A KINEMATIC COMPARISON OF JORDANIAN SPRINTERS IN RELATION TO LEGS STRENGTH AND LENGTH

HASHEM KILANI

FACULTY OF PHYSICAL EDUCATION, UNIVERSITY OF JORDAN, AMMAN,-JORDAN

INTRODUCTION

In running events, an athlete's goal is to cover a given distance in the shortest possible time. The performance time recorded by the athlete is determined by the distance of the event and by the athlete's average speed over that distance. The speed of the athlete is determined by the stride length and stride frequency. Both stride length and frequency are influenced by the length and strength of the lower extremities [2,3,5,6]. The kinematic parameters of the stride cycle are different among sprinters specialised in different sprinting events of 100, 200, and 400 m [1,4]. However, it is not clear whether the 400 m sprinters will have similar kinematic parameters to the 100 m sprinters when they sprint a 100 m sprinting event. It is important to understand this question in countries were a 400 m sprinter often participate in 100 and 200 m events, as is the case in Jordan. Therefore, the purpose of this study was to compare stride length and stride frequency of the 400 m sprinters when they run a 100 m event to those who are 100 m sprinters.

METIIODS

Selection and Pretesting of Subject:

Thirty top rated 100-200 m, and 400 m male sprinters in Jordan were approached. Twenty four subjects were available to participate in this study. Subjects (n=12) specialized in 100-200 m sprinting events composed Group A. Subjects (n=12) specialized in 400 m sprinting events composed Group B. The two groups were matched for their age, height, and leg length as shown in table 1.

Table 1. Descriptive data of the 24 subjects and the subgroups according to events A=100-2000 m, B=400 m

Variablles	Unit	Total group (mean)	Group A (mean	Group B (mean)
Age	year	21.41	21.33	20.95
Height	cm	176.45	175.50	179.41
Leg length	cm	96.79	96.16	97.41
Leg length (vertical jump)	cm	50.86	55.41	46.25

All subjects were pretested to determine their weight and height, leg strength, leg length, and time performance on the 100 m dash. To determine leg strength, a Sargent vertical jump protocol was used in which the best of a three vertical jump trials was chosen. Leg length was measured from the greater trochanter on the femur to the sole of the foot using a millimeter tape.

Filming Procedures:

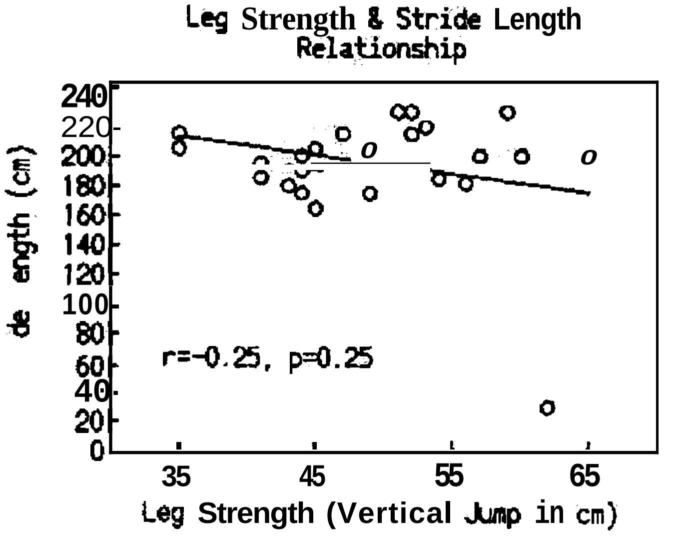
After warming up, each subject sprinted 100 m beginning with a crouch start simulating a competitive race. The twenty-four subjects were filmed by a Sony-video of 25 image/second from a perpendicular position to the sagittal plane of the running execution. The camera was set at the 50 m mark and 10 m from the lane and was panned to cover the whole run. To facilitate filming analyses, the 100 m was divided

