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Dr. Tran Ngoc Dung
Department of Athletics,
Weightlifting - Faculty of
Knowledge and Basic Skills –
Bac Ninh Sports University,
Vietnam

Dr. Nguyen Xuan Tuan
Department of Sports
Management - Bac Ninh Sports
University, Vietnam

D.S Vu Chung Tuan
Physical Education Department
Hanoi National University of
Education, Vietnam

Corresponding Author:
Dr. Tran Ngoc Dung
Department of Athletics,
Weightlifting - Faculty of
Knowledge and Basic Skills –
Bac Ninh Sports University,
Vietnam

The characteristics of respiratory function recovery of high-level athletics athletes while exercising in large capacity area

Dr. Tran Ngoc Dung, Dr. Nguyen Xuan Tuan and DS Vu Chung Tuan

Abstract

We used scientific research methods to select 06 criteria to evaluate the recovery ability of high-level athletics athletes while exercising in large capacity area with the Kostex Metamax 3B machine system. Based on that, we assessed the development of respiratory function recovery of the research subjects while exercising in large capacity area at different times: Before exercising, after starting, while exercising, 10 minutes after exercising and 24 hours after exercising.

Keywords: Recovery, respiratory function, athletics athletes, exercise, large capacity area

Introduction

Question

Studying the development of the recovery process is of great significance in determining the timing of the impact of the next exercise during training, and is the basis for assessing the physical fitness level and preventing pathological conditions from happening due to excessive exercise. It can be seen that the number of topics and monographs studied in the world is very large, stemming from the importance of the issue of recovery in sports.

So far, although the recovery rules and parameters after physical activities have been established by foreign scientists, it is not possible to apply fully those recovery parameters to the practice of Vietnamese. Because Vietnamese athletes have their own morphological and functional characteristics. Therefore, it is necessary to study the recovery characteristics of athletes in different exercising capacity areas.

Stemming from the importance of the problem, we conducted the research: The characteristics of respiratory function recovery of high-level athletics athletes while exercising in large capacity area.

Research Methods

The research process uses the following methods:

- Method of analyzing and synthesizing documents
- Interview method
- Pedagogical examination method (conducted on Kostex Metamax 3B system)
- Method of mathematical statistics

Results and Discussion

1. Select criteria for evaluating the respiratory function recovery of high-level athletes when exercising in large capacity area

Using the method of analyzing and synthesizing documents, interview method, we have chosen 06 criteria to evaluate the respiratory function recovery ability of high-level athletics athletes when exercising in large capacity area: Respiratory frequency (times/minute); Vital capacity (litre); Sudden vital capacity (%); Relative VO₂ (ml/min/kg); Relative VCO₂ (ml/min/kg); Respiratory quotient.

We conducted the research on 23 level-1 athletics athletes and grandmasters, including 10 males aged 18-20 and 10 females aged 16-17. The exercise selected to represent the large capacity area is: 3000m Running. The data were taken to assess the characteristics of the respiratory function recovery process of high-level athletics athletes while exercising in large

capacity areas at the following times: Before exercising (before athletes start exercising); After warm-up (immediately after athletes complete the general warm-up and the professional preparation for large capacity exercises), while exercising (10 seconds after completing the large capacity exercise), time: 10 minutes after exercising (10 minutes after completing the large capacity exercise) and 24 hours after exercising (24 hours after completing the large capacity exercise).

2. Respiratory function recovery characteristics of high-level athletics athletes when exercising in large capacity area.

2.1. Characteristics of the indicators reflecting the

Table 1: Characteristics of the respiratory function of high-level athletics athletes before exercising

o.	Criteria	Male (aged 18-20) (n=10)		Female (Aged 16-17) (n=10)	
		\bar{x}	σ	\bar{x}	σ
1	Respiratory frequency (times/min)	16.8	1.92	16.3	2.01
2	Vital capacity (litre)	3.25	0.34	3.16	0.33
3	Sudden vital capacity (%)	91.23	6.76	87.42	6.45
4	Relative VO_2 (ml/min/kg)	5.71	0.53	5.68	0.51
5	Relative VCO_2 (ml/min/kg)	4.85	0.47	4.71	0.48
6	Respiratory quotient	0.85	0.01	0.83	0.02

Table 1 shows that: Before exercising, the characteristics of the respiratory function of high level athletics athletes were at the threshold of normal people. However, compared to normal people of the same age and gender, high-level athletics athletes have good and fair respiratory function compared to the standard of Vietnamese athletes (Criteria for assessing training level in selection and sports training).

respiratory function of high-level athletics athletes before exercising in large capacity area.

