BUILDING A PROFILE OF SPECIFIC FITNESS INDICES FOR MALE TEENAGE CHINESE SPRINTERS

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CONSTRUÇÃO DE UM PERFIL DE ÍNDICES ESPECÍFICOS DE APTIDÃO FÍSICA PARA VELOCISTAS ADOLESCENTES DO SEXO MASCULINO NA CHINA

DESARROLLO DE UN PERFIL DE ÍNDICES DE APTITUD FÍSICA ESPECÍFICOS PARA VELOCISTAS ADOLESCENTES DEL SEXO MASCULINO EN CHINA

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ABSTRACT

Objectives: This study aimed to construct a profile of specific fitness indices for male teenage sprinters on the Chinese National Team to provide sprinting fitness assessments for teenage training. Material and Methods: 229 male teenage sprinters at the same level were recruited to participate in this test for the indices. The t- and Kruskal-Wallis tests were conducted for the first selection of fitness indices. In the second selection, principal components analysis was applied to select common factors with greater characteristic values. The fitness indices chosen were height, leg length, measurement B (ankle circumference/heel length×100%) and measurement A (thigh circumference/leg length×100%), hemoglobin, 60m sprint time, 100m sprint time, countermovement jump (CMJ), maximum countermovement jump velocity, CMJ flight time, CMJ maximum force, and CMJ force. Results: Thirteen indices were chosen for the specific fitness of male teenage Chinese male sprinters with 3 general categories and 9 subcategories. The weight of each fitness index was confirmed and used to construct a standard fitness assessment scale. Conclusion: Anthropometric indices indicate the athlete's innate limits in the structure of the sprinting motion. Physiological indices indicate the athlete's potential to expend energy and recover in a short time. Motor indices indicate the athlete's maximum sprinting ability, lower limb reaction strength, power, and maximum strength. ***Level of evidence II, Diagnostic studies - Investigation of a diagnostic test.***

Keywords: Adolescent; Physical fitness; Motor indices; Athletic performance.

RESUMO

Objetivos: Este estudo teve como objetivo construir um perfil de índices específicos de aptidão física para velocistas adolescentes do sexo masculino da Seleção Nacional da China, que proporcione uma base para avaliação da aptidão para corridas para treinamento de adolescentes. Materiais e Métodos: Foram recrutados 229 adolescentes do sexo masculino e velocistas de nível equivalente para participar deste teste de índices. Foram usados o teste t e o teste Kruskal-Wallis para a primeira seleção dos índices de aptidão física. Na segunda seleção foi aplicada a análise dos componentes principais para selecionar fatores comuns com maiores valores característicos. Os índices de aptidão física analisados foram estatura, comprimento das pernas, medida B (circunferência do tornozelo/comprimento do calcanhar x 100%) e medida A (circunferência da coxa/comprimento da perna x 100%), hemoglobina, tempo de sprint 60 metros, tempo de sprint de 100 metros, salto de contramovimento (CMJ), velocidade máxima de salto de contramovimento, tempo de voo do CMJ, força máxima do CMJ, força do CMJ. Resultados: Foram selecionados 13 índices para avaliar as aptidões específicas dos velocistas da amostra, divididos em 3 categorias principais e 9 subcategorias. O peso de cada índice de aptidão foi confirmado e usado para construir uma escala de avaliação de aptidão padrão. Conclusões: Os índices antropométricos indicam os limites inerentes aos atletas na estrutura do movimento do sprint. Os indicadores fisiológicos indicam o potencial do atleta de gastar energia e recuperá-la em curto período. Os índices motores indicam a capacidade máxima do atleta no sprint, o poder de reação dos membros inferiores, a força e a potência máxima. ***Nível de evidência II, Estudos diagnósticos - Investigação de um exame para diagnóstico.***

Descritores: *Adolescente; Aptidão física; Índices motores; Desempenho atlético.*

