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# Update Your Warm-Up Approach to Training and Competition

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A large amount of research has been conducted since 1950's concerning the proper warm-up regimens and recommendations for recreational and professional athletes before the training programs and the pre-event warm-up activities.

Given that a warm-up can undoubtedly be advantageous in muscle damage prevention and performance enhancement, taking into consideration recent knowledge growth and new theories development, there is much debate between specialists, regarding the type of warm-up methods choice and its relevant characteristics manipulation, in order to prepare athletes for training or competition [1].

Although the practice of some of the recommended warm-up components is widely undertaken, the value of warm-up is usually based on the trial and error experience of the athlete or coach, only few studies have investigated the warm-up related physiological changes in actual training or competition.

Summarizing the findings of the many warm-up studies conducted over the years is difficult [2]. Practically, several studies advocate that the warm up for power activities should include both general and specific activities [3], including stretching exercises as a part of general warm-up routine, as well as dynamic-ballistic exercises that mimic the main activity at progressively higher intensities in an attempt to increase neuromuscular activation. The purpose is obviously to prepare players for the game or training.

However, a number of practical questions rise concerning a) the necessity of static stretching in order to achieve the goals of injury prevention and performance enhancement, b) the relation and the order of using static and ballistic stretching to impair physical performance, c) the scientific base and the agreement between specialists to pick up the method they feel is best suited to the sport and the athletes.

Static stretching is the most frequently used technique to increase flexibility, because it seems to be more easily executed and safer than others [4]. However, many authors reported that the use of static stretching before maximal physical activity may temporarily reduce force and power production [5-7], vertical jump performance [8-10] and running speed [11,12]. In contrast, other studies have observed no detrimental effects of static stretching in selected neuromuscular parameters [13-16]. A number of mechanisms have been proposed to explain stretching decreases in force and power performance as: a) the low levels of musculotendinous stiffness [17], b) the reduced ability to recruit motor units [18], and c) the inhibition of the acute response of muscle proprioceptors, such as the Golgi tendon organs [19].

Therefore, some researchers tend to be against the use of static stretching before activities that require high levels of strength and power [5,20-22].

On the other hand, a number of studies have reported that ballistic stretching, which consists of fast specific movements that usually mimics specific sport kinetic patterns [23] can improve power production [11,24,25]. This temporary muscle performance increase has been attributed to a phenomenon known as PAP.

However, despite the increasing popularity of dynamic stretching, especially in power athletes, it is important that more research should be done examining its effects on athletic performance. Although PAP is a well known property of the muscle, the impact of PAP on human performance is less understood [26,27]. The mechanisms that cause PAP have been proposed to be related with metabolic changes within the muscle (phospolyration) as well as, with an alteration in a-motoneuron excitability as reflected by changes in the H-reflex [28] which, practically, tends to increase muscle force and rate of force development that occurs as a result of previous activation on the muscle.

Perhaps the foremost issue regarding PAP research would be to establish a greater degree of confidence with the population who would best be served by a potentiating exercise (athletes, specific athletic groups, recreationally trained individuals) followed by determination of the optimal characteristics of the potentiating exercise (load, volume) and recovery durations for that population [28].

The equivocal findings among the recently published studies may be due to a number of factors including intensity and volume of the preload exercise, duration of the rest intervals between the consecutive sets and before execution of the performance activity and gender, level and relative or absolute strength appeared to influence the ability of subjects to utilize PAP [29].

So what should we do? Should we do any stretching at all? Empirically many athletes perform plyometric exercises before a competition. Is that an effective technique?

The ideal flexibility for each sport activity is different. Practically, the optimal level of flexibility required to reduce the risk of injury, might not benefit performance since the compliant muscle – tendon unit absorbs and requires more energy to shorten and consequently delays and reduces external force production.

Thus, combined with its role in reducing muscle strains and enhance the performance, it may be advantageous to complete a routine that is conducted in the following order: Light aerobic exercise, static stretching, dynamic warm-up exercises, and main work out. Taking into consideration that warm-up effects are highly interindividually processes, trainers should be able to manipulate the order of the exercise to be used. The reverse order such that the dynamic warm-up exercises precedes the static stretching component of the work out, is something that athletes without any doubt can be advised to avoid.

Future research is needed to investigate the appropriate stretching techniques and the optimal level of flexibility which can maintain or improve performance in many sports with common physiological and neuromuscular characteristics.

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