Physiological Profiles of Different Competitive Levels and Weapons of Hong Kong Fencers

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Introduction

Extensive studies have been done using field-based physiological tests to assess the physical fitness level among fencers of various competitive levels [1-3]. However, those conducted during the past decade took no account of fencer-specific movement patterns and thus test results could not accurately reflect fencers' physical abilities. With the recent availability of fencer movement-specific tests [4-7] and the lack of effective fitness data about Hong Kong elite fencing athletes, we conducted a study to generate data on fencers based on their current training state, in terms of their speed, agility and endurance for future benchmarking and to guide training.

Methodology

Subjects

A total of 78 Hong Kong Sports Institute Scholarship fencing athletes (elite, senior squad, junior, and potential) of three weapon types (epee, foil, and sabre) participated in this study.

For analysis purpose, subjects were grouped into two competitive levels - elite (elite and senior squad categories) and sub-elite (junior and potential categories). Age distribution by gender, weapon type, and competitive level is shown in Table 1. All subjects were briefed on the study purpose and all test procedures.

Study design

Physical measurements covering height, weight, arm span and leg length were made. Fitness tests specific to fencers covering fencing-specific endurance test (FET) [4], maximum lunge speed [5] and maximum lunge distance [6] test, 5m shuttle run, and 2-4-2m shuttle run were administered. The 2-4-2m shuttle run required fencers to shuttle back and forth in 2m, 4m and 2m sequences and remain facing front throughout the run [6,7]. All fitness tests were completed within 2 days - one day for FET and one day for other tests - on a fencing track in a fencing hall. Physical measurements were also completed during this period. All fencers were required to wear tee-shirts, shorts and fencing shoes for all fitness tests.

Table 1. Mean age by gender, weapon type, and competitive level (Mean ± SD)

Gender	Weapon	Elite		Sub-elite	
		N	Age (year)	N	Age (year)
F	Epee	4	25.50 ± 6.24	9	17.11 ± 1.17
	Foil	3	21.67 ± 5.51	7	16.67 ± 1.51
	Sabre	5	22.40 ± 2.79	10	17.30 ± 2.06
	Total	12	23.25 ± 4.67	26	17.08 ± 1.61
M	Epee	5	28.40 ± 5.77	10	17.70 ± 2.11
	Foil	3	23.00 ± 3.61	9	16.33 ± 1.41
	Sabre	6	20.67 ± 2.25	7	17.57 ± 0.98
	Total	14	23.93 ± 5.20	26	17.19 ± 1.70

Table 2. Mean weight and height by gender, weapon type, and competitive level (Mean ± SD)

Gender	Weapon	Elite		Sub-elite	
		Weight (kg)	Height (m)	Weight (kg)	Height (m)
F	Epee	61.08 ± 8.54	170.48 ± 8.31	58.59 ± 10.84	162.87 ± 3.63
	Foil	57.67 ± 3.59	159.83 ± 2.74	52.54 ± 4.12	164.30 ± 3.52
	Sabre	62.52 ± 4.05	167.24 ± 3.86	60.68 ± 9.00	163.76 ± 5.55
	Total	60.83 ± 5.68	166.47 ± 6.61	57.77 ± 9.06	163.60 ± 4.32
M	Epee	80.20 ± 11.73	184.06 ± 6.09	66.65 ± 5.68	174.06 ± 6.14
	Foil	79.27 ± 14.00	181.60 ± 7.45	62.77 ± 5.65	172.74 ± 6.80
	Sabre	67.83 ± 4.98	180.72 ± 3.60	61.17 ± 4.71	174.30 ± 4.88
	Total	74.70 ± 10.97	182.10 ± 5.23	63.83 ± 5.72	173.67 ± 5.88

Table 3. Mean arm span and leg length by gender, weapon type, and competitive level (Mean ± SD)

