CHARACTERISTICS OF BODY COMPOSITION AND SOME PHYSIOLOGICAL AND BIOCHEMICAL INDICATORS OF VIETNAMESE SHORT DISTANCES RUNNING MALE ATHLETES

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Abstract:

Body morphological characteristics of the running athletes are average compared to the physical condition of Vietnamese people, with a height of 171.833 ± 5.672 cm, a body weight of 62.7 ± 4.545 kg; BMI: 21.746 (kg/m^2) shows that the athlete is neither fat nor thin; the athlete's body composition is not higher than body fat weight (kg): $\overline{X}$= 5.658 ± 0.535; Fat (%): $\overline{X}$ = 7.983 ± 0.793, athlete's muscle mass (57.558 ± 4.432) meets the ability to endure the fatigue during exercise; respiratory system (16,917 ± 0.793) and quiet heart rate (69,667 ± 3,985) are better than normal people; Vital capacity is higher than untrained people (3.982 ± 0.341), VO_2 max (50.867) reflects the aerobic capacity and is the basis for anaerobic formation and development of athletes that can confirm Oxygen supply ability of the respiratory apparatus in each athlete is good.

The biochemical indicators of blood especially RBC (5,343), Hb (15,042), Hct (45.3) and EPO (8,733) reflect the athletes' training level objectively about the athletic ability; this is also a basis for the coach to assess their training level, adjust the training program to suit the athlete's level, step-by-step scientification in training to improve the capacity of aerobic - anaerobic for the athletes.

Keywords: Body composition, heart rate (HRmin), Vital capacity (VC), VO_2 max, Red Blood Cell (RBC), hemoglobin (Hb), Hematorit (Hct), short distance running athletes.

INTRODUCTION

Athletics is a diversified sport that includes many different groups of subjects such as running, jumping, throwing, pushing ... and the running part is divided into many different distances. Short distance running is one of the basic contents of the Olympic Games, attracting the attention of many people as well as the media. In order to achieve the high-achievement goal in sport, Vietnamese sport needs to have a major change in many aspects such as innovation in recruiting the athletes, training high performance talents in the professional direction, applying science and technology to selection by sport biomedical examination to standardize and ensure more accuracy in recruiting and training the athletes. Examining and assessing the athletes' training level are important tasks, conducted in a systematic and scientific manner in order to accurately inform the training effectiveness to timely adjust the training process and to achieve the purpose; which is to become even more urgent with high performance sports, so we have conducted our research: "Characteristics of body composition and some physiological and biochemical indicators of short distances running male athletes".

RESEARCH METHODS

To solve the above problem, we used methods including: reading, analysis of documents, interviews, statistical maths, especially Inbody test, biomedical, hematological tests to consider some indicators of body composition, physiology, biochemistry including: body mass (BM), body fat weight (BF), muscle mass (FFM), fat percentage (Fat%), quiet heart rate (HRmin), VO_2max, vital capacity (VC), red blood cells (RBC), hemoglobin (Hb), hematorite (Hct) ...

Research object: interview samples are 12 experts, lecturers; and research samples include

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12 400-meter running male athletes with the first level or grandmaster level of the Ho Chi Minh City's national team (age: 20 ± 1.917, years of training: 3.96 ± 1.62 years, body height of 171.833 ± 5.672 cm, body mass: 62.7 ± 4.545 kg).

RESULTS AND DISCUSSION

1. Selecting the indicators, making the test to assess body composition and physiological and biochemical function indicators of short distances running male athletes

To select the indicators, tests to assess the body composition and physiological and biochemical function indicators of the short-distance male athletes, we refer to and synthesize the documents domestically and internationally, and then develop the interview questionnaire for the contents of Table 1 according to 3 levels: Very necessary (3 points), Necessary (2 points) and Unnecessary (1 point).

Conducting the interviews with 12 experts and lecturers (including 7 associate professors, 4 doctors, 1 specialist doctor I), we have selected 18 indicators and made some tests to assess according to the convention of the indicators. The test which reaches 75% of the total points or more is selected and used to test the body composition, physiological and biochemical functions of the short-distance male athletes; ensuring the relevance and reliability. The results are presented in Table 1.

