

Physical Training Courses of Mine Rescue Crew in Different Age

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Abstract. To scientifically formulate physical training plans and assessment standards for mine emergency rescue teams. This study adopts research methods including literature method, expert interview method, and field investigation method and takes the physical training course of the National Mine Rescue Team Kailuan Team as the research object. The problems, curriculum objectives, assessment standards and the courses contents of the physical training of the mine emergency rescue team has been researched, and physical training curriculum systems for different age groups have been proposed through this study. The results suggest that the theoretical knowledge of the basic-level physical fitness instructors (commanders) needs to be improved, the training methods are single, and the ambulance team members are not trained by age. The new curriculum goals are supposed to takes into account the physical features of rescue team members of different ages; the assessment standards should enable the evaluation indicators of rescue teams in training to be scientific to meet the diverse needs of rescuers; based on the existing curriculum reform practice, it is believed that the physical training system of the rescue team must be improved. The structure and content of the physical training courses of the segmented rescue team enable the comprehensive development of the rescue team's physical fitness and provide reference for the more scientific and reasonable training of the different emergency rescue team.

Keywords: Emergency Rescue; Physical Training; Curriculum System; Optimization; Age.

1. Introduction

Mine emergency rescue team is the "patron saint" of mine safety production, which plays an important role in protecting people's life and property safety and reducing accident loss to the greatest extent. "Comprehensive constitution" is one of the important contents of military management of mine rescue team. Is (AQ1009-2007) "mine rescue team quality standardization assessment specifications" in the provisions of the assessment items; It is also an important competition item in "mine rescue technology Competition". Physical training is the basic guarantee for mine rescue workers to carry out accident rescue work, and the strength of the physical quality of the rescue workers is one of the key factors to determine the success of rescue [1]. In the face of the randomness and complexity of rescue tasks, rescuers should have good physical fitness, which is the basis for completing various rescue tasks. The establishment of a mine emergency rescue team with excellent physical fitness meets the needs of modern emergency rescue work [2].

Ian B. Stewart found in his research that training provided by actual rescue or mining-related work was generally insufficient to maintain and improve the physical fitness of rescue workers. Therefore, rescue teams need to develop the necessary physical health standards and participate in regular training (and evaluation) to maintain these required physical standards [3]. COSTA Cristian designed a physical training program based on six training modes and found that physical training could help improve the efficiency of mine rescue activities [4]. At present, the physical training method of mine emergency rescue team in China is single, lacking scientific and targeted. Chinese scholars also believe that "scientific physical training" can improve the physical and will quality of rescue workers [1]. Some scholars also found that the use of high intensity interval training (HIIT) and wave cycle training (WCT) and other emerging physical training methods in military training can enhance the combat effectiveness of troops and reduce the incidence of training injuries [5], but these methods have not been applied in the physical training of mine emergency rescue teams in China. Yao Lu took mine emergency rescue workers as the research object and believed that psychological stress of mine

workers was closely related to age and education level [6]. At present, there is a lack of specific research on the physical and psychological characteristics of emergency responders at different ages.

Therefore, in the peacetime training of mine emergency rescue team, scientific physical fitness training plans and evaluation standards are of vital importance. The physical fitness index standards of mine rescue team members and the formulation of scientific physical fitness training plans need to be optimized and improved [7], including specific optimized courses and strategies based on age differences. Taking Kailuan National Mine emergency rescue team as an example, the author studied the optimization of the physical fitness course system of mine emergency rescue team in China by age levels. Kailuan Mine Rescue Team is one of the first 7 national mine emergency rescue teams in China, and is responsible for emergency rescue tasks of major accidents in North China and other regions, which is representative to a certain extent [8].

Training involves physical, psychological and command quality three aspects, including the physical qualities of rescue workers is the most important and urgent, therefore, the mine emergency rescue team physical training course structure and setting up the need according to the players on a rescue mission in the face of all kinds of special circumstances, combines the actual conditions of accident cases and rescuers to adjust and optimize, In order to cultivate higher quality emergency rescue personnel.

The national Mine emergency rescue Kailuan team and other mine emergency rescue teams and regional teams have added physical training in their daily training, the main purpose of which is to develop the unique physical strength and special quality of mine rescue team members. At present the mine emergency rescue team physical training curriculum is a reference standard for mine rescue procedures requirements for implementation, and after nearly 10 years of teaching practice and experience, according to the change of the training goal made some changes and adjustments to its, rescue teams physical training course in our country has got a certain development.

