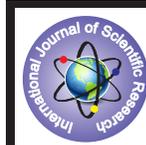


## Evaluation of Jumping Ability Between High Level Male and Female Athletes



### Physical Education

**KEYWORDS :** Vertical Jump, Squat Jump (SJ), Drop Jumps (DJ), Jumping Ability, Track and Field Athletes,

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### ABSTRACT

*The evaluation of jumping ability is very important for elite athletes. H jumping ability, directly related to athletics, having variable is essential for achieving a high-performance sports. The purpose of this study was to evaluate the jumping ability in top-level athletes in relationship to their sex. In this research participated 12 track and field athletes especially runners and jumpers (6 men and 6 women) with distinctions in sport. The instruments used were a force platform or forceplate (Kistler force plate) to measure jumping ability. To measure the jumping ability athletes were making vertical jumps (drop jump and squat jump). The survey was conducted in the laboratory of Sports Biomechanics (SBL) of Physical Education and Sport Sciences Department of Serres. The results showed that there were statistically significant differences between men and women, in the maximum power of the vertical jump (drop jump), in the maximum power of the vertical jump (squat jump), the maximum drop in the squat jump, the speed at takeoff during the squat jump, and the time duration of the vertical jump (squat jump).*

### INTRODUCTION

The stretch-shortening cycle is the succession of eccentric and concentric muscle activity (Svantesson et al., 1995). During this stretch-shortening cycle, stored elastic energy in the tendon structures in the phase of extension, due to the phase of the flexion (Komi et al., 1992). This stored energy can explain the positive work produced when the muscle which was previously stretched, contract concentrically (Cavagna et al., 1968).

Vertical jumps have been used in many studies, since they are a reliable measure of the mechanical strength of the lower extremities and jumping ability evaluation (Bosco et. al., 1982; Bosco et. al., 1995; Loturco et al., 2013; Nibali et al., 2013; Turner et al 2012). The squat jump (SJ), jumps with an initial acceleration downwards (CMJ) and drop jumps (DJ) were used to evaluate the jumping ability and maximum power of the lower limbs (Papadopoulos, 2005).

Athletes with a higher proportion of fast muscle fibers (type II), have the advantage in producing large eccentric force, as active by the size of motor neurons, and is also a type of muscle fibers which can increase the power output in fast kinetics activities (Enoka, 1996). They have been used in numerous studies to test the effectiveness of various training programs, as they are the most reliable method of measuring the maximum mechanical power of the lower limbs and evaluation of jumping ability (Bosco et al., 1982).

For evaluation of jumping ability and maximum power of the legs used the squat jump (SJ), with initial bending knees 90°, jumping with an initial acceleration downwards (CMJ), from up-

right) and jump performed with Fall (DJ) from various heights (Papadopoulos, 2005). With modern means such as force plate and special software analyzed the mechanical motion characteristics: the vertical reaction force and the vertical speed, the product of which is the mechanical power developed in vertical jump push phase (Zamparo et al., 1997) .

According to Kraemer et al. (1994), the main factors affecting the vertical jump are the maximum power, the power growth and neuromuscular coordination.

### METHODS

#### Participants

The sample consisted of 12 senior track and field athletes (men aged  $18 \pm 2$  years old, height  $182\text{cm} \pm 9$  and weight  $75\text{kg} \pm 6$  and women aged  $18 \pm 2$ , height  $166\text{cm} \pm 4$  and weight  $56\text{kg} \pm 5$  without injury problems. Participants were informed about the research protocol for the purpose and meaning and gave written consent to participate in it. Both the measurements and the experimental protocol took part in the Sport Biomechanics Laboratory (SBL) PESSD Serres.

#### Forceplate

For the measurement of vertical ground reaction forces, of the vertical jumps, was used a force platform KISTLER (9281CA, sampling frequency 1000Hz), which was equipped with 4 piezoelectric converters. To fully exploit the characteristics of piezoelectric crystals, the force platform was placed on the ground, using a special mounting frame (Mounting Frame, 9423), which were cast on the ground. The electrical charge generated in piezoelectric converters, due to external pressure, transported in

PC. For the conversion of analog to digital was used an analog-digital conversion KISTLER card (5606, 16 A / D Channels)

**Variables**

Fmax	N	Maximum Force
Vtakeoff	m/s	Take Off Velocity
Vmax	m/s	Maximum Velocity
max	cm	Maximum Height
tS	ms	Touch Down Time

**Table 1 : SJ & DJ Variables**

**Procedure**

Participants did warm up (5 min at Bicycle) with little overhead and then for 5 min performed light stretching, in main muscle that interested us: quadriceps, hamstrings and gastrocnemius.

**Squat Jump**

The number of attempts was 2 and the break between them 2-3 min. To capture the dynamic characteristics used a PC was connected to the force platform. The PC has installed special software ARIEL program, which records the dynamic data of the force platform.

