JUMPING PERFORMANCE OF YOUNG GIRLS IN TRACK AND FIELD

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INTRODUCTION: Jumping performance, as demonstrated by several types of vertical jumps performed on a force platform by individuals of different ages, varies in terms of the biomechanical analysis of the force-time curve (Dowling et al., 1993, Harman et al., 1990). The purpose of the present study was to examine the factors related to the jumping performance of young girls involved in track and field running and jumping events.

In track and field, jumping performance plays a decisive role in the effective performance of movements. Young children specializing in this event present similarities as well as differences in this specific performance. This study was aimed at examining the parameters of jumping performance in a group of young girls, giving special emphasis in the variable conditions, relationships and factors.

METHODS: Fourteen young girls, averaging in chronological age 12.53 ± 1.24 yrs, body height 160.78 ± 9.78 cm and body weight 48.00 ± 8.17 kg, participated in the study. Their performances were measured on a force-platform (Kistler type 9281 B, Instrument Corp., Amherst, NY) and sampled at 250 Hz while performing a test consisting of a vertical jump while swinging the arms (With Arms Jump - WAJ) (Fig. 1) and another without swinging the arms (Countermovement Jump - CMJ) (fig. 2).

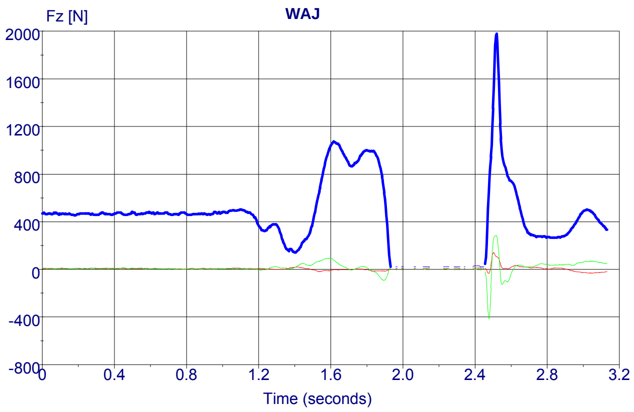

Fig. 1. Force time structure of vertical ground reaction force (Fz) during vertical jump while swinging the arms (With Arms Jump - WAJ) of one subject.

The following results were obtained by employing temporal and force time analysis and using the specialized software program Bio-Ware. Descriptive, correlation and factor analysis (SPSS and STATISTICA 5.0 packages) were used for the statistical analysis.

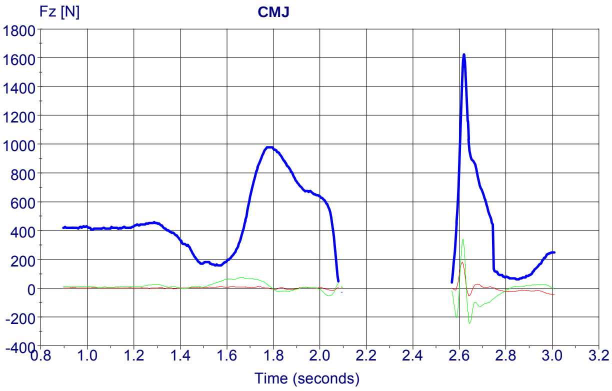

Fig. 2. Force-time structure of vertical ground reaction force (Fz) during countermovement jump (CMJ) of one subject.

RESULTS: The maximum height of the center of gravity in WAJ (30.25 ± 4.07 cm) was higher than in CMJ (26.25 ± 3.50 cm), (table 1). In contrast, the relative force exhibited by the subjects was lower in WAJ (1.33 ± 0.17) than in CMJ (1.48 ± 0.18).

Table 1. Mean values, standard deviations and coefficients of variation of the parameters of jumping performance in the two types of vertical jumps (WAJ and CMJ).