But overall, the rescue team physical training course system is not yet mature, unclear orientation of existence, the outdated structure is not reasonable and the content and the curriculum pattern of a single problem, especially at present the mine rescue team has not more accurately training according to age, cannot give attention to both the different characteristics of all ages, can't do it according to their aptitude, vary from person to person. In addition, there is no essential difference between the physical training courses of the mine rescue team and those of other teams (such as the SWAT team) except the special equipment and other contents of the rescue team, which cannot meet the training needs of the mine rescue team for rescue personnel in the future.

2. Course Objective Optimization

2.1 Objectives before Course Optimization

The objectives of physical training courses of various mine emergency rescue teams in China are similar with minor differences, basically the setting mode of "physical health + special quality", which to a large extent fails to reflect the "vary from person to person" of the course, that is, there is no course arrangement according to the physical characteristics of rescue team members at different ages. According to the current mine rescue Regulations, the concept of mine emergency rescue team physical training course and the needs of society and members, the objectives of mine emergency rescue physical training course can be summarized as follows:

- Improve physique, improve health, and enhance the adaptability of rescue workers to the natural environment and mine operation environment;
- Improve the movement skills of rescue team members, transfer and develop rescue skills;
- Develop special physical qualities for rescue team members' career needs and maintain a positive mental health state;
- Develop the professional comprehensive quality required by rescue team members and enhance their social adaptability;

- To improve the awareness of lifelong physical exercise of rescue team members and establish an active lifestyle.

2.2 Objectives after Course Optimization

18-25 years old is the emerging stage of adulthood [9], when rescue workers are in their best physical and psychological state. Due to the high intensity of the mine rescue task and the high requirements on the members, it is generally difficult for the members to be competent for the first-line disaster relief post after the age of 45, so the upper age limit is 44 years old. According to the physical and psychological conditions of different ages, this study took 10 years as a unit and roughly divided it into three stages. Specific optimization and expansion of the physical training objectives of the mine rescue team were carried out based on age, as shown in Table 1.

Table 1. The goal of the physical fitness course for the mine rescue team after optimization

<i>Age</i>	<i>Objective</i>
Under 25	<ol style="list-style-type: none"> 1. Develop the comprehensive physical and psychological quality of rescue workers in an all-round way, and enhance the adaptability of rescue workers to the natural environment and mine operation environment; 2. Develop specialized physical and comprehensive professional qualities required by rescue team members to enhance their social adaptability; 3. Maintain a healthy state of positive psychology, improve the awareness of lifelong physical exercise of rescue team members, and establish a positive lifestyle.
25~34	<ol style="list-style-type: none"> 1. Focus on developing strength and endurance; 2. Develop rescue team members' comprehensive physical quality with sensitivity, flexibility and core as auxiliary; 3. Develop special physical and comprehensive professional qualities needed by rescue team members, and maintain positive psychological health; 4. Improve rescue team members' awareness of lifelong physical exercise and establish an active lifestyle.
35~44	<ol style="list-style-type: none"> 1. Exercise strength and endurance without injury; 2. Supplemented by sensitivity and flexibility; 3. Maintain a healthy state of positive psychology, improve the awareness of lifelong physical exercise of rescue team members, and establish a positive lifestyle; 4. Enhance the awareness of preventing sports injury and self-protection.

At present, the physical training objectives of mine rescue personnel have not been set according to age differences. The author has optimized the physical characteristics of rescue personnel in different age stages as follows:

- The rescue team members were divided into three age groups: below 25 years old, 25-34 years old, 35-44 years old;
- Rescuers under the age of 25 should focus on the overall development of physical and psychological quality, and enhance the adaptability of rescue workers to the natural environment and mine operation environment;
- 25~34 years old rescue team, should develop strength, endurance quality mainly, supplemented by agility, flexibility, core and other qualities, maintain a positive mental health state, cultivate the consciousness of lifelong physical exercise;

Rescue team members aged from 35 to 44 should be trained in strength, endurance, agility and flexibility without injury; Maintain a healthy state of positive psychology, improve the awareness of lifelong physical exercise, enhance the prevention of sports injury, self-protection awareness.

3. Optimization of Evaluation Standard System

3.1 Evaluation Standard System before Optimization

The standard requirements of the original Mine Rescue Regulations [10] are shown in Table 2 [10]. It can be found that the original evaluation standard also ignores age difference, an important variable, and the evaluation does not vary from person to person. In addition, the flexibility and sensitivity of rescuers have not been evaluated, and the evaluation criteria are not comprehensive.

