



## Evaluation of Strength Between High Level Male And Female Athletes

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### ABSTRACT

*The evaluation of strength is very important for elite athletes. The strength is directly related to athletics as well as is essential for achieving high-performance in sports. The purpose of this study was to evaluate the strength in elite athletes in relationship to their gender. In this research participated 12 athletes especially runners and jumpers (6 men and 6 women) with distinctions in sport. The maximum Isometric, Eccentric and Concentric force of the lower limbs was measured. The instruments used were one multijoint isokinetic machine type (hydromechanics SA), located in the Sports Biomechanics Laboratory (DAC) of the Physical Education. Serres, for the measurement of isometric, the eccentric and concentric force. The study was conducted in the laboratory biokinetics (ODA) of Physical Education Serres. The results showed that there were statistically significant differences between men and women in body weight in body height, the maximum isometric strength, the maximum concentric force, the maximum eccentric force,*

**KEYWORDS :** maximum strength, isometric, Eccentric, concentric, jumping ability, track and field athletes, athletics, gender,

### 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 shortening this stored energy can explain the positive work produced when the muscle concentric contract, which was previously stretched (Cavagna et. Al., 1968).

Viitasalo et al. (1984), examine the effect of training in isometric force-time (ft), eight men jumpers measured, checked six to seven times during a twelve month period. Fluctuations in the isometric maximum force, the rate of force development of isometric force (RFD), as well as the vertical jump height during the follow-up period compared with the changes in the results of the maximum vertical jump. The isometric strength and height of the vertical jump were found to have higher values compared to the other seasons (competitive seasons in January and July-August). The rate of force development of isometric force may be the result of a momentary situation at the time of the vertical leap.

Young et. al. (1995), investigates the relationship between power meters and sprint performance, and determines whether these relationships vary for different phases of free running speed. Measured

twenty (11 men and 9 women) top athletes. Pearson correlation analysis showed that the single best predictor of performance entry (2,5 m time) was the peak force (relative to body weight) produced in the course of a jump from an angle of 120 degrees of knee (concentric contraction) ( $r = 0.86, p = 0.001$ ). The single best correlation in maximum speed sprint power was applied to 100 ms (compared to body weight) by the start of the vertical jump action (concentric contraction) ( $r = 0.80, p = 0.001$ ). The conclusion was that endurance athletes was related to their performance in the sprint and this relationship change the maximum speed at startup.

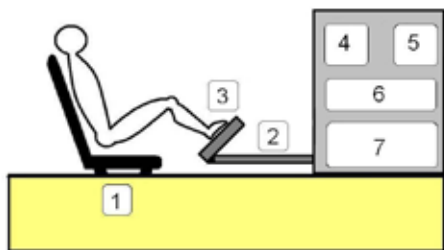
### MATERIAL & METHODS

#### Participants

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

**Multyjoint isokinetic machine and force platform**

In this study was used a multijoint isokinetic machine (type hydro-mechanics SA), located in the Sports Biomechanics Laboratory (SBL) TEFAA Serres. Also used a force platform AMTI (ADVANCED MECHANICAL TECHNOLOGY INSTRUMENTS-model number OR 6-6-4000, Serial number 5157, sampling frequency 1000Hz) that stood over a rigid metal frame in the isokinetic dynamometer and moved by means of a metal shaft. Then was transferring the generated electric charge, the elastic laminates of force plate by the external pressure, the PC and converting the analog signal to digital, for which was used by the analog-digital card AMTI (32 channel analog data, 2006, version 2.02).