RESUMEN

Objetivos: Este estudio tuvo por finalidad el desarrollo de un perfil de índices de aptitud física específico para velocistas masculinos adolescentes de la Selección Nacional de China , que proporcione una base para la evaluación de la aptitud física en velocidad durante el entrenamiento de adolescentes. Materiales y Métodos:En esta prueba de índices participaron 229 velocistas adolescentes masculinos de nivel equivalente. En la primera selección de índices de aptitud se utilizó la Prueba T y la Prueba Kruskal-Wallis. En la segunda selección se aplicó el análisis de componentes principales para identificar factores comunes con mayores valores característicos. Los índices de aptitud física analizados fueron: altura, longitud de las piernas , medida B (circunferencia del tobillo / longitud del talón x 100%) ,

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y medida A (circunferencia del muslo / longitud de la pierna x 100%) × 100%, hemoglobina, tiempo de sprint de 60 m, tiempo de sprint de 100 m, salto de contramovimiento (CMJ), velocidad máxima del salto de contramovimiento, tiempo de vuelo del CMJ, fuerza máxima del CMJ, fuerza del CMJ. Resultados: Se seleccionaron 13 índices para evaluar la aptitud física específica de los velocistas del estudio, divididos en 3 categorías principales y 9 subcategorías. Se confirmó la ponderación de cada índice de aptitud física y se utilizó para crear una escala estándar de evaluación de la aptitud. Conclusión: Los índices antropométricos reflejan los límites innatos de los atletas en la estructura del movimiento del sprint. Los índices fisiológicos indican el potencial del atleta para gastar energía y recuperarla en un corto período. Los índices motores indican la capacidad máxima del atleta en el sprint, la potencia de reacción de las extremidades inferiores, la fuerza y la potencia máxima. ***Nivel de evidencia II, Estudios diagnósticos - Investigación de un examen para diagnóstico.***

Descriptores: *Adolescente; Aptitud física; Índice de movimiento; Rendimiento atlético.*

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INTRODUCTION

Performance of sprinting events relies on athletes' level of comprehensive fitness capacity.[1-2] Despite sprinting specific fitness indices for training assessment being scientifically mature to a certain extent, research concerning sprinting fitness was majorly based on elite or collegiate athletes.[3-4] Furthermore, these studies were mostly focused on single factors such as psychological ability,[5] speed structure,[6] strength of knee extension and flexion,[7] stride and frequency.[8] Little research regarding specific fitness was focused on teenage sprinters. Establishing sprinters' specific fitness indices for assessment in training is vital to enhance teenage sprinters' performance. This study aimed to determine important specific fitness indices for teenage Chinese male sprinters through testing large samples with a view to provide practical uses for sports science, talent identification in sprinters and teenage sprint training.

METHODS

Subjects

A total of 229 male teenage sprinters from the teenage training base of China National Team were recruited in the study. The project was approved by the Ethics Committee on Human Research. Passive informed consent was applied. The participants subjects were divided into made of two groups: the elite group was made of elite teenage sprinters (n=57) and the control group was made of physical education students (n=172). Average 100m sprint time 100m performance of the elite group was sub 11.74s, while the performance of control group was between11.75-12.64s. The subjects' information is provided in Table 1. This study was approval by ethic committee of China University of Mining and Technology.

Measurement

For the integrity of the testing fitness parameters, fitness-related references were studied and accessed to possible relating parameters. Expert interviews were carried out with professionals in national athletics teams, elite teenage athletics training bases and schools with athletics teams. Questionnaires regarding testing parameters were then designed according to the results of fitness-related references and expert interviews. Afterward, 12 experts were invited to check confirm the content validity and structure of questionnaires. Consequently, 92% of experts confirmed the content validity of questionnaires regarding the testing parameters. Three rounds of selections were carried out for the determination of final testing parameters. The overall recovery ratio of 57 questionnaires was 92.98%. 33 testing parameters were chosen in the final selection, which could be categorized into 3 general categories and 10 subcategories. The final 33 testing parameters were: height (H), leg length A (LLA) (vertical distance from subjects' anterior superior iliac spine to the floor), leg length B (LLB) (vertical distance from subjects' greater trochanter to the floor), shank length A(SLA), Aachilles tendon length (ATL), ilium width (IW), shoulder width (SW), thigh circumferences (TC), ankle circumferences (AC), weight, body fat, resting heart rate, cardiac effort indices, vital capacity weight indices, red blood cell count, Hemoglobin (HGB), human growth hormone (HGH), testosterone, 30m, 60m, 100m, standing long jump (SLJ), standing triple jump (STJ), 2kg medicine ball backward throw, CMJ flight time (CMJFT), CMJ maximum strength (CMJMS), CMJ height (CMJH), CMJ maximum speed velocity (CMJMVS), CMJ power (CMJP), CMJ impulse (CMJI), seated body anteflexion. (Table 2) In the final round of selection, values of the parameters Cronbach's alpha coefficient were greater than 0.70 (0.762), showing high reliability.