**Drop Jump**

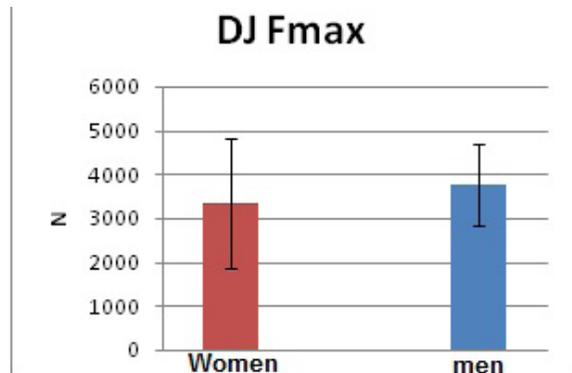
They drop jump from height 30 cm. The number of attempts for each height was two and the interval between attempts 2-3 min. To capture the dynamic characteristics used a PC was connected to the force platform. The PC has installed special software ARIEL program, which records the dynamic data of the force platform.

**Statistical analysis**

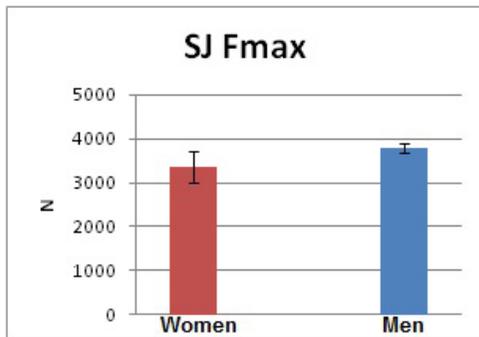
First used methods of descriptive statistics, calculated the average, standard deviation and standard error of the mean and followed inferential statistics. Originally became the control of regular distributions with Kolmogorov-Smirnov test. To determine the impact of training on the characteristics of variables between groups was used the t-test analysis of variance with repeated measures (Repeated Measures). Differences between variables were tested at a significance level  $p \leq 0.05$ .

**RESULTS**

From the results statistically significant difference observed in the averages of the maximum force to the maximum vertical jump of different drop height (DJ) with  $p = 0,013$ (Figure 1), the averages of the maximum force to the maximum vertical squat jump (SJ) between men and women with  $p = 0,000$  (Figure 2), the averages of touch down time of the vertical squat jump (SJ) with  $p = 0,007$  (Figure 3), the averages of the maximum take off velocity in the vertical squat jump (SJ) with  $p = 0,000$  ( Figure 4) and the averages of the height of the vertical jump (SJ) with  $p = 0,000$  (Figure 5).



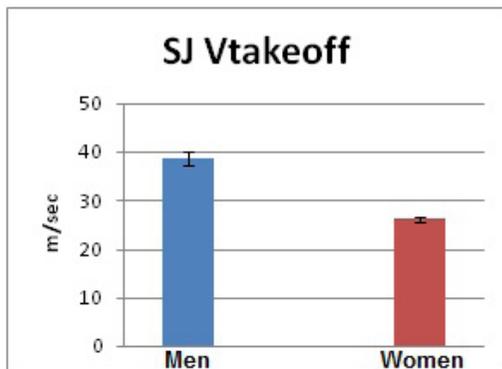
**Figure 1:** The maximum force to the maximum vertical jump of different drop height (DJ)



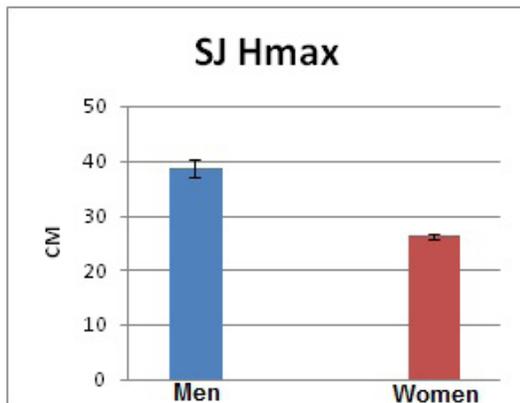
**Figure 2:** The maximum force to the maximum vertical squat jump (SJ)



**Figure 3:** Touch down time of the vertical squat jump (SJ)



**Figure 4:** The maximum take off velocity in the vertical squat jump (SJ)



**Figure 5:** Maximum height of the vertical jump (SJ)

## DISCUSSION

The aim of this study was to see if the high-level track and field athletes show quite big differences as regards their jumping ability in relation to the sex. We observe that men have better vertical jumps than women. Athletes, who have a higher percentage of slow muscle fibers in vastus lateralis, achieve higher storage of elastic energy during vertical jumps, as demonstrated by the higher, in this percentage difference between the DJ jumping height and SJ (Bosco et. Al., 1982). Gender does not influence the quality of our muscle, but affects their quantity. Although the muscle tissue of men and women are characteristically the same, men generally have more muscle tissue than women, and muscle size is increased by the presence of testosterone, the male hormone.

Investigations of Buehrle et al., (1985) concluded that the maximum power is the basis for the development of strength force. The same conclusion comes and Gollhofer (1987), who after a thorough factorial analysis of all factors affecting the jumping ability, he found that the vertical jumping ability while dynamic form of power is an independent power capacity, while growth is based on developed a good level of maximum power.

Therefore the results found in the research we did seem to agree with the survey results of other researchers, the superiority that had the men athletes against women athletes is normal feature of their nature since as men are stronger and jumping ability is based on the maximum force person.

## CONCLUSION

In conclusion, although there were several limitations to this research the survey results agree with the results of other researchers. They should also be noted some proposals for new studies. At the end of the measurements must be taken of all the results, to see the differences in each group and then compare them with each other. This whole process will produce correct results and accurate interpretations of all these measurements.

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