1. Seat adjuster, 2. Displacement piston, 3. Force platform, 4. Speed adjuster, 5. Resistance adjuster, 6. Electric motor, 7. Oil Tank

**Variables**

Fmax	N	Maximum Force
F30	N	Force in the first 30 ms
F60	N	Force in the first 60 ms
F100	N	Force in the first 100 ms
tFmax	Ms	Time of the Maximum Force

**Table 1: Isometric Force**

Fmax	N	Maximum Force
F30	N	Force in the first 30 ms
F60	N	Force in the first 60 ms
F100	N	Force in the first 100 ms
tFmax	Ms	Time of the Maximum Force

**Table 2: Eccentric Force**

Fmax	N	Maximum Force
F30	N	Force in the first 30 ms
F60	N	Force in the first 60 ms
F100	N	Force in the first 100 ms
tFmax	Ms	Time of the Maximum Force

**Table 3: Concentric Force**

*Procedure*

*Isometric contraction*

Participants in multijoint isokinetic dynamometer placed the feet on force platform that the angle of the hip joint is 90 degrees, which were fixed with straps to the hip joint and shoulders. They were asked to measure the maximum isometric force (Fmax-iso) an angle of 120° to the knee joint (3 attempts). The Directive on isometric efforts was to push the suffering of the explosive force platform and maintain the power of a high level for about 2-3 sec.

**Eccentric contraction**

Participants in multijoint isokinetic dynamometer placed the feet on force platform that the angle of the hip joint is 90 degrees, which were fixed with straps to the hip joint and shoulders. It was measured the maximum eccentric force (Fmax - ecc) at the speed, in angle range 130-160 into the knee joint. The Directive on eccentric efforts was to push the maximum force platform and maintain the power of a high standard.

**Concentric contraction**

Participants in multijoint isokinetic dynamometer placed the feet on force platform that the angle of the hip joint is 90 degrees, which were fixed with straps to the hip joint and shoulders. Measured maximum concentric force (Fmax - con), at a speed of 0,20m / s and the range of motion in the knee joint 130-160. The directive on concentric force was to push the maximum force platform and maintain the power of a high standard.

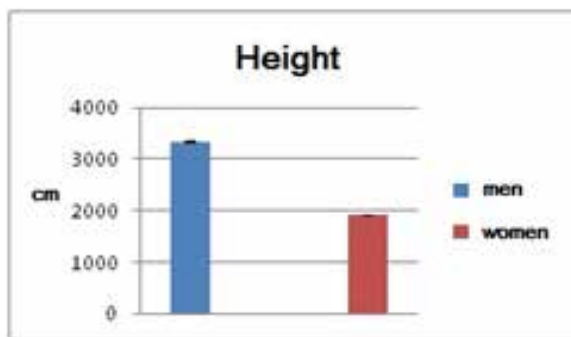
**RESULTS**

We compared the differences between men and women in athletics in their dynamics in maximal concentric and eccentric isometric efforts using the t-test (comparison of averages of different groups).

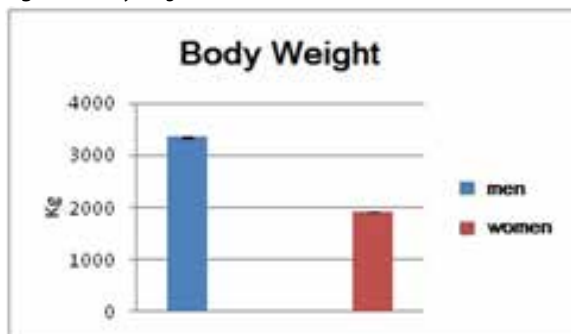
The results showed that all the variables in total there were significant differences in the following variables.

*Anthropometric characteristics*

From the results statistically significant difference in average body height between men and women with  $p = 0,011$  (Figure 1) and the average weight gain with  $p = 0,001$  (Figure 2).



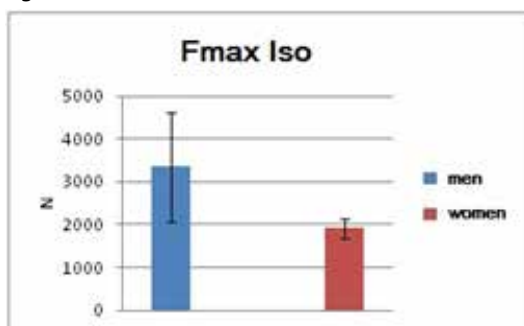
**Figure 1:** Body Height



**Figure 2:** Body Weight Force

From the results statistically significant difference in the averages of maximum power during the eccentric effort between men and women with  $p = 0,000$ , (Figure 3), the averages of the maximum force during the isometric effort with  $p = 0,004$ , (Figure 4) and the averages of the maximum power during the concentric effort  $p = 0,000$  (Figure 5).

