REGRESSION ANALYSIS ON LONGITUDINAL KINEMATICAL DATA FROM ONE ELITE HIGH JUMP ATHLETE IN COMPETITION

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INTRODUCTION

This abstract aims to provide some insight into data that was collected as part of the scientific support for an elite female high jump athlete (personal best 2.05m) during the last two years prior to the 2008 Olympic Games. Dapena et al. described the influence of kinematical parameters on a population basis [1]. A study of Greig & Yeadon [2] discussed the influence of touch down parameters on the performance over several (16) training jumps within one male athlete. Similar data from one elite female athlete has not yet been published. The present data set is unique because of the high skill level of the subject and the number of jumps (55) that all were recorded during international level competitions.

METHODS

This abstract concerns a subsample of 16 jumps that were manually digitized by the same observer. The jumps were recorded with four 100Hz cameras placed around the competition site. 19 body landmarks were tracked in Simi Motion and lowpass filtered at 6Hz. 3D reconstruction was realized through a DLT-11 algorithm. Segmental mass distribution was obtained from a geometrical model of the athlete. From each trial 21 parameters were calculated that were assumed to have a potential influence on the performance. The apex of the flight path of the center of gravity (Z_{apex}) was obtained from a 2^{nd} order polynomial regression of the flight path. Linear regressions of the parameters versus Z_{apex} were calculated with SPSS 15.0.

RESULTS AND DISCUSSION

As expected from literature [1, 2] the highest positive correlation (R=0.64 p=0.01) was found for horizontal velocity prior to touch down (V_{hor}) (table 1). It should be noted that the athlete has a very high V_{hor} ($7.50\pm0.11 m.s^{-1}$) (table 2) with respect to values reported in other studies [1-3].
A trend towards a significant correlation (R=0.48 p=0.06) was found in the minimum knee angle during amortization ($\alpha_{knee\ am}$). Less knee flexion could be interpreted as higher leg stiffness resulting in a higher jump.
In contrast to Greig & Yeadon [2] a negative correlation with the backward lean or α_{plant} was observed. It seems that for this athlete α_{plant} has an optimum around 39.5° and should rather be fitted with a 2^{nd} order polynomial (figure1).
The height of the center of gravity at touchdown (Z_{td}) and the activeness of the arms (ACT_{arm}) have been reported to have a influence on a population basis [1] but showed almost no correlation in this individual in competition (R<0.25).

Overall it is obvious that the correlations in Greig & Yeadon [2] are higher than in this study. This could be partly explained by the higher variation in the approach parameters in the latter induced by manipulating the length of the approach run. When the data of Greig & Yeadon are limited to the attempts where the full approach run was used correlations drop below 0.59 which is close to our results.

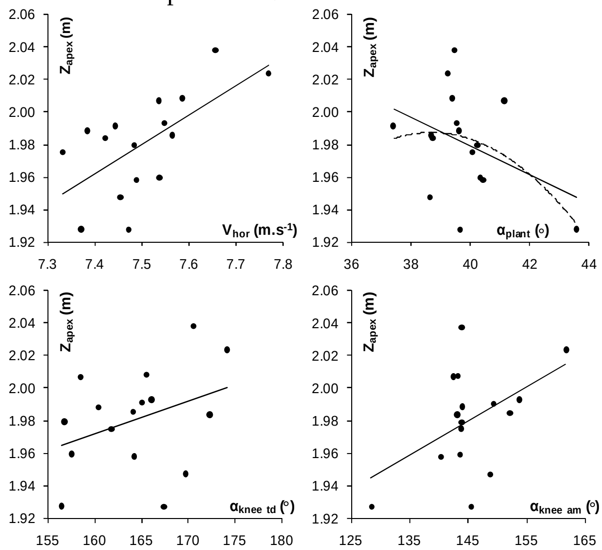

Figure 1: Plots of V_{hor}, α_{plant}, $\alpha_{knee\ td}$ and $\alpha_{knee\ am}$ versus Z_{apex}.

Table 1: Linear regression analyses versus data from literature.

	Linear regression analysis			*Greig & Yeadon [2]*		
	R	R^2	p	*R*	*R^2*	*p*
V_{hor} ($m.s^{-1}$)	0.64	0.41	0.01	*0.80*	*0.65*	*0.00*
α_{plant} (°)	-0.38	0.14	0.15	*0.68*	*0.47*	*0.00*
$\alpha_{knee\ td}$ (°)	0.35	0.12	0.18	*0.85*	*0.72*	*0.00*
$\alpha_{knee\ am}$ (°)	0.48	0.23	0.06			
Z_{td} (m)	0.25	0.06	0.34			
ACT_{arm} (%)	-0.18	0.02	0.51			

CONCLUSIONS

This data set of one elite female athlete reproduces some trends that were found in the literature although the correlations are low because of the high consistency in V_{hor} due to the performance in competition.
Future work will focus on extending the set of digitized jumps and investigating multiple and higher order regressions.

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REFERENCES

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2. Greig MP, Yeadon MR. *J Appl Biomech*. **16**:367-378, 2000.
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Table 2: Descriptive statistics versus data from literature.

	Descriptive statistics		*Greig & Yeadon [2]*	
	mean	SD	*mean*	*SD*
Z_{apex} (m)	1.98	0.03	*2.17*	*0.04*
V_{hor} ($m.s^{-1}$)	7.50	0.11	*6.60*	*0.45*
α_{plant} (°)	39.8	1.3	*34.1*	*1.8*
$\alpha_{knee\ td}$ (°)	164.4	5.6	*170.3*	*5.6*