STUDIES ON THE FUNCTIONS OF SPRINT EXERCISES ON JUVENILE JOINT TORQUE

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The purpose of this study is to discuss the function of sprint on development of juvenile muscle strength. The study tests and the isokinetic strength of 30 ordinary healthy boys and girls and 30 ones from Physical Educational School, carrying out the test of the shoulder, hip and knee joints according to 3 different angular velocities: 60°/s, 120°/s and 240°/s. The main index of the test is: the Peak Torque of muscle tissues caused by joints extension and flexion; poking into the function of sprint exercises on juvenile muscle's development. The outcome indicates that: sprint exercise has a distinctively positive effect on boys' development of the muscle strength of shoulders, hips and knees, and the coordination of the harmony of Flexion and Extension muscles. Whereas, sprint only exerts an apparently positive effect on girls' knees, but not hips and shoulders.

KEY WORDS: juvenile, joints, torque

INTRODUCTION: Boys and girls are the future of the nation. Their health has always been the focus of the public. The recent years has seen the increasing studies concerning boys and girls. However, studies of sports items on the influence of juvenile physical development are seldom paid attention to. Thus, this essay contrast the function and influence of sprint exercises on youngsters, targeting 30 boys and girls who have not receive special training before with 30 ones who have been taking routine sprint exercises. The ultimate aim of this study lies in: (1) to investigate the function of sprint exercises on youngsters' strength development; (2) the disparity of different sexes on the influence of sprint exercises on their respective strength development.

METHODS:

Experimental subject: Take randomly 30 volunteers from 4 different schools in Shijiazhuang, including 15 boys and 15 girls (Ordinary Group), who have not received special training before. Take randomly 30 from Shijiazhuang Physical Educational School, inclusive of 15 boys and 15 girls (Professional Group), who have been taking the routine sprint exercises. Ordinary Group only take part in the common activities in school; Professional Group have an around 2-hour training package on a weekly 4-6 times basis. During the test period, no one of both groups is affected by sickness; no one is involved in violent movement of any form; Fatigue of muscles is avoided.

Research Method: The Kinitech Uniform-velocity Muscle Strength Evaluation System (Kylingk Company, Australia) was used in this test. The test items include: the extension and flexion of shoulder joints of both arms, knee joints of both legs and hip joints. Test separately the Peak Torque of each joint. The extension and flexion of each joint is tested of 3 different angular velocities: 60°/s, 120°/s and 240°/s. The participants warm up sufficiently before the formal test. Take mimic exercises 3 times and then have the formal test 6 times. The interval between different angular velocity tests is 30 seconds. All the tests conform strictly to the requirements of the Kinitech Uniform-velocity Muscle strength Evaluation system: fix and regulate appropriately. All experimental data are described by $M \pm SD$.

Analysis Methods: Experimental outcome is processed by the statistic software SPSS 11.0.

RESULTS:

The basic profile of the test participants: Table 1 is the display of the basic profile of the test participants. Except the distinctive disparity of heights between the male Ordinary Group and Male Professional Group, other indexes have no significant disparity. This shows that the height of Male Professional Group is usually higher than that of Ordinary Group, which is also the general principle to choose sprint players in our country.

Table 1 The basic profile of the test participants.

Character Value	OG/M	PG/M	OG/F	PG/F
Age (years)	14.13±0.96	14.19±1.24	14.14±1.70	14.35±1.87
Height (cm)	171.25±3.97	77.07±6.21*	166.66±1.48	166.21±5.19
Weight (kg)	62.59±9.89	63.61±7.93	58.40±10.01	53.08±6.93
Average training length (year)		3.90±2.02		3.60±1.26

Annotation: OG/M: male Ordinary Group, PG/M: male Professional Group,
OG/F: Female Ordinary Group, PG/F: female Professional Group
* signifies that $p < 0.05$,which is a distinctive disparity;
** signifies $p < 0.01$,which is a ultra-distinctive disparity.

Table 2 Display of shoulder joint Peak Torque.