Gender	Weapon	Elite		Sub-elite	
		Arm span (cm)	Leg length (cm)	Arm span (cm)	Leg length (cm)
F	Epee	175.83 ±11.83	85.38 ± 5.12	169.54 ± 6.09	81.83 ± 2.80
	Foil	165.87 ± 1.80	80.17 ± 1.76	168.81 ± 3.17	81.86 ± 2.01
	Sabre	173.20 ± 6.42	84.30 ± 2.73	167.43 ± 7.16	81.85 ± 4.13
	Total	172.24 ± 8.36	83.63 ± 3.87	168.53 ± 5.80	81.85 ± 3.10
M	Epee	190.92 ± 5.80	93.00 ± 3.94	181.11 ± 7.89	86.65 ± 4.45
	Foil	189.67 ± 9.93	91.77 ± 4.82	180.89 ± 9.12	85.61 ± 4.89
	Sabre	188.35 ± 5.08	90.92 ± 3.76	180.71 ± 5.96	87.36 ± 2.93
	Total	189.55 ± 6.07	91.84 ± 3.83	180.93 ± 7.59	86.48 ± 4.16

Table 4. Mean movement speed at lactate concentration level 4mmol by gender, weapon type, and competitive level during the Fencing-specific Exercise Test (FET) (Mean ± SD)

Gender	Weapon	Elite		Sub-elite		Total	
		N	Speed (km/h)	N	Speed (km/h)	N	Speed (km/h)
F	Epee	4	5.24 ± 0.82	8	4.45 ± 0.4	12	4.77 ± 0.69
	Foil	2	5.08 ± 0.5	7	4.93 ± 0.81	9	4.96 ± 0.73
	Sabre	4	6.05 ± 0.2	9	4.62 ± 0.45	13	5.16 ± 0.82
	Total	10	5.47 ± 0.7	24	4.68 ± 0.61	34	4.95 ± 0.73
M	Epee	4	5.71 ± 1.1	10	5.2 ± 0.82	14	5.36 ± 0.9
	Foil	3	5.32 ± 0.24	9	5.94 ± 0.89	12	5.78 ± 0.82
	Sabre	6	5.19 ± 1.31	7	5.24 ± 0.74	13	5.21 ± 1.01
	Total	13	5.38 ± 1.04	26	5.49 ± 0.87	39	5.45 ± 0.92
Total		23	5.42 ± 0.9	50	5.14 ± 0.86	73	5.24 ± 0.88

Table 5. Mean lunge distance and time by gender, weapon type, and competitive level (Mean ± SD)

Gender	Weapon	Elite			Sub-elite		
		N	Distance (m)	Time/W (s/kg)	N	Distance (m)	Time/W (s/kg)
F	Epee	4	1.5 ± 0.08	0.37 ± 0.07	9	1.41 ± 0.16	0.42 ± 0.09
	Foil	1	1.49	0.43	7	1.40 ± 0.17	0.50 ± 0.09
	Sabre	5	1.49 ± 0.16	0.39 ± 0.03	10	1.51 ± 0.13	0.37 ± 0.04
	Total	10	1.49 ± 0.12	0.38 ± 0.05	26	1.45 ± 0.16	0.42 ± 0.09
M	Epee	5	1.70 ± 0.23	0.33 ± 0.11	9	1.63 ± 0.17	0.35 ± 0.05
	Foil	2	1.83 ± 0.17	0.34 ± 0.02	9	1.62 ± 0.10	0.36 ± 0.05
	Sabre	6	1.69 ± 0.14	0.33 ± 0.04	7	1.71 ± 0.17	0.37 ± 0.07
	Total	13	1.71 ± 0.17	0.33 ± 0.07	25	1.65 ± 0.15	0.36 ± 0.05
Total		23	1.62 ± 0.19	0.36 ± 0.07	51	1.54 ± 0.18	0.39 ± 0.08

Table 6. Mean agility time by gender, weapon type, and competitive level in 5m shuttle run test and 2-4-2m shuttle run test (Mean ± SD)