Table 1. The result of selecting the indicators, making the test to assess body composition and physiological and biochemical function indicators of short distances running male athletes (n=12)

No	Test content, indicators	Number of selection			Total score	Actual percentage
		Very necessary	Necessary	Unnecessary		
1	Height (cm)	3	7	0	23	76.70
2	Body weight (kg)	3	7	0	23	76.70
3	BMI (kg/m^2)	3	7	0	23	76.70
4	Body fat weight (kg)	4	6	0	24	80.00
5	Fat percentage (%)	6	4	0	26	86.70
6	Muscle mass (kg)	9	1	0	29	96.70
7	Respiratory frequency (times/minute)	10	0	0	30	100
8	Quiet heart rate frequency (times/minute)	10	0	0	30	100
9	Vital capacity (liter)	6	4	0	26	86.70
10	VO_2 max relatively (ml/kg/minute)	6	3	1	25	83.30
11	Leucocyte "WBC" (x 109L)	5	5	0	25	83.30
12	Number of red blood cells "RBC" (x 10^{12}L)	10	0	0	30	100
13	Hemoglobin "Hb" (g/dL)	10	0	0	30	100
14	Volume of Red blood cell "Hct" (%)	10	0	0	30	100
15	Average volume of Red blood cell "MCV" (fL)	6	4	0	26	86.70
16	Hemoglobin/ Red blood cell "MCH" (pg)	5	5	0	25	83.30
17	Accumulation of red blood cell "RDW" (%)	4	5	1	23	76.70
18	Erythropoietin "EPO" (mIU/mL)	7	2	1	26	86.70

2. Characteristics of body composition and physiological and biochemical function indicators of short distances running male athletes

On the basis of using the selected indicators and test, we carry out the test and analyze the results through the following tables:

Table 2. Characteristics of morphology and body composition of short distances running male athletes (n=12)

No.	Test content	$\overline{x}$	δ	ε	Cv%
1	Height (cm)	175.417	5.299	0.02	3.021
2	Body weight (kg)	67.092	5	0.05	7.452
3	BMI (kg/m2)	21.746	1.347	0.04	6.195
4	Body fat weight (kg)	5.658	0.535	0.05	9.456
5	Fat percentage (%)	7.983	0.793	0.04	9.933
6	Muscle mass (kg)	57.558	4.432	0.05	7.7

Above survey data show:

The height (cm) reflects the development of athletes, the test results of short distance athletes are $\overline{X}$ = 175.417 ± 5.299, compared to the scale table to assess the 400-meter running athletes' training level, the athletes only reach 7.5 points.

In the activities, the body weight is affected by the oxygen demand under the VO2max aerobic capacity condition; the weight test result includes $\overline{X}$= 67.092 ± 5; at the same time, this index reflects the overall state of the muscles - bone growth faces, subcutaneous fat, internal organs and the level of body development; BMI (kg/m^2) with the result of $\overline{X}$= 21.746 ± 1.347, this index reflects the relationship between weight and height, used to evaluate a person's level of thinness or fatness. According to the World Health Organization (WHO) standards for Asian people, athletes' BMI is within the limits of normal body condition from 18.5 to 24.9 (it means that the body condition is not thin, not overweight or obese). The above 03 indexes have Cv <10% all; showing the uniformity, can represent the sample set with **ε** ≤ 0.05.

The amount of body fat is inversely proportional to athletic performance, the smaller the F%, the less body fat and the more beneficial it is to achieve high athletic performance. The test result of athletes with the body fat weight (kg): $\overline{X}$= 5.658 ± 0.535; Fat ratio (%): $\overline{X}$= 7.983 ± 0.793, compared to the scale in the evaluation criteria for 400-meter running athletes, this rate reaches 8.5 points. Besides, muscle mass assesses the influence of training and metabolism on the cells, and assesses the fatigue tolerance ability of muscle, the test result with $\overline{X}$= 57.558 ± 4.432. The above 03 indexes have Cv <10% all; showing the uniformity, can represent the sample set with **ε** ≤ 0.05.