		Left Flexion		Left Extension		Right Flexion		Right Extension	
		OG	PG	OG	PG	OG	PG	OG	PG
M	60	41.80 ± 14.06	149.00 ± 6.81**	42.40 ± 9.96	148.00 ± 6.25**	40.40 ± 11.10	145.00 ±9.00**	48.20 ± 7.08^^	147.00 ± 9.58**
	120	38.80 ± 10.20	44.80 ± 3.79**	42.60 ± 8.00	143.20 ± 3.79**	39.80 ± 9.49	138.80 ±7.84**	51.80 ± 9.21^^	140.40 ± 7.87**
	240	36.00 ± 12.18	145.40 ± 7.48**	45.60 ± 12.39	144.40 ± 6.85**	36.00 ± 8.43	145.20 ±9.71**	50.00 ± 7.65^^	136.80 ±11.78**
F	60	31.50 ± 7.46	35.55 ± 6.69	34.50 ± 6.98	35.55 ± 9.09	33.25 ± 7.95	39.55 ± 8.17	36.75 ± 7.62	39.11 ± 7.94
	120	27.25 ± 6.92	33.11 ±4.13	34.70 ± 5.42	35.33 ± 8.18	32.00 ± 9.44	38.00 ± 7.61	36.00 ± 7.92	40.22 ± 9.29
	240	27.80 ± 5.01	29.40 ± 2.31	35.00 ± 8.12^	36.40 ± 6.31^^	31.20 ± 6.21	31.60 ± 4.97	37.20 ± 6.70^	36.44 ± 8.60^

Annotation: OG: Ordinary Group PG: Professional Group M: Male F: Female
*signifies that there is a distinctive disparity of the joint Peak Torque between the Ordinary Group and Professional Group. * signifies $p < 0.05$, which is a distinctive disparity; ** signifies that $p<0.01$, an ultra-distinctive disparity.
^ signifies that there is a distinctive disparity of the joint Muscle Torque of Extension and Flexion. ^ signifies $p < 0.05$, a distinctive disparity; ^^ signifies $p < 0.01$, an ultra-distinctive disparity. This annotation applies to the following figures.

The relevant analysis of shoulder joint Peak Torque of Professional Group and Ordinary Group: Table 2 is a display of the shoulder joint Peak Torque of both Ordinary Group and Professional Group. From the figure, we can learn that there is an ultra-distinctive disparity of Peak Torque between Male Ordinary Group and Male Professional Group when shoulder joints move with 60°/s, 120°/s, 240°/s. and with the increase of angular velocity, Peak Torque doesn't change distinctively. This may be due to the flexibility of shoulder joints: With big angular velocity, it can still keep a high-speed sway. In Professional Group, the extension and flexion Peak Torque of the left and right shoulders don't vary distinctively, whereas, in Ordinary Group, the extension and flexion Peak Torque of the right shoulder has a significant divergence compared with before. This demonstrates that sprint can positively

promote the faster increase of the muscle strength of shoulder joints and the coordinative development of the extension and flexion muscle tissues for boys.

Female Professional Group and Female Ordinary Group don't have a distinctive disparity in their Peak Torque of shoulder joints, which indicates that sprint exercise serves little in increasing the muscle strength of young girls' shoulder joints. With the angular velocity at 60°/s and 120°/s, there is no remarkable disparity of the extension and flexion Peak Torque of the left and right shoulders; however, with the increase of angular velocity, at 240°/s, there will be a disparity of the left and right shoulder respectively. Generally speaking, sprint exercise has little influence on the muscle strength and the coordinative development of the extension and flexion muscle tissues for girls.

The analysis of hip joint Peak Torque of both Professional Group and Ordinary Group: As we can see from Table 3, there is a ultra-distinctive disparity or distinctive disparity of the flexion Peak Torque with 60°/s, 120°/s, 240°/s between Male Professional Group and Male Ordinary Group; whereas, there is no disparity at extension. By experiment, the Peak Torques of the left and right hip joint extension and flexion have a distinctive disparity for Ordinary Group, whereas, there is no remarkable disparity for Professional Group. This shows that sprint exercise can positively promote the coordinative development of the extension and flexion muscle tissues of hip joint for boys.

There is no distinctive disparity of the left and right hip joint Peak Torques for female Ordinary and Professional Group. However, there is ultra-distinctive disparity or distinctive disparity of Peak Torque of hip joint extension and flexion of each group respectively. Thus we can come to the conclusion: sprint exercise has little influence on the muscle strength and the coordinative development of the extension and flexion muscle tissues of hip joints for girls.

Table 3 The display of hip joint Peak Torque ($\bar{x} \pm s$).