Table 1. Subjects' information.

Parameters	Elite (n=57)	control(n=172)	t	P
Height (cm)	176.38±5.87	174.37±7.19	0.079	0.054
Weight (kg)	65.19±5.9	58.29±8.81	4.660	0.000
100m (s)	11.43±0.21	12.43±0.66	-9.509	0.000

Procedures

In the anthropometry test, height and weight scale, martin ruler and measuring tape were used to measure H, weight, LLA, LLB, ATL, IL, SL, TC and AC. In the physiological function test, Electrospirometer (FCS-10000, Yilian Latrical Instrument Equiment Co. Ltd., Shanghai, China), SPM400SPM400WEP105 metronome (S.N.Shure Polar H10, Bohaotong Science and Technology Co.,Ltd., Beijing, China), Stopwatches (PC2810, Timestar Electronic Co., Ltd., Shenzhen, China) 5ml blood collecting (EDTAK2, Chengwu Medical Equipment Co., Ltd., Shandong, China) were

Table 2. The final testing parameters of teenage male sprinters' fitness.

General	subcategory	parameters
Anthropometry	Length	Height, LLA, LLB, SHL, (LLA/H) ×100(%), (LLB/H)×100(%),TL/ SHLA×100%, (AL/SHLA)×100(%)
	Width	Ilium width /shoulder width ×100(%)
	Body circumference	(TC/LLA) ×100(%), (AC/ATL) ×100(%)
	Body composition	weight, body fat
Physiological function	Cardiac function	Resting heart rate, cardiac effort indices, vital capacity weight indices
	Energy Metabolism	Red Blood Cell Count, HGB
	Hormone levels	HGH, Testosterone
Motor ability	Speed	30m, 60m, 100m
	strength	SJ, STJ, MBBT 2kg, CMJFT, CMJPS, CMJFH, CMJMS, CMJP, CMJI
	flexibility	Seat body anteflexion

used to measure resting heart rate, cardiac effort indices, vital capacity weight indices, red blood cell count, HGB, HGH and testosterone.

In the motor ability test, stopwatches, 2kg med ball, measuring tape, force plate (9281EA, Kistler Inc, Switzerland) body anteflexion 2.meter were used to test 30m, 60m, 100m, SJ, STJ, 2kg medicine ball backward throw, CMJFT, CMJMS, CMJFH, , CMJMV, CMJP, CMJI and seated body anteflexion.

Statistical analysis

All statistical analyses were conducted using the SPSS (Version.22.0, SPSS Inc, USA). Analyses were as follow: Fitness parameters for anthropometry, physiological function and motor ability. Independent sample T-test or Kruskal-Wallis H test were applied to compare differences between two groups. Factor analysis and Principal Components was respectively used for second round of parameters determination and selection of common factor. The relative percentile method was used to make the final specific fitness assessment scale of teenage male sprinters.

RESULTS

As mentioned, teenage athletes' specific fitness is a complex system, which can be generally classified into anthropometry, physiological function, and motor abilities. Specific fitness is a combination of inborn and acquired ability that makes the difference in athletes' performance in the event.[9] Accordingly, a significance test of the differences was conducted on 33 parameters of two groups in the study in order to eliminate the parameters with low discrimination and distinction. However, potential parameters suggested by professionals (height) were kept for the second selection. As result of the first selection, 26 fitness indices were chosen. (Table 3)

KMO value of anthropometry, physiologic function, and motor abilities were respectively 0.669, 0.607 and 0.782. Mean values were all greater than 0.6 and reported significantly different when using the Bartlett test ($p<0.001$). (Table 4) Accordingly, factor analysis was able to be carried out. According to the default standard in which eigenvalues should be greater than 1.0 (Figure 1), factor rotation was conducted. Consequently, three parameters were chosen for anthropometry (cumulative proportion: 74.66%). Two parameters were chosen for physiologic function (cumulative proportion: 75.29%). Three parameters were chosen for motor ability (cumulative proportion: 83.789%).

