamstring and quadriceps co-contraction.

Behm et al.[18] investigated the acute effect of intermittent static stretching with duration of 135 seconds for each exercise and lower limb warm-up on strength, static balance, proprioception, reaction time, and movement time and concluded that, although strength decreased, it was not sufficient to reach statistical significance, as Simão et al.[19] found no differences in the supine 1-RM test result when preceded by a Proprioceptive Neuromuscular Facilitation (PNF) session with six seconds of lift.

In another study by Fabrício et al.[20] the results showed that the acute effect of passive static stretching did not promote statistically significant changes in muscle strength and power of young soccer athletes.

It should be taken into account that in the present study the stretching exercises used were very superficial and extremely limited in relation to most sports situations. Usually in sports practice stretching exercises are performed several times divided into sets with various repetitions.

Conclusion

According to the results obtained in the study it can be concluded that the acute effect on the use of static stretching exercises may be contraindicated before physical and sports activities that use power strength. If the reduction in power strength occurs, it is suggested to be more careful in the use of static stretches before sports activities that have their success dependent on this type of force manifestation. It showed that warming up before exercise can contribute to a higher performance and that even without any stimulation (G1), the result was better than when the stretching group (G2) intervened. However, further studies should be performed taking into account other variables that were not used in this research to better clarify the use of both static and dynamic stretching exercises also before activities that require the use of maximum strength and endurance strength.

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Conflicts of interest

I declare no conflict, as only one researcher participated in the study.

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