Respiratory function is important in exercising activities. It determines the physical capacity of the body not only in a coordinated role to provide oxygen for the metabolism process but also to participate in the process of eliminating CO_2 , avoiding poisoning for the body. The ability to provide O_2 not only determines the aerobic capacity but also determines the anaerobic capacity, which has been recognized by theory and practice.

We used the 06 selected criteria to assess the respiratory function of athletes before exercising in large capacity area. The results are presented in Table 1.

2.2. Characteristics of the indicators reflecting the respiratory function of high-level athletics athletes after warming up to exercise in large capacity area.

After the athletes perform general warm-up exercises and professional preparations for exercising in large capacity area, the topic will check the athletes using the selected criteria. Results are presented from Table 2.

Table 2: Characteristics of the respiratory function of high-level athletics athletes after warming up to exercise in large capacity area

S. No.	Criteria	Male (aged 18-20) (n=10)		Female (Aged 16-17) (n=10)	
		\bar{x}	σ		
1	Respiratory frequency (times/min)	18.56	2.15	18.33	2.15
2	Vital capacity (litre)	3.55	0.31	3.44	0.36
3	Sudden vital capacity (%)	92.42	9.17	91.85	8.65
4	Relative VO_2 (ml/min/kg)	8.18	3.35	8.20	3.27
5	Relative VCO_2 (ml/min/kg)	6.87	3.94	6.97	3.42
6	Respiratory quotient	0.84	0.10	0.85	0.11

Table 2 shows that: After warming up, the respiratory function characteristics of high-level athletics athletes had significant changes in the direction of being more adapted to exercising activities. Specifically, the measured indicators tend to increase much higher than those measured in the pre-exercising period and the increase reached approximately 10%. The topic uses the measured parameters after warming up as a milestone to assess the recovery process of athletes.

2.3. Characteristics of the indicators reflecting the respiratory function of high-level athletics athletes while exercising in large capacity area.

The respiratory data and air analysis of the athletes 10 seconds right after completing the above test were taken on the system Kostex Metamax 3B. Results are presented in table 3.

Table 3: Characteristics of the respiratory function of high-level athletics athletes while exercising in large capacity area

No.	Criteria	Male (aged 18-20) (n=10)			Female (Aged 16-17) (n=10)		
		\bar{x}	σ	% alter	\bar{x}	σ	% alter
1	Respiratory frequency (times/min)	58.47	5.75	211.01	59.13	5.91	222.59
2	Vital capacity (litre)	3.25	0.31	-7.67	3.16	0.32	-8.14
3	Sudden vital capacity (%)	86.73	8.62	-5.74	83.27	8.23	-9.34
4	Relative VO_2 (ml/min/kg)	61.38	6.17	646.72	59.45	5.91	625.00
5	Relative VCO_2 (ml/min/kg)	93.91	8.97	1243.51	89.77	8.89	1187.94
6	Respiratory quotient	1.53	0.15	80.00	1.51	0.14	77.65

Table 3 shows that: While exercising in large capacity area, the respiratory function characteristics of high-level athletes had significant changes in the test parameters. Specifically:

- The respiratory frequency of all athletes tested increased sharply while exercising in large capacity area. Specifically, the increase was 211.01% for male athletes and 222.59% for female athletes. The reason for the increase in respiratory frequency during exercising activities is to make up for the oxygen right during the exercise. This is also the area where athletes reach the maximum VO₂.
- Vital capacity and sudden vital capacity tend to decrease slightly for both male and female.
- VO₂ and VCO₂ increased sharply, in which, VCO₂ increased much faster than VO₂, leading to a sharp

increase in respiratory quotient. This is also the motor region with the largest respiratory quotient among the 4 areas of motor intensity: Maximum, below maximum, large and medium. The respiratory quotient achieved in the high intensity area for male was 1.53 and for female was 1.51.

2.3. Characteristics of the indicators reflecting the respiratory function of high-level athletics athletes 10 minutes after exercising in high capacity area

The data were taken to assess the respiratory function of high-level athletes 10 minutes after exercise in large capacity area, and the results were compared with the respiratory function characteristics test results taken before starting the test. The results are presented in Table 4.