According to the size of factor rotation value characteristic and experts' opinions, the final 13 parameters were determined, which could be categorized into 3 general categories and 9 subcategories. (Table 5)

DISCUSSION

For years, talent identification through scientific means has become a focus among coaches, researchers and specialists. Anthropometrics is critical in talent identification and in teenage athletes. Previous study reported the anthropometric characteristics of elite sprinters are mesomorph figure, low body fat (5-10%), long legs, small length ratio of thigh and shank, strong gluteus, long Achilles tendon etc.[10] This sort of figure gives athletes a better structure for muscle contracting efficiency in sprinting conditions, increasing speed through leg stride length. As the sprint event and its technique developed, world elite sprinters became taller. Hence, longer stride and slower frequency were developed for the height trend, decreasing muscle work to increase sprinting efficiency.[11] Studies also indicate Achilles tendon length is correlated with the power of lower extremities. TC/ LLA×100% indicates the strength of quadriceps and growth of LL. In the sprinting cycle, strength of quadriceps and hamstring are crucial for the swing and push technique.[12] Research suggest short thigh and long shank shorten the swing radius

Table 3. Result of first parameter selection of teenage male sprinters' fitness (average± one standard deviation).

No.	parameters	Elite	Control	t	P
1	Height (cm)	176.38±5.87	174.37±7.19	0.079	0.054
2	LLA (cm)	99.76±4.49	98.49±5.03	0.207	0.089
3	LLB(cm)	91.87±4.05	90.21±4.41	0.153	0.011
4	SLA(cm)	46.24±2.26	46.37±2.42	0.24	0.707
5	(LLA/H)×100(%)	56.55±1.16	56.49±1.77	0.135	0.816
6	(LLA/H) ×100(%)	52.08±1.23	51.76±1.52	0.448	0.149
7	[(LLB- SLA)/ SLA] ×100(%)	98.84±6.27	94.64±5.63	0.111	0.000
8	(ATL / SLA) ×100(%)	54.05±5	49.63±5.26	0.756	0.000
9	(IW/SW) ×100(%)	67.61±5.66	70.34±8.34	0.242	0.021
10	(TC / LL) ×100(%)	54.05±3.44	52.47±5.76	0.114	0.048
11	(AC /ATL) ×100(%)	87.51±11.01	95.43±11.81	0.334	0.000
12	Weight (kg)	65.23±5.58	59.98±8.38	0.009	0.000
13	body fat	11.76±2.9	13.5±3.29	0.367	0.000
14	Resting heart rate(times/min)	63.86±6.56	69.37±6.28	-5.734	0.000
15	Cardiac effort index	5.29±2.43	7.95±2.3	-6.816	0.000
16	Vital capacity weight index (ml/kg)	61.64±17.66	60.22±12.28	0.678	0.498
17	Red Blood Cell Count(×10.e6/ul)	5.28±0.53	5.03±0.51	3.099	0.002
18	HGB(g/l)	152.5±12.42	140.13±14.68	5.617	0.000
19	HGH(ug/L)	3.19±4.49	3.46±4.58	-0.379	0.705
20	Testosterone(nmol/L)	17.79±4.25	12.92±4.58	6.948	0.000
21	30m(s)	4.18±0.03	4.47±0.02	-7.159	0.000
22	60m(s)	7.22±0.03	7.93±0.04	-14.658	0.000
23	100(m)	11.49±0.03	12.79±0.06	-18.021	0.000
24	Standing jump(m)	2.76±0.02	2.48±0.02	9.282	0.000
25	Standing triple jump (m)	7.98±0.14	7.2±0.06	4.685	0.000
26	2kg med ball backward throw (m)	16.59±0.48	13.86±0.24	5.089	0.000
27	CMJFT(S)	0.59±0.01	0.55±0	5.184	0.000
28	CMJMS(N)	1672.59±46.26	1465.04±31.7	3.368	0.001
29	CMJH(m)	0.43±0.01	0.37±0.01	5.376	0.000
30	CMJMV (m/s)	2.89±0.04	2.68±0.02	5.224	0.000
31	CMJP(standardization)	74.9±2.16	65.89±1.14	3.831	0.000
32	CMJI	186.32±3.54	159.09±2.72	5.253	0.000
33	Seat body anteflexion(cm)	15.65±4.67	13.87±5.98	1.728	0.086

Table 4. Parameter value of KMO and Bartlett test.