	Parameters	**WAJ** (M , SD, CV%)	**CMJ** (M , SD, CV%)
1	Maximum height of center of gravity (cm)	30.25 ± 4.07 - 13.4	26.05 ± 3.50 - 13.4
2	Vertical velocity of take-off (m/s)	2.430 ± 0.16 - 6.6	2.250 ± 0.15 - 6.7
3	Relative Force (Max Fz / Bw)	1.330 ± 0.17 - 12.8	1.480 ± 0.18 - 12.2
4	Duration of take-off phase (s)	0.764 ± 0.17 - 22.2	0.687 ± 0.08 - 11.6
5	Duration of flight phase (s)	0.496 ± 0.03 - 6.1	0.460 ± 0.03 - 6.5
6	Duration of negative impulse (s)	0.292 ± 0.09 - 30.8	0.285 ± 0.05 - 17.5
7	Duration of positive impulse (s)	0.445 ± 0.10 - 22.5	0.374 ± 0.06 - 16.0
8	Duration from minimum to maximum force (s)	0.407 ± 0.17- 41.8	0.259 ± 0.05 - 19.3

Higher coefficients of variation were observed in the WAJ variables, indicating a higher variability in the way the vertical jump was performed. The duration of the take-off phase was 0.764 ± 0.17 s, and the duration from minimum to maximum vertical force was 0.407 ± 0.17 s, with the coefficient of variation being high (41.8%). The variability in the performance of the WAJ, in relation to the performance of the CMJ, is also shown in Figure 3, where it is evident that all parameters except flight duration exhibit significant non-homogeneity. This indicates lack of coordination of movements and technical performance in the attempt of the jump while swinging the arms; an observation which did not appear in the case of the vertical jump without swinging the arms. This observation was also verified by the enhanced relative force achieved in CMJ, compared to WAJ, since the CMJ is performed within a more technically advantageous framework.

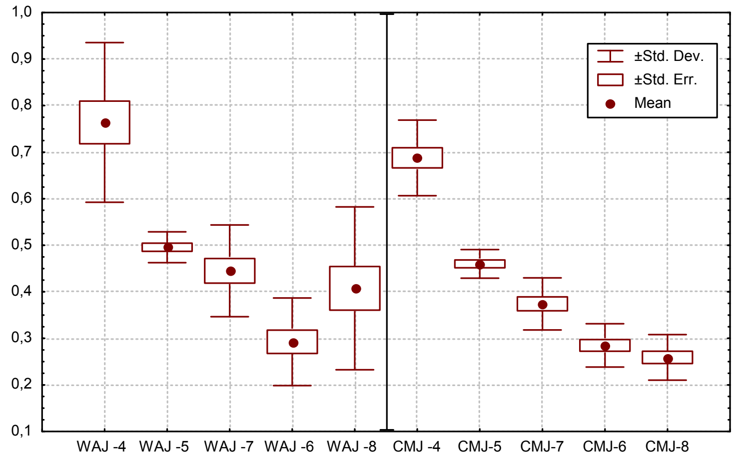

Fig. 3. Means, standard deviations and standard errors of the time parameters (in sec) in the two types of vertical jumps (WAJ and CMJ).

The correlation analysis of the parameters showed that in both types of jump the score of each jump (maximum height of center of gravity) was not significantly related to the various time parameters, or to the relative force. It is, however, interesting to notice the fact that the number of significant correlations among the WAJ parameters was nearly three times higher than the number of the corresponding CMJ ones. Particularly for the WAJ, the most important correlations were observed to be between the relative force and the duration of the take-off phase (r=-0.608, p=.021), just as was the time duration of the positive impulse (r = -0.683, p = .007) (Fig. 4). Such findings were not evidenced in CMJ, however.

