DYNAMIC ANALYSIS OF THE JUMP IN LENGTH: A COMPARATIVE STUDY AMONG MALE AND FEMALE ATHLETES

D. Matavel, L. Fernando, A. Fabião, A. Graziano(*)
Faculdade de Educação Física e Desporto, Universidade Pedagógica, Mozambique
(*)Email: albertograziano06@gmail.com

ABSTRACT

The purpose of this study was to make an analysis of changes in dynamic parameters jump in length in Athletes of Maputo City Clubs. For quantifying the dynamic parameters of the study was used a force plate Bertec # K80204 (4060-15) linked to a conversion board A / D 16-bit and a computer with a sampling frequency of 2000 Hz and a time acquisition of 6 seconds, sufficient to record all the time to support the lower thrust member. The study was organized in two working sessions in a single period in the morning. The first session consisted of a free heating lasting 20 minutes. The characteristics of this heating resembled the preparation for a workout. Following the heating, the athletes performed successive tests of progressively adjusting the measuring device, namely the thrust forces on the platform that was used to collect data dynamometer. Overall, there were no statistically significant differences between the two groups of our sample, except the vertical force Fz in function of time (F = 18.807, p = 0.05) and the Fz\textsubscript{max} (F = 3.251; p = 0.05).

Keywords: Long jump, biomechanics, dynamics, ground reaction force.

INTRODUCTION

The Long Jump (LJ) is a purely technical proof of Athletics, consisting of an approach run, call, flight and fall. It has been analyzed since the late sixties in order to maximize yield. This can be seen by observing the literature focusing on this subject (Bruggmann and Nixdorf 1990; Hay & Miller, 1985; Hay et al., 1987, Hay, 1994; Ozolin, 1965; Less, et al, 1994. These studies have been concentrated on the cinematic aspects, observing almost no research on the dynamic context. Another issue focuses on the fact that most of these studies address the approach run, race-bound connection and special exercises to improve aspects of the race and lead or flight phase.

The fundamental literature problem of (LJ) is the transformation of horizontal velocity (V\textsubscript{x}) that the athlete is excited about vertical speed (V\textsubscript{z}) with little loss of V\textsubscript{x} (Hay et al, 1985; Lees et al., 1994; Locatelli, 1994; Strizhak, 1989). However in the call (LJ) is the time or stage at which it finds a wide range of complexity, with all its implications for performance (Lees et al., 1994).

According to Hay (1994) despite having assembled a variety of studies and knowledge of the different phases, technical and practical consequences of changes in the Long Jump little is known biomechanics of the call, and that it should occur the most important developments. In Mozambique, no studies related to call in long jump was performed.

And according to the present study sought to analyze the variations of dynamic parameters in the Long Jump in Mozambican athletes from the Maputo city Clubs.
RESULTS AND CONCLUSIONS

The strength of the reaction Amadio (1989) is seen as the main component to characterize the stance phase of the sports movement.

When we analyze the jumps and particularly the long jump, we find that the stance phase, according to Amadio (1989), is a complex phenomenon from a biomechanical point of view, since many dynamic variables influencing this movement phase. Also according to this author, the resulting muscle strength in the call is the product of the action of various forces such as braking forces and acceleration boost.

As you know the sports physical performance levels are quantified by force parameter expression, resulting hence the importance of coaches and athletes attach to this capability as a performance factor.

Table 1 lists the values for dynamic measurement of the maximum vertical component of the ground reaction force normalized by body weight of the athletics, the horizontal component in the jump direction, the medial-lateral support member and the length of time obtained in this study, in the long jump.

Table 1 - Dynamic Measurement results of mean values (x) and standard deviation (sd) of the maximum vertical force ($F_{z_{\text{max}}}$), Maximum horizontal force in the jump direction ($F_{y_{\text{max}}}$), maximum medial-lateral force ($F_{x_{\text{max}}}$), time duration of support($\Delta t$) and the ratio between the maximum vertical force and body weight ($F_{z_{\text{max}}}/G$) for the male group (1) and female (2).

<table>
<thead>
<tr>
<th>Group</th>
<th>$F_{z_{\text{max}}}$ (N)</th>
<th>$F_{y_{\text{max}}}$ (N)</th>
<th>$F_{x_{\text{max}}}$ (N)</th>
<th>$\Delta t$ (s)</th>
<th>G (kg)</th>
<th>$F_{z_{\text{max}}}/G$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3597.16+807.3</td>
<td>818.12+18.</td>
<td>393.59+154.</td>
<td>0.16+0.0</td>
<td>71.30+4.5</td>
<td>5.04+0.2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>67</td>
<td>90</td>
<td>2</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2508.41+484.3</td>
<td>830.62+26.</td>
<td>297.97+137.</td>
<td>0.15+0.0</td>
<td>57.57+4.6</td>
<td>4.35+0.3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>69</td>
<td>30</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Relative to the peak vertical force the male group showed the average value of 3597.16 N for a time of 0.16 seconds, and the female group the 2508.41N value for a time of support 0.15 seconds. As for the horizontal force in the movement direction ($F_y$) as well as the medial-lateral force ($F_x$) average values were 818.12N and N 830.62 and 393.59 and 297.97 N respectively for male and female group.