		Anthropometry	Physiologic function	Motor ability
KMO adequacy		0.669	0.607	0.78
Bartlett factor rotation	chi-square	1337.94	367.87	2612.39
	df	36	10	66
	P	0.000	0.000	0.000

KMO: Kaiser–Meyer–Olkin.

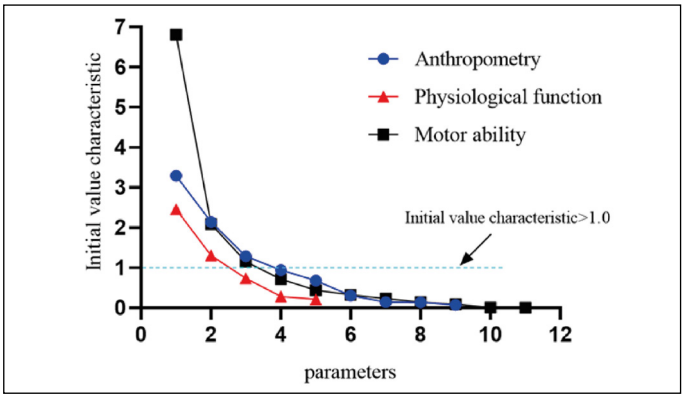

Figure 1. Eigenvalues of 3 general categories of fitness indices.

Table 5. Result of final parameters selection of teenage male sprinters' fitness.

General	Subcategory	Final parameters
Anthropometry	Length	Height, LLB
	Lower extremity Circumferences	(AC / ACL) ×100(%)
	Ratio of Lower extremity	(TC/ LLA) ×100(%)
Physiological	Aerobic ability	HGB
function	Recovery ability	Resting heart rate, cardiac work indices
Motor ability	Speed	60m, 100m
	Lower extremity Power	CMJMV, CMJFT
	Lower extremity Maximum strength	CMJPS, CMJP

and decrease the resisting moment, increasing sprinting efficiency by creating more horizontal distance and less vertical displacement.[13-15]

An athlete's physiological function is influenced by numerous factors and genetics from an early age. Thus, to find the physiological indices correlated with performance the elite teenage sprinters' specific physiological state. In sprinting events, the respiratory and circulatory system function to create an ideal internal environment for athletes' bodies by catabolic buffering, enduring and adapting. It increases musculoskeletal capacity in anaerobic sprinting, delaying occurrence of fatigue and to maintain the balance of the body. As a result, the oxygen usage of muscle and recovery ability helps to promote the effects of training.[16-17] Szygula[3] found VO_2max is highly correlated with HGB. In sports, the increment of HGB results in better VO_2max and ability to resist fatigue. Hypoxia of central nervous system could be detrimental to ability of repeated sprinting. Better anaerobic ability could reduce the neuromuscular fatigue. The ability for muscles to use oxygen could be beneficial to long-time repeated sprinting. Resting heart rate, a simple and easily controlled way to evaluate and compare, is widely used in health assessment, physiological assessment, training monitoring and talent identification in sports. Studies show the decrease of resting heart rate shows less myocardial consumption of oxygen and improves myocardial blood supply. The cardiac effort index is an important factor in physiological indices because it reveals the ability of myocardial recovery, meaning the individual potential and cardiovascular system athletes show and recover in short time.