Table 4: Characteristics of the respiratory function of high-level athletics athletes 10 minutes after exercising in large capacity area

No.	Criteria	Male (aged 18-20) (n=10)			Female (Aged 16-17) (n=10)		
		\bar{x}	σ	% recover	\bar{x}	σ	% recover
1	Respiratory frequency (times/min)	25.31	3.25	83.09	26.12	3.08	80.91
2	Vital capacity (litre)	3.56	0.38	103.33	3.45	0.34	103.57
3	Sudden vital capacity (%)	92.28	8.79	97.54	91.03	9.11	90.44
4	Relative VO ₂ (ml/min/kg)	37.32	4.02	45.23	36.33	4.06	45.11
5	Relative VCO ₂ (ml/min/kg)	33.21	4.11	69.73	32.70	4.12	68.93
6	Respiratory quotient	0.89	0.08	92.75	0.90	0.09	92.42

Table 4. shows: 10 minutes after completing exercising in large capacity area, the respiratory function characteristics of the athletes have recovered significantly, in which an indicator has recovered further than the time after warming up. Specifically:

- Respiratory frequency has recovered by about 80% compared to the time after warming up. At this point, the respiratory frequency is still high to make up for the oxygen after exercising in large capacity area.
- The vital capacity measured at this time reached a higher indicator than the time after warming up and the recovery level reached approximately 110%.
- Sudden vital capacity indicator; Relative VO₂ and relative VCO₂ are the slowest recovery indicators. In

which VO₂ relatively recovered much slower than relative VCO₂. This has brought the respiratory quotient indicator closer to the level calculated at the time of warming up. Respiratory quotient index recovered by about 95% at this time.

2.4. Characteristics of the indicators reflecting the respiratory function of high-level athletics athletes 24 hours after exercising in high capacity area

The data were taken from the respiratory function tests of high-level athletes 24 hours after exercising in large capacity area, and the results were compared with the respiratory function characteristics test results before starting the test. The results are presented in Table 5.

Table 5: Characteristics of the respiratory function of high-level athletics athletes 24 hours after exercising in large capacity area

No.	Criteria	Male (aged 18-20) (n=10)			Female (Aged 16-17) (n=10)		
		\bar{x}	σ	% recover	\bar{x}	σ	% recover
1	Respiratory frequency (times/min)	16.91	1.62	104.13	16.41	1.64	104.71
2	Vital capacity (litre)	3.32	0.31	23.33	3.20	0.31	14.29
3	Sudden vital capacity (%)	91.31	9.08	80.49	88.26	8.76	58.16
4	Relative VO ₂ (ml/min/kg)	5.73	5.63	104.61	5.72	0.57	104.84
5	Relative VCO ₂ (ml/min/kg)	4.87	0.47	102.30	4.80	0.45	102.61
6	Respiratory quotient	0.85	0.09	98.55	0.84	0.08	101.52

Table 5 shows: 24 hours after completing exercising in large capacity area, the respiratory function characteristics of the athletes recovered to the pre-exercise level, in which an indicator recovered back to a better level than after warming up.

Conclusion

- Before exercising, the respiratory function characteristics of high-level athletes were at the optimal threshold of normal people of the same age and gender.
- After warming up and preparing for exercising in large capacity area, all indicators evaluating the respiratory function of the athletes had significant changes in the increasing tendency which show adaptability to

exercising activities. The increase is approximately 10%.

- While exercising, the respiratory frequency increased sharply; vital capacity and sudden vital capacity decreased slightly in both male and female; VO₂ and VCO₂ increased sharply, in which, VCO₂ increased much faster than VO₂, leading to a sharp increase in respiratory quotient.
- 10 minutes after exercising, the respiratory frequency has recovered about 80%; Recovered vital capacity is approximately 110%; Sudden vital capacity; Relative VO₂ and relative VCO₂ are the slowest recovery indicators. In which VO₂ relatively recovered much slower than relative VCO₂. This has brought the respiratory quotient index closer to the level calculated at

the time of warming up.

- 24 hours after completing exercising in large capacity area, the respiratory function characteristics of the athletes recovered to the pre-exercise levels, with an indicator recovered back to an even better level than after warming.

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