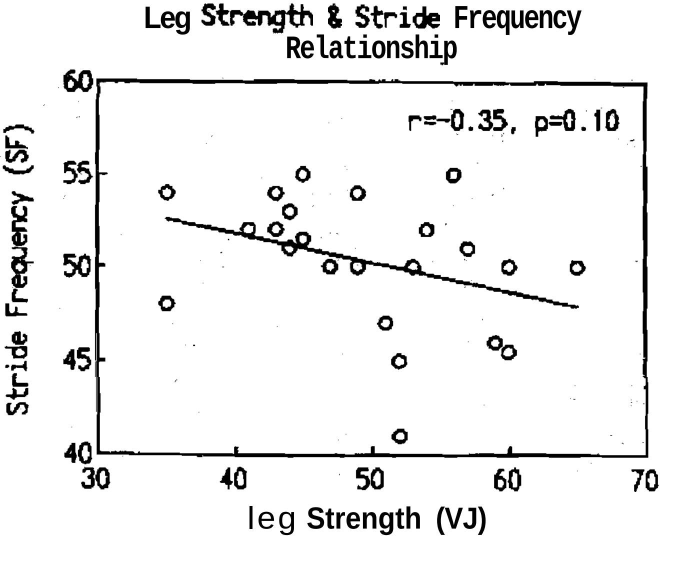
into four phases: Phase 1 from 0 m to 30 m, phase 2 from 30 m to 60 m, phase 3 from 60 m to 90 m and phase 4 from 90 m to 100 m. The number of strides were counted to each subject from the film. The time for each phase was extracted from the video image system. The dependent variables were calculated using these formulas:
(SL) Average Stride Length = distance / number of strides
(ST) Average Stride Time = distance time / number of strides
(SR) Average Stride Rate = 1 / ST
Data were analyzed by a SAS computer statistical program. T test and **Pearson** correlation were used for analyses.

RESULTS:
The mean values and the standard deviation of the selected variables for both groups in the four phases of the100 m run are presented in Table 2.

Variables			Group A		Group B	
		Unit	M	SD	M	SD
SR	Phase 1	Stridelsec	3.99	**..37**	3.63	**..30**
	Phase 2	Stridelsec	4.39	.41	4.19	.46
	Phase 3	Stridelsec	5.49	1.06 .	4.36	.42
	100 m	Stridelsec	4.43	.32	3.97	**.30.42**
SF	Phase 1	Stridelsec	16.5	.82	16.20	.94
	Phase 2	Stridelsec	15	1.16	15.04	**.86**
	Phase 3	Stridelsec	15.04	1.13	14.5	1.14
	100 m	Stridelsec	51.16	3.19	50.62	2.97
SL	Phase 1	cm	181.66	8.81	185.16	10.84
	Phase 2	cm	197.75	12.3	200.83	11.68
	Phase 3	cm	199.87	16.58	207.58	15.68
	100 m	**sec**	196.0	13.24	197.91	27.5
Time	Phase 1	**sec**	4.14	.28	4.48	.32
	Phase 2	**sec**	3.42	.29	3.61	.33
	Phase 3	**sec**	2.80	.35	3.34	.32
	100 m	**sec**	11.54	.40	12.74	.61
Speed	**m/s**	Phase 1	7.26	.46	6.72	.48
		Phase 2	8.82	.7	8.35	.71
		Phase 3	10.90	1.6	9.04	**.82**
		Phase4	8.87	.31	7.86	.36

The time in Group A was significantly shorter than in Group **B`in** all phases **(T=4.55, P<0.05).** There was no significant difference in the mean stride frequency and stride length analyzed within phases 1, 2, 3 and the 100 m between the two groups. In order to investigate relationship between variables, a **Pearson** correlation for the total group of twenty four subjects showed a significant positive correlation between the length of the legs and stride length in phases 2 and 3 and in the 100 m **(r=0.49,0.58,0.57, P<0.05)** respectively. Where as, a significant negative correlation was found between legs length and stride frequency within phases 2, 3, and the 100 m **(r=-0.56, 0.57,0.57, P=0.01)** respectively. However there was no significant correlation between legs strength and stride length or stride frequency **(Fgures** 1- 2).





DISCUSSION:
Although a significant difference in the time between the two groups was demonstrated, the 400 m sprinters have **kinematic** parameters not significantly different from the 100 m sprinters when they run the 100 m sprinting event. This indicates that the 400 m sprinter can **excute** the 100 m sprinting event in a similar **kinematic** trend to the 100 m sprinter.

The absence of significant correlation between the leg strength and stride length or stride frequency may indicate the interference of other variables like the leg length in shaping the kinematic trend of the sprinters. Therefore, a strength training program can be used to improve the utilization of legs strength in executing a 100 m sprinting event.

CONCLUSION:

A **400 m sprinter can excute the 100 m sprinting event in a similar kinematic trend to the 100 m sprinter.**

Jordanian sprinters do not use their leg strength efficiently when they execute a 100 m. A strength training program is suggested to improve their sprinting performance .

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