Hristo[18] suggested the distance of maximum velocity training should base on ATP-PC energy system (6-8 sec). 60m sprinting is an ideal way to develop sprinters' speeds, and it could be an indicator for 100m sprinter talent identification. Maćkała et al.[19] stated that the ability to accelerate and maintain maximum velocity is crucial in 100m performance. Tyson Gay and Derrick Atkins's decreasing percentage of velocity in the 100m final in 2007 Athletics World Champion were 1.69% and 1.53%. The Chinese sprinter decreased their velocity by 7.54% in the last 20m of the 100m sprint.[20] It indicates maximum velocity is highly correlated to 100m performance. CMJ parameters including CMJMV, CMJMS, CMJP indicate lower extremity explosive power to jump in a vertical downward direction. It shows an athlete's ability to use lower extremities to move from a static to dynamic state. The stretch-shortening cycle is the way muscles express strength in sprinting, which makes it a good way to evaluate teenage sprinters' lower extremity power.[21-23] Kukolj[24] reported the height of CMJ and maximum velocity is correlated positively with the peak power of lower extremities. We concluded that muscle strength and its contraction speed result from the individual difference of reactional strength, which makes reaction strength an influential factor for different level of teenage sprinters. Expert questionnaires using the Likert scale were conducted to determine the weight of the indices. Experts were asked to grade each parameter. Normalization and the main component analytical method were used to determine the weight of indices and the 3 general categories. (Table 6) Where W_i is the weight of i factor in fitness. Pij is the experts' and coaches' grading of i factor.

$$W_i = \frac{\sum_{j=1}^{11} Pij}{\sum_{i=1}^{7}\sum_{j=1}^{11} Pij} \quad (i=1,2,3)$$

According to the normal distribution, deviation and relative percentile method were applied to transform the values of parameters into scores. The chosen parameters were calculated into scoring points. Equation for scoring was used by:

$$\text{Indices sorces} = \frac{WGC \times WCP \times RL}{5} \times 100\%$$

WCG is the weight of the 3 general categories. WCP is the weight of chosen parameter. RL is the relative level.

Subjects' testing data were transformed to total points based on relative points. According to P90, P70, P30, P10, the final teenage Chinese male sprinters' fitness indices ranking scale was made. (Table 7) The relative percentile method was applied to grade subjects into elite group (<P90, n=18), good group (P70-P90-△, n=32)and normal group (P30-P70-△, n=57). Ultimately, the assessment standard scale of teenage Chinese male sprinter specific fitness indices was established. (Table 8) Afterward, a retrospective test was conducted for 107 subjects. Results of the test indicate subjects who reached level 5 in the elite group were significantly better than good and normal group. Talent identification for the good and normal groups was based majorly on level 4 and 5. It suggests the fitness scale made in the study demonstrates suitably to identify different level of athletes in a similar age group. Results of the retrospective test demonstrate the differences in different fitness levels of each group. (Figure 2)

Table 6. Weights of final teenage Chinese male sprinters' fitness and 3 general categories.

3 General Categories	Weight	Parameters	weight
Anthropometry	0.3	height	0.26
		LLB	0.22
		(AC/ ATL) ×100(%)	0.33
		(TC /LLA) ×100(%)	0.19
Physiological	0.25	HGB	0.54
function		Resting heart rate	0.20
		Cardiac work indices	0.26
Motor ability	0.45	60m	0.21
		100m	0.25
		CMJMV	0.18
		CMJFT	0.16
		CMJPS	0.12
		CMJP	0.08

CONCLUSIONS

13 parameters were chosen for teenage Chinese male sprinters' specific fitness indices, which could be categorized into 3 general categories and 9 subcategories. The final scale for teenage Chinese male sprinters' specific fitness has established the relationships and influences between parameters. Indices regarding teenage Chinese male sprinters' specific fitness can be categorized generally to anthropometric, physiological

Table 7. Teenage Chinese male sprinters' fitness indices ranking scale.