The cardiovascular system which includes the heart and vascular system in the body, and performs the blood transport and metabolism function with cells, is a vital part of the body's oxygen supply system including the respiratory system, circulatory system; the test results show that the respiratory frequency (times / minute): with $\overline{X}$= 16.917 ± 0.793 in the low-lying range of normal people from 16-18 times / minute; quiet heart rate (times / minute): $\overline{X}$= 69.667 ±

Table 3. Characteristics of physiological functions of short distances running male athletes (n=12)

TT	Test content	$\overline{x}$	δ	ε	Cv%
1	Respiratory frequency (times / minute)	16.917	0.793	0.03	4.687
2	Quiet heart rate frequency (times / minute)	69.667	3.985	0.04	5.72
3	Vital capacity (liter)	3.982	0.341	0.05	8.57
4	VO_2 max relatively (ml/kg/minute)	50.867	3.195	0.04	6.281

3.985 with Cv < 10% showing the uniformity, can represent the sample set ε <0.05, but this result is still higher than the result in the training evaluation criteria of the short distance running athlete with $\overline{X}$= 61.3times/minute. The above results show that practicing a sport will fundamentally change the functional state of the respiratory system, so this index will decrease along with the athlete's training level if exercised more.

Vital capacity is an index which evaluates of the oxygen supply ability of respiratory system. Each person's vital capacity depends on their lungs capacity, their ability of the lungs to expand when they inhale, exhale and the strength of their breathing muscles. On the other hand, it is related to the fitness of each athlete such as height, weight and skin area of the body, vital capacity value of untrained people is about 3 - 3.5 liters, of the athlete is $\overline{X}$= 3.982 ± 0.341, with Cv < 10% showing the relative uniformity, the average value can represent the sample set. The above results shows that the vital capacity of the athletes is higher than normal people who do not practice. That can confirm the oxygen supply ability of the athletes' respiratory system in good condition.

This index is developed under the impact of the physical training and sports. It is an important index not only to evaluate the athlete's training level but also very valuable in selection. In a sport, the maximum oxygen consumption (VO_2max) is the most characteristic index of physical activity. VO_2max reflects the anaerobic capacity and is the basis for anaerobic formation and development. When practising the intensive exercises with aerobic - anaerobic intensity (2 hours a day), practising within 6 to 8 weeks will increase the capacity of the aerobic exchange system. Test results of 12 running athletes of the national team present $\overline{X}$= 50.867 ± 3.195, with Cv < 10% showing the relative uniformity, relative error ε = 0.04 <0.05, and the average value can represent the sample set. Under the effect of systematic training, the components of the aerobic system are improved. When using the intensity above anaerobic threshold, the athlete's aerobic capacity increases, the senior athletes improve many body potentials, then improve VO_2max. In the first 2-3 months, VO_2max improves 15 - 30%; when training from 9-24 months, VO_2max increases 40-50% and training for many years, VO2max will not exceed that percentage, but due to the training effect , aerobic enamel activity improves very quickly.

WBC (x 10^3/L): The normal value of this parameter is 4000 - 10000 leukocytes/mm3 (An average of 7000 leukocytes / mm3 of blood). The results of Table 4 show that the number of leukocytes of the athletes in the study group is within normal range with $\overline{X}$ = 6.149 ± 0.468.

RBC (x 10^6/L): Is the number of red blood cells in a unit of blood (usually liter or mm3). RBC components include: H_2O 63.5%, Hb 32-34%, Lipit 1%, and Protein-sugar 2%. RBC has 4 functions: the respiratory function is carried out by the hemoglobin (hemoglobin) contained in RBC; immune function; acid and alkali

Table 4. Characteristics of some biochemical indicators of short distances running male athletes (n=12)

No	Test content	$\overline{x}$	δ	Cv%	References
1	WBC (x 109/L)	6.149	0.468	7.618	(4.0-10.0)10^9/L
2	RBC (x 1012/L)	5.343	0.445	8.337	(3.80 - 5.60)10^12/L
3	Hb (g/dL)	15.042	0.934	6.207	(12 - 18 g/dL)
4	Hct (%)	45.3	2.247	4.961	(35 - 52 %)
5	MCV (fL)	86.775	7.727	8.904	(80 - 97 fL)
6	MCH (pg)	28.4	2.75	9.684	(26 - 32 pg)
7	RDW (%)	14.117	1.308	9.265	(11.0 - 15.7%)
8	EPO (mIU/mL)	8.733	2.816	9.249	(4.3 - 29 mIU/mL)

Athletics Vietnam has made remarkable achievements in recent years (photo source: http://toquoc.vn)

balance conditioning function of the body; adhesives pressure creation function. In Vietnam, the adults have from 3 and 5 million red blood cells. The results in the table 4 show the number of red blood cells of the athletes in the study group is higher than the Vietnamese adult, with $\overline{X}$ = 5.343 ± 0.445, but still within the reference range (3.80 - 5.60)10^12/L). The number of red blood cells of athletes is at a high level, which will meet the needs of metabolism and oxygen transport, adapt to a large amount of prolonged exercise, and prove that the practice program is suitable for the level, age characteristics of the athletes. However, if the number of red blood cells is higher than the normal range, it does not mean to have the ability to exchange and transport oxygen well, because MCH is the index used to determine the concentration of Hb inside the red blood cells, if the MCH is low, it shows that red blood cells are small and weak/asthenia, leading to high number of leukocytes so the ability to exchange and transport oxygen to muscle cells will be less.