Gender	Weapon	Elite			Sub-elite		
		N	5m (s)	2-4-2m (s)	N	5m (s)	2-4-2m (s)
F	Epee	4	13.29 ± 0.42	8.32 ± 0.40	9	13.54 ± 0.61	8.22 ± 0.35
	Foil	2	12.76 ± 0.45	7.71 ± 0.39	6	13.32 ± 0.86	8.01 ± 0.55
	Sabre	5	12.53 ± 0.59	7.52 ± 0.39	10	12.88 ± 0.75	7.85 ± 0.50
	Total	11	12.85 ± 0.58	7.85 ± 0.52	25	13.22 ± 0.76	8.02 ± 0.47
M	Epee	5	11.48 ± 1.13	7.43 ± 1.22	10	11.44 ± 1.00	7.32 ± 0.65
	Foil	3	11.73 ± 0.19	7.44 ± 0.20	9	11.74 ± 0.58	7.18 ± 0.37
	Sabre	6	11.33 ± 0.77	6.74 ± 0.55	7	10.95 ± 0.48	6.59 ± 0.32
	Total	14	11.47 ± 0.81	7.14 ± 0.84	26	11.41 ± 0.79	7.07 ± 0.56
Total		25	12.08 ± 0.99	7.45 ± 0.79	51	12.30 ± 1.19	7.54 ± 0.70

Results and Discussion

Descriptive statistics of anthropometric characteristics for subjects of different competitive levels and weapon types are presented in Tables 2 and 3. Physical fitness test results are presented in Tables 4, 5 and 6. Test results suggest elite fencers are at a higher level of physical fitness compared to sub-elite fencers, for total and within each gender/weapon subgroup.

To understand how Hong Kong fencers were compared to fencers from other countries in terms of physical fitness level, test results were reviewed against data from other countries:

- Compared to Greek fencers [6], Hong Kong fencers have a lower mean lunge speed; (Table 7)
- Compared to German fencers [4], Hong Kong fencers have a lower mean movement velocity at the same lactate concentration level (4mmol); (Table 8)
- Compared to Iranian male fencers [5], Hong Kong male fencers have a longer mean lunge distance; (Table 7)
- In 5m shuttle run test, Hong Kong fencers scored better than Greek fencers [6]; (Table 7) in 2-4-2m shuttle run test, they scored better than British fencers [7]. (Table 9)

Table 7. Lunge characteristics and 5m shuttle time comparison between Hong Kong and foreign (Greek and Iranian) fencers (Mean ± SD)

Competition level	Distance (m)		Time/W (s/kg)		5m shuttle time (s)	
	Iranian male fencers	Hong Kong male fencers	Greek fencers	Hong Kong fencers	Greek fencers	Hong Kong fencers
Elite	1.17 ± 0.17	1.71 ± 0.17	0.18 ± 0.03	0.36 ± 0.07	12.43 ± 0.95	12.08 ± 0.99
Sub-elite	1.02 ± 0.10	1.65 ± 0.15	0.21 ± 0.04	0.39 ± 0.08	13.28 ± 0.93	12.30 ± 1.19

Table 8. Movement velocity comparison between Hong Kong and German fencers at lactate concentration level 4mmol during the Fencing-specific Exercise Test (FET) (Mean ± SD)

Competition level	Movement velocity (km/hr)	
	German fencers	Hong Kong fencers
Elite	7.02 ± 1.31	5.42 ± 0.9
Sub-elite	6.26 ± 0.75	5.14 ± 0.86

Table 9. 2-4-2m shuttle run test performance comparison between Hong Kong and British fencers (Mean ± SD)

Weapon	2-4-2m Agility time (s)			
	British fencers	Hong Kong fencers	British fencers	Hong Kong fencers
	Male	Male	Female	Female
Epee	8.0 ± 0.6	7.36 ± 0.84	9.1 ± 0.3	8.25 ± 0.36
Foil	8.4 ± 0.7	7.24 ± 0.35	9.0 ± 0.9	7.93 ± 0.51
Sabre	7.9 ± 0.7	6.66 ± 0.43	9.1 ± 0.8	7.74 ± 0.48

The study has first established a fencing fitness database which will provide a solid understanding of the profile of Hong Kong fencing athletes in terms of their fitness level, and help coaches optimise their training programmes and identify talents. The result is then reviewed against overseas fencers in an attempt to understand Hong Kong fencing athletes' competitiveness. Unfortunately, overseas data are not comprehensive enough for benchmarking. Benchmarking and analyses will be carried out once more relevant information from overseas countries is available.

Acknowledgement

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