Comparison Plyometric Rope Jumping with Different Work Interval 10,20,30 Second towards Speed

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Abstract. Plyometric rope jumping is an easy training, and it can be done anywhere, also have an effect of physical performance. The goal of this research is to compare the effectiveness of plyometric rope jumping training with 10, 20 and 30 second – work interval toward speed. The total of subjects in this research was 33 students (trained) which would be divided into 3 groups of 10 second – work interval (n=11), 20 second – work interval (n=11), and 30 second – work interval (n=11). The measurement of speed was by using running 40 meters test. This research used consecutive sampling method with pre-test – post-test control group design. Research has shown mean of age 19.30±0.91 years old, body mass index 22.05±2.46 kg/cm², leg 85.09±4.98 cm. There were significant differences (p>0.05) in speed with 10 second – work interval group (0.002), 20 second- work interval group (0.000) and 30 seconds-work interval group (0.037). In the ANOVA test there were not significant differences in speed(0.488). Plyometric rope jumping decrease speed with work interval 10, 20, 30 second.

Introduction
Nowadays there have been many different types of training methods developed to increase speed. One of them is plyometric exercises. Plyometric exercises can be used to improve the performance of athletes [1]. In addition to improving performance, plyometric training is also useful for preventing injuries and is able to be used as a treatment for athletes who are undergoing rehabilitation of ligament injuries. Plyometric is a very strong movement of muscle contraction to achieve maximum strain in the shortest possible time [2]. When stretching, there are three contractions that occur which are eccentric, isometric and concentric. Plyometric exercises can increase maximum voluntary contraction (MVC) during eccentric, isometric and concentric contractions [3]. The other hand, being able to increase muscle contraction strength, this exercise also affects the biomotor component. Plyometric exercises can increase strength, power and speed [1]. There are various variations of plyometric exercises such as rope jumping, squat jumps, drill boxes, depth jumps and standing jumps. Rope jumping is a plyometric exercise that is easy to do. Plyometric exercises can improve neuromuscular function during static and dynamic contractions [3]. The equipment are ropes and meters, rope jumping training can be done both individually and collectively.

Plyometric exercises use the ATP-PC energy system. The ATP-PC system can produce more energy if it is trained intermittently because there are rest periods for recovery. To be able to increase training using the ATP-PC energy system you can use interval training. Interval training is a method of training with repetitive work and intermittent breaks [4]. In the ATP-PC system the duration to use energy is not more than 30 seconds. The difference in work intervals determines the difference in
training results because it is related to recovery, for exercises that use high intensity, the ratio of work and rest is 1: 3 [4]. An effective model of exercise design is needed in the process of improving performance. The faster, easier and more effective is an important factor in making an exercise design program.

**Methods**

The type of research that was used was experimental field using a research plan of pre test and post testcontrol group design in three groups. The samples of this research were sport science students (trained) in FIO UNESA, sport sciencedeparmentwhich were chosen through consecutive sampling. The number of samples was 33 students in total where were divided into three groups randomly. The first group used a training using 10 second – work interval, the second group used a training using 20 second – work interval, and the third group used a training using 30 second – work interval. The ratio rest and work interval between 1:3. The plyometric rope jumping training was done by jumping a rope as high as 40 cm medial and lateral. This research was done as long as six weeks and measuring speed used 40 meters running test.

**Results and Conclusion**

There were many data which were gained from this research then they were analysed and matched with research’s aim. The results of research which were gained : the mean of ages of all groups 19.30±0.9 years old, BMI 22.59±6.7 kg/cm², leg 85.09±4.9 cm.

| Characteristic | Range±SD Group | p  |
|----------------|----------------|----|
| Age(year)      | 19.30±0.918    | 0.42|
| BMI(kg/cm²)    | 22.59±6.7      | 0.1 |
| Leg(cm)        | 85.09±4.9      | 0.49|
| n              | 33             |     |

Note: BMI (Body Mass Index), N (total sample), p(significant)

The age data, BMI( body mass index) and leg were homogenity due to p>0.05. The mean and standard deviation of plyometric rope jumping were 4.82±0.3 seconds. On the other hand, the value of homogeneity test using Bartlett test produced homogeneous data due to p>0.05. The results of homogeneity test on speed before the training of plyometric rope jumping were0.31. On the mean of pre – test and post – test on speed, the first group using 10 second – work interval experienced a decrease from 5.5±0.29 seconds to 6.08±0.38 seconds, the second group using 20 second – work interval experienced a decrease from 5.42±0.19seconds to 5.84±0.19 seconds, and the third group using 30 second – work interval experienced a decrease from 5.74±0.48 seconds to 6.07±0.39 seconds.
However, the speed variable revealed where the first group using 10 second – work interval showed there are no significant different (p=0.002).

**Table 2. Speed Variable**

| Variable | mean | Sig(2-tailed) |
|----------|------|---------------|
| Speed pre & post 10 second | -0.58±0.48 | 0.002 |
| n | 11 |

Note: n (total sample), Sig(significant p<0.05)

The second group using 20 second – work interval showed there are no significant different (p=0.000).

**Table 3. Speed Variable Second Group**

| Variable | mean | Sig(2-tailed) |
|----------|------|---------------|
| Speed pre & post 20 second | -0.41±0.25 | 0.000 |
| n | 11 |

Note: n (total sample), Sig(significant if p<0.05)

The third group using 30 second – work interval showed there are no significant different (p=0.037).
Table 4. Speed Variable Third Group

| Variable                | mean | Sig(2-tailed) |
|-------------------------|------|---------------|
| Speed pre&post 30 second | -0.33±0.45 | 0.037         |
| n                       | 11   |               |

Note: n (total sampel), Sig(significant if p<0.05)

The anova test results of plyometric rope jumping training groups using 10, 20 and 30 second – work interval on speed indicated there are were no significant different (0.488). The decreasing of work interval 10, 20, 30 second because fatigue and stretch reflex is impossible. A critical aspect of fatigue resistance when performing repeated bouts of high-intensity running activity is the capacity to counteract the adverse effects of peripheral and central fatigue on lower limb mechanical properties and sprinting mechanics [5]. Other fatigue mechanisms identified with repeated sprint activity involve the accumulation of inorganic phosphate (Pi) within the muscle cell [6]. In this study there were decrease in speed. The decrease in time on a 40 meter running after being given a plyometric rope jumping exercise treatment is assumed to occur due to a slowdown during running. The slowdown can occur because the intensity of the exercise is too high, causing fatigue during training. In fact, the respective maximal running speeds supported by aerobic and anaerobic metabolism for an individual athlete have each been identified as significant predictors of that athlete’s high-speed running performance capacities [7]. Muscle oxidative capacity and sodium/potassium pump activity, respectively, are the physiological parameters implicated with these particular fatigue mechanisms [7]. Rope jumping exercises are included in plyometric exercises, but the exercise movements that lead medially and laterally are not favourable for increasing the speed of the 40 meter (horizontal) run test.

Resistance sprint training increases speed more than plyometric exercises [8]. The ability to manipulate and control the orientation of the body and maintain a stable posture is therefore identified as a key factor that influences acceleration and speed performance over short distances [7]. Speed is the time achieved as short as possible which is influenced by reaction time and movement time. The ability to manipulate and control the orientation of the body and maintain a stable posture is therefore identified as a key factor that influences acceleration and speed performance over short distances [7]. Speed can be increasing with plyometric exercises with a straight forward motion. Because exercises that move medially and laterally like plyometric rope jumping are not beneficial in a straight motion

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