Table 2. Standard requirements of "Mine Rescue Regulations"

<i>Category</i>	<i>Project</i>	<i>Standard</i>	<i>Requirements</i>	<i>Needs</i>	<i>Points</i>
Strength	Pull-ups	8times	Forehand grip	—	0.5
	Weightlifting	10times	30kg barbell	—	0.5
	High jump	1.1m	—	—	0.5
	Long jump	3.5m	—	—	0.5
	Climbing	3.5m	Climb with bare hands	—	0.5
	Dumbbell	20times	Dumbbell 8kg (2 pcs) up, middle and down 20 times each	—	0.5
	Weight-bearing Squat	15times	Barbell 40kg	—	0.5
	Pull Calibrator 100 times	150s	Immediately after 1000 meters of equipment walking	—	2
Endurance	2000m running	10min	—	—	0.5
	1000 m Equipment Walking	8min	100 times consecutively with the pull tester, no interval	Wear oxygen breathing apparatus and carry equipment according to fire accident	2
	Walking 10,000 m with a weight of 15kg	4h	—	Wear oxygen breathing apparatus	2
	Pull the calibrator 100 times in the thick smoke at 50°C and saw 2 pieces of φ16~φ18 wood section	30min	Inside the drill tunnel	—	2

3.2 Optimized Evaluation Standard System

Smoothly for the helmet crew have physical training and carry out the mine accident emergency rescue ability to combat missions, select pull-ups, weight lifting, squat legs to stand up, jump, 100 meters, 5000 meters, five kilometers armed cross-country, sandbags to run back and stand before body bends, combination and practice as a mine rescue team fitness index system, and develop the mine rescue team physical index standard. In order to better meet the physical needs of different age groups, this study focused on the optimized physical education curriculum objectives, refined the age stages, and formulated more specific and accurate evaluation standards and training courses. The setting of this evaluation standard not only takes into account the requirements of specific skills and quality content modules of emergency rescue teams, reflecting professional characteristics, but also fully takes into account the diversified and multi-level needs of rescue teams, which has been unanimously recognized by rescue teams (see Table 3 for details).

Table 3. Optimized the physical fitness index standard of the mine rescue team

Category	Project	Under 25	25~29	30~34	35~39	40~44	Points	
Strength	Pull-ups	8	7	5	4	3	0.5	
	Weightlifting	30	25	20	15	10	0.5	
	Squat	90	85	80	70	60	0.5	
	Long jump	4.3	4.1	3.9	3.7	3.5	0.5	
	High jump	1.1						0.5
	Climbing	3.5			3	2.5	0.5	
	Dumbbell	20					0.5	
	Weight-bearing Squat	15					0.5	
	Pull Calibrator 100 times	150			130	110	2	
Endurance	100m running	15''	15''3	15''5	16''	16''5	0.5	
	5000m running	23'	23'30	24'	25'	—	1	
	5km armed cross-country	26'	26'30	27'	28'	—	2	
	Walking 10,000 m with a weight of 15kg	4	4.5	5	5.5	—	2	
	Back sandbag run	7'	8'	—	—	—	0.5	
	Pull the calibrator 100 times in the thick smoke at 50°C and saw 2 pieces of φ16~φ18 wood section	30					2	
Stretching	Standing Forward Bend	Keep both palms touching the ground at the same time for 3s			Keep fingertips on the ground at the same time for 3 s		0.5	
Agility	Combination exercises	1'	1'20	1'40	1'50	2'	0.5	

4. Optimization of Course Structure and Content

4.1 Course Structure and Content before Optimization

In the existing mine emergency rescue team physical training courses generally in the form of a mandatory training session, the structure of a single, emphasizes the endurance, strength, oriented, mainly in order to support the rescue workers need physical quality in the process of rescue, ignoring basic physical courses and other physical course, and not according to the age of the rescue workers classified evaluation standard, It is difficult to carry out targeted training according to the age stratification of rescue team members, and it is difficult to meet the development of different physical qualities of rescue team members, which is harmful to cultivate their lifelong habit and awareness of physical exercise. On national mine emergency rescue team kailuan team as investigation object, through on-the-spot investigation to get some countries directly under a squadron of kailuan mine emergency rescue team daily work schedule, found that kailuan rescue team training programs are according to the standard requirements of the mine rescue procedures and scoring methods, the training methods of the single, only for the two physical strength and endurance training, It is difficult to meet the requirements of training compound rescue talents in the process of mine rescue.