The results obtained in this case study, was found that the maximum vertical force is superior, in all cases, the horizontal components in the jump direction and the medial-lateral force. This means that athletes in our sample issued in an efficient way to produce the high levels of production of the vertical force. It is also observed that the value of the horizontal force in the jump direction is higher than the average lateral force in all cases.

If we consider the positive values for the horizontal force in the jump direction ($F_y$), we found that the lowest value is for the male group which leads us to interpret this group, compared to the female group, has lower values of positive acceleration in the horizontal direction. As for the values of the medial-lateral horizontal force, we found that the male group presented a higher value than the female group. This result reflects a greater strong movement of supination.

Comparing the values of maximum vertical force of the present study, with the values obtained in other studies obtained in the athletics (Table 2), particularly in the long jump, the
triple jump and high jump, the values of maximum vertical force obtained in these studies (5500 N-15900 N), have considerably higher values. We believe that these results are due to the fact that athletes have made the leap in laboratory conditions which influenced greatly the support (active foot placement) which is generally used in this modality.

Table 2 - Maximum reaction force values ($F_{z_{\text{max}}}$) in the stance phase in different movements. Mode reaction force (N) Vertical Transverse Longitudinal.

<table>
<thead>
<tr>
<th>Modality</th>
<th>Reaction Force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical</td>
</tr>
<tr>
<td>walking*</td>
<td>700-1000</td>
</tr>
<tr>
<td>run (sprinter)*</td>
<td>2000-3000</td>
</tr>
<tr>
<td>Highjump*</td>
<td>3000-6000</td>
</tr>
<tr>
<td>Highjump ****</td>
<td>6950±1500 – 7950±450</td>
</tr>
<tr>
<td>Long Jump *</td>
<td>5500-7000</td>
</tr>
<tr>
<td>Long Jump***</td>
<td>5030-7500</td>
</tr>
<tr>
<td>Highjump *</td>
<td>2000</td>
</tr>
<tr>
<td>Triple jump**</td>
<td>10000-15900</td>
</tr>
</tbody>
</table>


As is known, the active foot placement in the soil reduces the horizontal vector $v_x$, thereby reducing the horizontal forces on the ground braking moment of impact and is supported by Ozalin (1965, apud Conceição, 1996).

However, there is a current which states that the leg should contact the locked way call which is defended by Tilupa et al. (1982) (Conceição, 1996). The foot, according to these authors, contacts the ground in a large horizontal velocity in the direction of the run. This fact leads to a strong force of reaction soil, which causes a horizontal braking and a large reduction of CM $V_x$ during the early part of the next stage (Conceição, 1996).

On the other hand, we believe that the differences observed, translate probably the differences in the type of training and competition in our athletes, compared to athletes from other countries.

It was also calculated that the ratio between the maximum vertical force and body weight ($F_{z_{\text{max}}}/G$), is the ratio of the vertical reaction force to the body weight (Table 1). For our sample, the average values were 4.5 for males and 4.35 for females group.

Comparing to the values presented in Amadio (1989), for the jump moving length, high jump and the triple jump (11-18 times body weight), our results are considerably lower. We think that this result is related to the fact that the athletes in our sample did not implement major
mechanical loads. We believe that these results were considerably less vertical impact compared to those reported by other authors.

Overall, there were no statistically significant differences between the two groups of our sample except the vertical force $F_z$ in function of time ($F = 18,807, p = 0.05$) and the $F_{z\text{max}}$ ($F = 3.251, p = 0.05$). We believe that this is probably related to different levels of the different muscle groups of the lower limbs, as well as with different choices dictated in execution technique, in addition to the above, by differences in body build (sexual dimorphism to the dimensions of the leg muscles).

Compared the average values of the two groups shows that male reached greater results in $F_x$ and $F_z$. Which meet with Malina (1987) that a larger size and a greater length of the levers by the male provide better performance tasks that require the coarse displacement body in space. While a greater amount of fat mass, equivalent to more than dead weight to move, of the female part, it will hinder body movement tasks in space.

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**REFERENCES**