**Figure 3:** Maximum Isometric Force



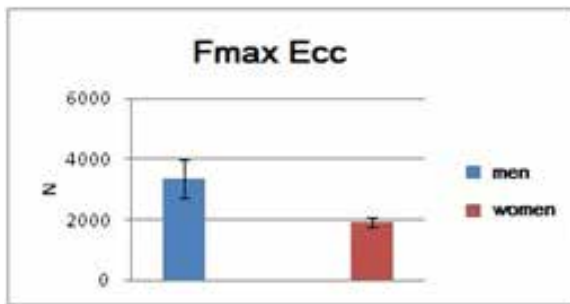


Figure 4: Maximum Eccentric Force

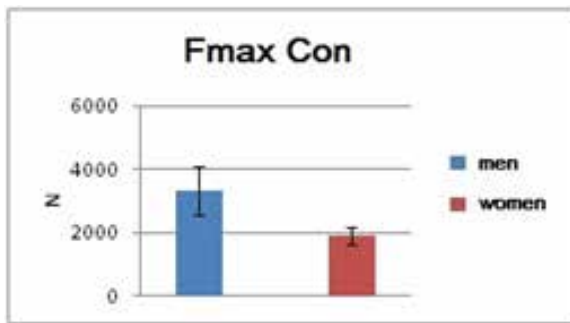


Figure 5: Maximum Concentric Force

## DISCUSSION

The aim was to see if the high-level athletes show quite big differences regarding the strength ability in relation to the gender.

First of all, prior to carrying out the study we measured body weight and body height of the athletes. We saw that men were superior in both against women.

Studies dealing with this issue show significant differences between the races in body size, physical dimensions and proportions, and to the degree of biological maturity (Eveleth & Tanner 1990; Beunen et al. 2006; Haas & Campirano 2006).

It is also distinct differences in comparisons made between high-level athletes of various sports (Carter 1984). Data from young Americans, of African origin, show that on average tend to mature faster than their European peers to organic maturation markers (Ontell et al. 1996; Malina et al. 2004).

Also the same seems to be the case with young Japanese (Ashizawa et al. 1996) and young Chinese (Ye et al. 1992), in terms of skeletal maturation. There are also differences between the Japanese and Chinese in the first have age lead to skeletal maturation. The explosive increase in the level (peak height velocity, PHV) occurs in a very small number of girls, very early in the 9.5 years too late at 15 in others (Lindgren 1978).

Boys can do the same with a variation from 11 to 17 years old. Generally on average PHV occurs at 12 for girls and 14 for boys. At the age of 13 years old girls are characterized biologically young women, while at the same age boys are still children (Åstrand 1992). Accordingly there that boys age have a longer biological maturation therefore it is normal to have a higher body height and higher weight compared to women.

### Force

We found, however, major differences in maximum concentric, eccentric and isometric strength. All the men were superior to women.

Studies have shown that the presence of testosterone in the female body is very small, so that women will not be able to gain muscles like those of men, even if they wanted. The woman that is insufficient to gain similar muscled like a man, when subjected to the same

strength training program with him, not due to the fact that it lacks the hormonal chemical tool to succeed. Some athletes who develop excessive muscle have unusually high levels of testosterone, either by natural or by chemical aids. The larger the active body (muscle) of human is, produce the higher maximum power.

The force largely depends on the diameter of the fiber. Other critical factors are the construction of the fiber, muscle fit and elasticity.

We see therefore that the results found in the research that we carried out for the evaluation of the force at different sheet athletes consistent with other research studies.

## CONCLUSION

In conclusion, although there were several limitations to this study the results are consistent with the results of other researchers.

It should also be noted some proposals for new studies. According to these measurements should all be done properly by the teams and experts their supervisors and shall be included in these similar coaching methods.

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