4.2 Optimized Course Structure and Content

Mine emergency rescue physical stamina training in foreign countries as a reference in this paper, the experience of the course content choice and the mine rescue procedures in China divided two quality content, on the basis of field around the optimized evaluation standard, changed the traditional according to the classification of endurance, strength, quality, and to the mine emergency rescue physical training course content according to the function into the field of quality training of four, It mainly includes developing strength, endurance, flexibility and agility. (Table 4 and Table 5) national kailuan mine emergency rescue team, for example, in expanding the content of the mine emergency rescue physical training course, after a lot of rescuers were flexible and the sensitive quality training, and that these training courses for their survival, practical skills, has the practical, scientific and

challenging. In the physical training course, the rescue team can learn how to develop aerobic and anaerobic capacity in life (such as climbing stairs, cycling, jumping rope, etc.), learning the body exercises suitable for the usual training; They also learned theoretical and practical knowledge about how to maintain physical strength through nutrition and exercise, prevent obesity and prevent injury.

Table 4. The optimized course structure of our mine emergency rescue team

<i>Emergency rescue team physical training course</i>	<i>Course Mode</i>		<i>Course content</i>	<i>Course objectives</i>
Teaching practice	Basic physical class	Practical courses	Develop basic quality and physical fitness programs for rescue team members	Develop basic quality and physical strength
—	—	Theory course	Scientific physical exercise, sports injury prevention and treatment	Tell the story in combination with teaching practice
—	Rescue special physical class	Practice	Wind curtain hanging, plate closing, construction of closed wall, high bubble, installation of local fan, air duct, troubleshooting, on-site first aid, alarm gathering, well preparation, etc	To understand the theoretical knowledge related to mine rescue and develop the necessary special qualities and physical strength of rescue team members
—	—	Theory	<i>Mine Rescue Regulations, Coal Mine Safety Regulations, etc</i>	—
Extracurricular sports	Association, autonomous exercise		Choose sports according to your interests	Cultivate lifelong sports awareness and establish an active lifestyle
Fitness test Constitution monitoring	Physical fitness, physical fitness testing center consultation		Emergency rescue physical fitness test and evaluation method, rescue personnel physical fitness test and exercise prescription	Lectures, on-site guidance and other forms can be used

5. Conclusion

This paper optimizes the comprehensive physical ability and physical ability curriculum system of mine emergency rescue team from three aspects:

- In terms of course objective optimization, the physical characteristics of rescue team members at different ages are optimized, and the connotation of the target is enriched to make the training more comprehensive;
- In terms of the evaluation system standard, the physical index standard of mine rescue team is optimized and perfected according to the age stratification, so that the evaluation index of rescue team can be scientific in training, so as to meet the diversified needs of rescue personnel;
- In terms of course structure and content, closely follow the evaluation indicators, based on rescue physiology and psychology, combined with the characteristics of the emergency rescue team industry, select scientific, practical and effective content that integrates the experience of rescue team members and social needs, so as to comprehensively develop the physical quality of rescue team members.

Table 5. Optimized content of physical fitness courses Standard for mine rescue teams

Category	Project	Under 25	25~29	30~34	35~39	40~44	Interval
Strength	Pull-ups	18/16/12	15/12/8	12/10/8	10/8/6	8/6	1min
	Weightlifting	30*3	25*3	20*3	15*3	10*3	1min
	Squat	90/80/70	85/75/65	80/70/60	70/60/50	60/50/40	3min
	Climbing	4*3			3.5*3	3*2	3min
	Dumbbell	30*3			20*3		1min
	Weight-bearing Squat	30*3			20*3	15*3	30s
	Pull Calibrator 100 times	110*3			100*3	100*2	3min
Endurance	100m running	15''/16''/17''			16''/17''/18''		1min
	5000m running	20'	21'	22'	23'	Unlimited time	—
	5km armed cross-country	23'	23'30	24'	25'		—
	Walking 10,000 m with a weight of 15kg	3.5	4	4.5	5		—
	Back sandbag run	6'	7'	8'	Unlimited time	—	
	Pull the calibrator 100 times in the thick smoke at 50°C and saw 2 pieces of φ16~φ18 wood section	22	24	26	28	30	—
Stretching	Limbs stretch	Stretching for the arms, forearms, shoulders, waist, thighs, and calves, each stretch is maintained for 30 seconds					—
	Sitting forward bending	Keep palms over toes for 20s			—		—
Agility	Sprint-retreat	1'*3	1'20*3	1'40*3	1'50*3	2'*3	30s
	Bend, lean forward and sprint	1'*3	1'20*3	1'40*3	1'50*3	2'*3	
	Push-up start	1'*3	1'20*3	1'40*3	1'50*3	2'*3	
	Sideways crosswalk	1'*3	1'20*3	1'40*3	1'50*3	2'*3	

*Number of training sessions in the representative

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