		Left Flexion		Left Extension		Right Flexion		Right Extension	
		OG	PG	OG	PG	OG	PG	OG	PG
M	60	1108.00 ± 31.45	178.33 ± 33.95**	147.50 ± 37.41^^	202.66 ± 59.68	107.7 ± 18.71	148.00 ± 13.32**	145.25 ± 35.45^	151.33 ± 14.34
	120	123.5 ± 47.74	189.00 ± 46.47*	161.75 ± 39.87^	193.00 ± 42.66	112.2 ± 28.31	155.66 ± 6.25*	157.50 ± 21.26^	157.00 ± 6.66
	240	77.50 ± 32.50	150.33 ± 20.99**	151.25 ± 44.01^^	191.25 ± 41.99	97.00 ± 47.65	170.33 ± 3.44*	143.75 ± 31.02^^	171.33 ± 2.06*
F	60	90.00 ± 14.69	92.40 ± 30.69	139.60 ± 16.96^^	166.40 ± 42.39^^	93.60 ± 31.15	96.60 ± 34.09	133.40 ± 29.33^	135.00 ± 39.13^
	120	106.8 ± 25.51	115 ± 34.21	139.80 ± 27.47^^	163.40 ± 33.80^	108.2 ± 35.95	126.20 ± 42.16	143.00 ± 41.21^^	175.20 ± 35.96^^
	240	70.80 ± 26.09	86.80 ± 34.29	166.60 ± 39.94^	160.80 ± 45.14^	79.80 ± 33.76	102.40 ± 21.51	124.80 ± 42.66^	164.00 ± 31.60^^

The analysis of knee joint Peak Torque of both Professional Group and Ordinary Group: As we can see from Table 4, there is a ultra-distinctive disparity or distinctive disparity of the flexion and extension knee joint Peak Torque with 60°/s, 120°/s, 240°/s between Male/Female Professional Group and Ordinary Group. This indicates that sprint exerts a distinctively positive role in the development of boys and girls' knee joint muscle strength. By test, we learn that there is no distinctive disparity of the Peak Torque of knee joint extension and flexion respectively for each group of Male and Female Professional and Ordinary Group. This demonstrates that sprint exercise can promote the coordinative development of boys and girls' knee joint.

Table 4 The display of Knee joint Peak Torque ($\bar{x}\pm s$).

		Left Flexion		Left Extension		Right Flexion		Right Extension	
		OG	PG	OG	PG	OG	PG	OG	PG
M	60	137.50 ± 42.62	195.66 ± 29.99*	147.75 ± 25.48	222.66 ± 20.92**	161.2 ± 92.08	220.33 ± 96.31*	166.00 ± 21.30	214.3 ± 31. 54**
	120	113.42 ± 47.88	193.33 ± 23.27**	129.14 ± 29.84	201.00 ± 17.69**	117.0 ± 49.03	171.66 ± 24.73*	117.50 ± 42.22	188.0 ± 16.14**
	240	93.00 ± 25.76	152.66 ± 19.33**	98.25 ± 23.77	162.66 ± 29.97**	96.75 ± 42.58	148.66 ± 15.83*	97.00±32.49	137.6 ± 19.03*
F	60	80.00 ± 18.97	148.28 ± 40.00**	74.40 ± 11.43	159.14 ± 56.69**	81.60 ± 21.69	135.14 ± 51.50*	94.00±16.37	147.7 ± 53.30*
	120	77.20 ± 19.42	134.85 ± 30.24**	66.40 ± 24.26	144.28 ± 31.23**	81.60 ± 32.19	113.14 ± 19.72*	72.00±36.74	123.1 ± 24.16*
	240	64.00 ± 11.91	96.57 ± 26.55*	60.80 ± 15.59	91.42 ± 26.45*	56.40 ± 10.33	79.14 ± 18.61*	54.00 ± 15.93	84.14 ± 22.11*

CONCLUSION: Sprint exercise has a positive influence on the development of boys' muscle strength and coordination of joints extension and flexion, especially for the coordinative development of shoulder strength.

Sprint exercise only has a positive influence on the development and coordination of girls' knee joints muscle strength.

The test result indicates that the development of boys and girls' physical strength fits in with their biological mechanism.

Besides sprint exercise, girls should pay attention to the drills of shoulder and hip joint muscle strength, which is beneficial for the coordinative development of joints muscle tissues.

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