Hb (g/dL): is the concentration of hemoglobin in the blood (calculation unit as g/l or g/dL). The normal hemoglobin value in the adult is compared to the male of 12 - 15g/dL; in the athlete, the hemoglobin value is higher than the average person. This index is the standard for diagnosing the sports anemia, less than 12 g/dL is anemia for the men. Hemoglobin is an indispensable index in the testing process to evaluate the effectiveness of the training. If the hemoglobin test result is less than 12g/dL, it is essential to find out the cause of the decrease in hemoglobin content in the blood. In which, we need to pay attention to the nutrition, bioactive substances as well as medicinal foods, etc.., and the amount of exercise must be adjusted until the hemoglobin is within the normal range of the normal people. If the hemoglobin is too high > 16 g/dL, it is necessary to reconsider the arrangement for the amount of exercise, it may be too light. The results in Table 4 show that the hemoglobin concentration of the male athletes in the study group is within the normal limit and equivalent to the hemoglobin concentration of the high-level athletes with $\overline{X}$ = 15.042 ± 0.934 g/dL.

Hct (%): This is the percentage between the red blood cells and the whole blood or the percentage of volume of blood that the blood cells are mainly red blood cells. In sports, this index is valuable for assessing the blood concentration due to excessive sweating during the training or due to the dehydration. In the research results, the red blood cells volume of the athlete has $\overline{X}$ = 45.3 ± 2.247% within the reference range (35 - 52%).

MCV (fL): the average volume of the red blood cells is an index to assess the cell structure of red blood cells, the MCV reduction or increase beyond the limit will affect the ability to transport and exchange the gas of red blood cells; at the same time, when the MCV increases highly, it will increase the viscosity of the blood, increase peripheral resistance, thereby it will affect the overall physical activity ability of the body. The value for MCV is 80 - 95fL in the adult. The results in Table 4 show that the average red blood cell volume of an athlete has $\overline{X}$ = 86.77 ± 7.727 fL and is within the normal range (80 - 97 fL).

MCH (pg): The number of hemoglobin / red blood cells is the index to be used to determine the concentration of Hb inside red blood cells. If the MCH is low, it indicates that the red blood cells are small and weak/asthenia, if the MCH is high, it is likely to be excellent. This index normally ranges from 26 to 32 picograms. The results in Table 4 show that the number of Hemoglobin / red blood cells of the athletes group with $\overline{X}$ = 28.4 ± 2.75 pg is within the reference limits.

RDW (%): In sports activities, this index can also be used to evaluate the ability to transport oxygen to muscle cells in the body. When the pressure is within the reference level, the oxygen transport ability is assessed well for the aerobic capacity, whereas when the pressure is higher than the reference level, the ability to transport oxygen to the cells will be less; because of low oxygen absorption, the results of Table 4 show that $\overline{X}$ = 8.733 ± 1.308 is higher than in the reference level (11.0 - 15.7%) so in this case, it is assessed that the anaerobic capacity is good.

EPO (mIU/mL): Erythropoietin is a major stimulant of the process of making red blood cells in response to hypoxia, is a glycoprotein with a molecular weight of 34 KDa, With this hormone deficiency, an oxygen deficiency does not increase or insignificantly increase the activity of erythropoiesis. The results in Table 1 show that the athlete's EPO index is $\overline{X}$ = 8.733 ± 2.816, still within the normal reference limits (4.3 - 29 mIU/mL).

CONCLUSION

Based on the summary, we have interviewed and selected 18 indicators, made the test to check the characteristics on morphology, body composition, physiology and biochemistry which affect the operation process, physical exercise of the athletes. The research result reflects the aerobic capacity and is the basis for anaerobic formation and development of the athletes. This is also a basis for the coach to assess their training level, adjust the training program to suit the athlete's level, step-by-step scientification in training to improve the capacity of aerobic - anaerobic for the athletes.

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