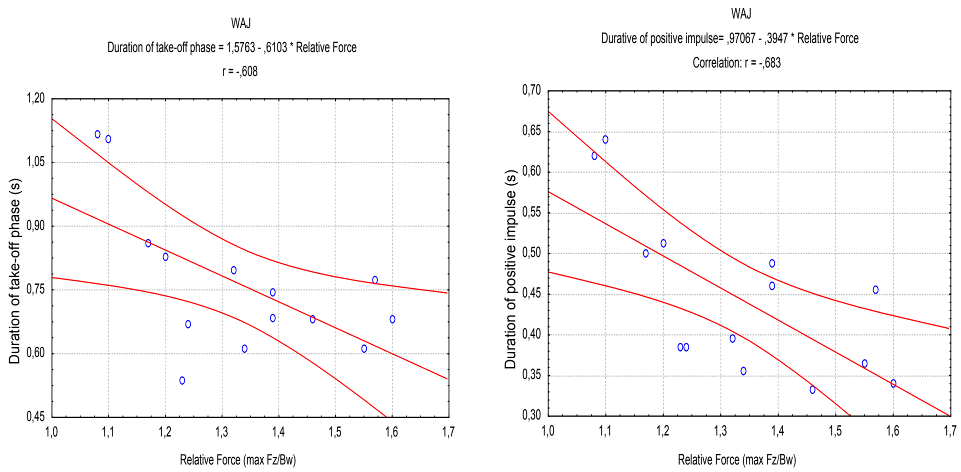

Fig.4. Statistically significant correlations between the examined WAJ parameters.

It is of interest to note that the duration of impulse is significantly correlated with the duration of negative impulse (r=0.880, p=.001), the duration of positive impulse (r=0.892, p=.001), and the duration from minimum to maximum force (r=0.727, p=.003). Likewise, a significant correlation (r=0.572, p=.033) was observed between the duration of negative impulse and that of the positive one. For the CMJ, the only important positive correlations are observed to be those between the duration of the take-off phase and the duration of negative impulse (r = 0.743, p=.003) and the duration of positive impulse (r = 0.808, p =.001), (fig.5).

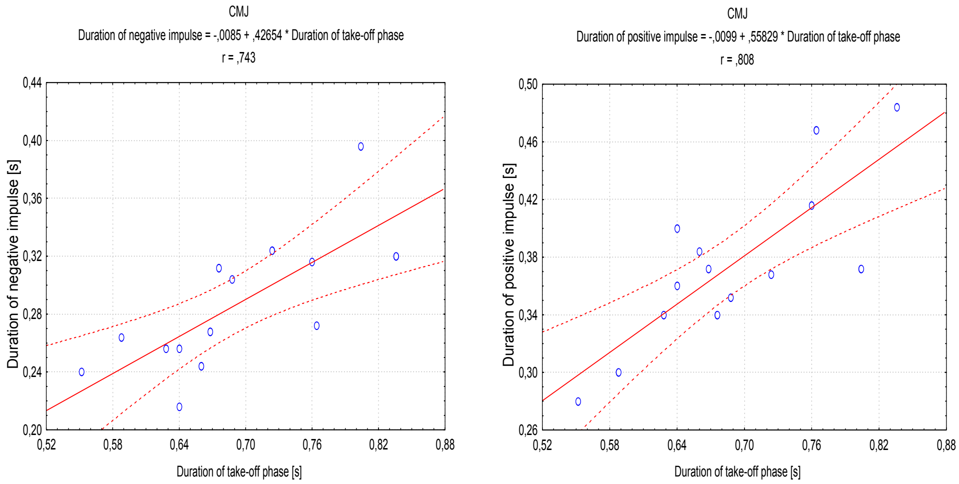

Fig. 5. Statistically significant correlations between the examined CMJ parameters.

The difference of performance in the two types of vertical jumps was also verified by means of factor analysis. This approach revealed that 66.5% of the WAJ performance and 55.9% of the CMJ performance could be explained by two factors. The factor analysis showed that: (a) the duration of the take-off phase and the relative force applied by the subjects played important roles in WAJ jumping performance; (b) the duration of the flight phase, the maximum height of center of gravity, the vertical velocity, and the duration from minimum to maximum force played the prime roles in CMJ jumping performance.

CONCLUSIONS: The sample of young girls participating in the study exhibited differences in the factors related to their jumping performances. The lack of coordination of movements was especially obvious in WAJ. These results are different from those observed in jumping performance studies performed with older individuals, suggesting that further research is required at this basic stage of athletic development. In order for the children of ages 11 to 13 - who are taking their first steps in athletic activities - to make the most of their kinetic abilities, a better and more thorough study of the factors of their jumping performance is of utmost importance. Consequently, the results of these studies are very valuable for the rationalistic selection process of talented young girls in running and jumping events in track and field.

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