

**EFFECTS OF ACUTE STATIC STRETCHING AND BALLISTIC STRETCHING ON VERTICAL JUMP PERFORMANCE**

**Introduction**

Stretching before performance is a common practice among athletes in hopes of increasing performance and reducing the risk of injury [1]. There are few types of stretching that are commonly used in a warm-up session, for example, static stretching, dynamic stretching, ballistic stretching, and proprioceptive neuromuscular facilitation stretching. According to the research by Bacurau et al. [1], they found that acute stretching had an effect on strength. The research subjects were 14 physically active women (169.3 ± 8.2 cm; 64.9 ± 5.9 kg; 23.1 ± 3.6 years) who performed three experimental sessions which is a control session (estimation of 45 degrees leg press one-repetition maximum at 1-RM), a ballistic session (20 minutes of ballistic stretch and 45 degrees leg press at 1-RM), and a static session (20 minutes of static stretch and 45 degrees leg press at 1-RM). Result shows that the maximal strength after static stretching changed from 213.2 ± 36.1 to 184.6 ± 28.9 kg, but it was unaffected by ballistic stretching (208.4 ± 34.8 kg). This shows that ballistic stretching could be more appropriate because it seems less likely to decrease maximal strength.

Static stretching is one of the most common types of stretching used by athletes. Static stretching is recommended for use in warm-up sessions and it is already proven safe to use for increasing muscle flexibility [4,5]. In addition, in a recent study by Bacurau et al. [1] comparing the effects of acute static and ballistic stretching on flexibility and maximal strength, the results indicated that static stretching exercises produced a greater acute improvement in flexibility compared with ballistic stretching exercises.

Ballistic stretching is a popular stretching method usually chosen by researchers. In previous studies, Bacurau et al., & Woolstenholme et al. [1,7] found that ballistic stretching can give positive effect on vertical performance. In Woolstenholme et al. [8]'s study, the results showed that only the ballistic stretching group demonstrated an acute increase in vertical jump performance 20 minutes after basketball play (p < .05).

Vertical jump is one of the important skills to almost all athletes, especially for basketball, netball, and volleyball players. If players jump higher, they will gain advantage by being closer to the goal ring. This will allow them to get a goal easily. Is there any increase or decrease in jumping performance after stretching? And is the effect on jumping performance different between acute static stretching and ballistic stretching?
THE EFFECTS OF SIX WEEKS OF PLYOMETRIC TRAINING ON THE HEIGHT OF VERTICAL JUMP IN HANDBALL PLAYERS

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Introduction

Plyometric is a type of exercise training designed to produce fast, powerful movements, and improve the functions of the nervous system in enhancing athletic performance [4]. Commonly when talking about plyometrics, we are referring to the stretch-shortening cycle which consists of two phases, the eccentric and the amortisation phase. Amortisation (or transition) refers to the time period between the eccentric contraction and the resultant concentric contraction [4]. A greater power output can be found when the stretch-shortening cycle is used because of the efficiency gained by releasing elastic energy stored in the muscles [2].

Power, the combination of speed and strength, is crucial in sporting events. The purpose of plyometrics training is the same as strength training which is to develop greater physical power and speed. While strength training can create muscular and nervous system adaptations necessary for power development, plyometrics focus on the component of speed in power and transforms the physiological changes into athletic ability [5].

The effectiveness of plyometrics is very well supported by research. One example is a research by Reymert et al. [6] with 17 healthy, male division 3 hockey players, between the ages of 18 and 24. All subjects were tested in the vertical jump, 40 yard dash time, 10 yard dash time, and anaerobic power using the Wingate Bike test prior to starting the plyometric program. The subjects then completed a four-week plyometric training program and were retested. There were significant differences in the right foot vertical jump height (p = .046) and left foot vertical jump height (p < .001). The findings suggested that two days of plyometric training a week for four weeks is sufficient enough to show improvements in single leg vertical jump height and overall power endurance. In contrast, plyometric training two days a week, for four weeks was not sufficient enough to show improvements in two foot vertical jump height, minimum power (W) values, and relative minimum power (W/kg) values [6].

Plyometric training has the potential to develop quicker reaction times that lead to an increase in an athlete’s speed and power. This type of training can improve performance in explosive sports that rely on moving speed and power such as hockey, basketball, volleyball and football [7].