classification	indices	Level 5	Level 4	Level 3	Level 2	Level 1
Anthropometry	Height (cm)	>180	179 ~ 174.8	174.7 ~ 170.8	170.7 ~ 166.3	<166.2
	Score	7.8	6.24	4.68	3.12	1.56
	Leg length B(cm)	>94	93 ~ 90.51	90.5 ~ 87.5	87.4 ~ 85	<84.9
	Score	6.6	5.28	3.96	2.64	1.32
	Ankle Circumference/Achillies tendon length×100(%)	<87.58	87.57 ~ 93.86	93.85 ~ 103.03	103.02 ~ 111.57	>111.58
	Score	9.9	7.92	5.94	3.96	1.98
	Ankle circumference / leg length A×100(%)	>55.51	55.5 ~ 52.77	52.76 ~ 49.9	49.89 ~ 47.6	<47.59
	Score	4.5	3.6	2.7	1.8	0.9
Physiological function	HGB(g/l)	>150	141 ~ 149	127 ~ 140	107 ~ 139	<106
	score	13.5	10.8	8.1	5.4	2.7
	Resting hear rate (times/min)	<59	60 ~ 63	64 ~ 71	72 ~ 76	>77
	Score	5	4	3	2	1
	Cardiac work indices	<4.8	4.9 ~ 7.1	7.2 ~ 9.9	10 ~ 11.4	>11.5
	score	6.5	5.2	3.9	2.6	1.3
Motor ability	60m(s)	<7.15	7.16 ~ 7.37	7.38 ~ 7.69	7.7 ~ 8.09	>8.1
	Score	9.45	7.56	5.67	3.78	1.89
	100m(s)	<11.49	11.5 ~ 11.84	11.85 ~ 12.31	12.32 ~ 13.01	>13.02
	Score	11.25	9	6.75	4.5	2.25
	CMJ(m/s)	>2.9	2.89 ~ 2.73	2.72 ~ 2.56	2.55 ~ 2.38	<2.37
	Score	8.1	6.48	4.86	3.24	1.62
	CMJ(s)	>0.59	0.58 ~ 0.56	0.55 ~ 0.52	0.51 ~ 0.48	<0.47
	Score	7.	5.76	4.32	2.88	1.44
	CMJ MS(N)	>1761	1760 ~ 1508	1507 ~ 1285	1284 ~ 1032	<1031
	Score	5.4	4.32	3.24	2.16	1.08
	CMJ P	>75.45	75.44 ~ 67.25	67.24 ~ 59.95	59.94 ~ 51.67	<51.66
	Score	3.6	2.88	2.16	1.44	0.72

Table 8. Assessment standard scale of teenage male sprinter specific fitness indices.

Levels	Relative percentage	Score
Level 5 (excellent)	>P90	>81.6
Level 4 (good)	P70-P90-$_{\Delta}$	68.54 ~ 81.5
Level 3 (average)	P30-P70-$_{\Delta}$	55.46 ~ 68.53
Level 2 (fair)	P10-P30-$_{\Delta}$	47.55 ~ 55.45
Level 1 (poor)	<P10-$_{\Delta}$	<47.54

Δ represents the smallest unit.

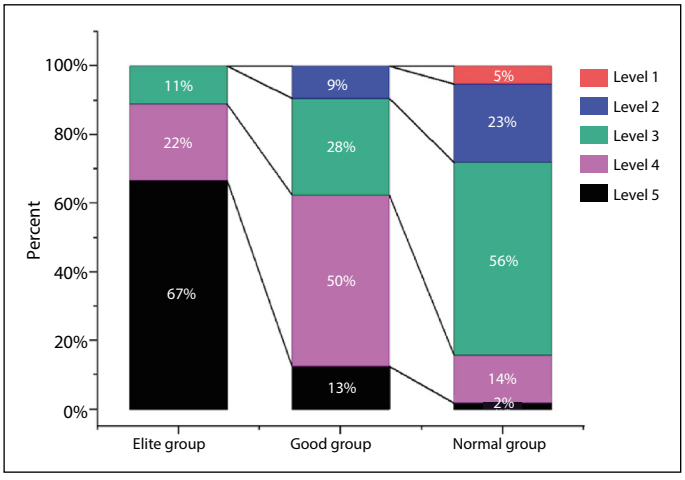

Figure 2. Retrospective test results for different fitness level of each group.

function and motor ability. Anthropometric indices indicate innate limits in high-speed sprinting motion structure; physiological indices indicate athletes' potential to express energy and recover in a short time; motor abilities indicate athletes' ability of maximum sprinting, reaction strength of lower extremities, power and maximum strength. Coaches and practitioners should emphasize teenage sprinters' ability of acceleration, maximum velocity, speed endurance and lower extremity strength. Moreover, when developing muscle strength for sprinting specific abilities in teenagers, motor ability should be focused on.

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