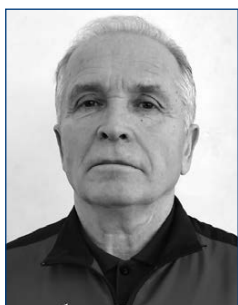




# Combination of students' strength and aerobic load for successful completion of control standards related to strength endurance

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## Abstract

**Objective of the study** was to identify the most effective combination of strength and aerobic load of students and evaluate their impact on the level of physical fitness when passing control standards.

**Methods and structure of the study.** The pedagogical experiment was conducted with students of the Tyumen Industrial University Institute of Industrial Technology and Engineering. The students were divided into three groups - two experimental and one control. Each group had its own method of combining power and aerobic exercise. An exemplary program for combining such loads for the successful passing of control standards based on strength endurance is given.

**Results and conclusions.** The dynamics of changes in the results of students, which was observed during one semester, is presented. It is shown that the dynamics of the growth of results in the fulfillment of control standards occurs as a result of the simultaneous development of both power endurance and aerobic endurance. It is noted that the development of aerobic endurance should not be neglected during training in the gym. The growth of results in the implementation of power standards is given by two workouts a week for 30 minutes to develop the aerobic capabilities of the body.

**Keywords:** aerobic load, strength training, gym, control standards, cardio load.

**Introduction.** There are two opinions among those involved in sports. Some are confident in the great benefits of physical exercise, which develops overall endurance, that is, improves the aerobic capacity of the body. Such loads improve the functioning of the cardiovascular and respiratory systems, saturate the blood with oxygen, which speeds up the metabolism. In addition, the content of cholesterol in the blood decreases, blood pressure returns to normal, as well as weight [2]. In order for the loads on the development of the aerobic capabilities of the body to be productive, they must be performed with a certain intensity. Sports medicine advises to determine the intensity of aerobic exercise as a percentage of the upper point of maximum heart rate (MHR). Maximum heart rate is calculated by the formula:  $MHR = 220 - \text{age}$

of the trainee [1, 4]. Aerobic work usually gives an effect in the range of 120-200 bpm. Proponents of aerobic exercise believe that aerobics gives a load on all muscle groups. But practice and its analysis show that aerobic complexes consist of cyclic movements and minimally load the muscles of the upper body, where up to 65% of human muscles are located. Aerobics gives a load mainly on the muscles of the legs [3]. In addition, there are different opinions about the timing of aerobic exercise to reduce weight and improve the functionality of the athlete's body. Someone prefers the morning hours, someone - the evening.

Other athletes believe that classes in the gym with weights - kettlebells, barbells, dumbbells, etc., are more effective, since in this case all muscle groups are worked out. And with optimal planning of training ses-



sions, good results are achieved in the development of both the upper and lower parts of the athlete's body, which aerobics does not give.

**Objective of the study** was to identify the most effective combination of strength and aerobic load of students and evaluate their impact on the level of physical fitness when passing control standards.

**Methods and structure of the study.** The experiment was carried out at the Tyumen Industrial University of the Institute of Industrial Technologies and Engineering. Methods: comparative analysis and generalization method. To assess the degree of effectiveness of the combination of power and aerobic loads, the trainees were divided into three groups - two experimental and one control. The subjects were relatively healthy and had a doctor's approval for physical exercises. The experiment continued during the semester, 34 training sessions were held.

**Results of the study and their discussion.** The first experimental group included those who had the ability and desire to perform aerobic exercise in the morning before breakfast. The load was carried out according to the plan given in Table 1.

Such a load consisted of cross-country running, the duration of which was 30 minutes, and the total aerobic load was 40 minutes. It included 5 minutes of brisk walking, then running for 30 minutes with a gradual increase in intensity (heart rate control up to 120-140 beats / min was controlled by a heart rate monitor) and again 5 minutes of brisk walking. These exercises were carried out twice a week. Aerobic workouts in the morning were held on days when the trainees did not visit the gym. Weight control was carried out every week on days of strength training. Strength training

was carried out twice a week with the study of certain muscle groups, depending on the individual plan of each trainee. As a result of a combination of aerobic and power loads, the average weight loss in the first group was 5-6%. The group consisted of 14 people.

It should be noted that the athletes were not always able to maintain the intensity of cross-country running, since the level of training was different. Nevertheless, the majority of those involved completed the task and noted an improvement in well-being, ease of movement, as well as an increase in results when performing strength exercises with a barbell, when performing control standards in pulling up, pushing up and in lifting the body from a prone position. All trainees noted an improvement in body shape during visual assessment. The results in pull-ups increased by 30-40%, in push-ups - by 20-25%, in lifting the torso - by 10-15%, in standing long jumps - by 5-6%.

The second experimental group consisted of 12 people who performed aerobic exercise on cardio machines immediately after the power load. Aerobic exercise was performed on a treadmill. Power load was performed with free weights on power simulators. In the second group, training in the gym lasted 1 hour 30 minutes: 1 hour - strength and 30 minutes - cardio load. Classes were also held twice a week. This group adhered to the intensity load as shown in Table 2.

The second group included students whose weight was normal - eight people, four people were overweight. Students with normal weight set the task to improve their shape (relief), those with excess weight wanted to reduce their weight to normal. Difficulties in fulfilling a given intensity of aerobic exercise occurred in overweight students, but after a month and a half,

*Table 1. Sample program for combining strength and aerobic exercise*

Day of the week	Workout type	Muscle groups and type of cardio load	Intensity, %
Monday	Power	Muscles of the back, legs, arms (biceps), abdominal muscles	
Tuesday	Aerobic	30 min cross	50-60
Wednesday	Rest		
Thursday	Power	Chest muscles, deltas, triceps, abdominal muscles	
Friday	Aerobic	30 min cross	60-65
Saturday, Sunday	Rest		

*Table 2. The plan of the intensity of the load on the treadmill*

Intensity, % of MHR	Time, min
50	1
60	2
75	24
60	2
50	1



the intensity of the load increased significantly, and by the end of the semester it reached the recommended intensity level. As a result, overweight exercisers made the most progress in weight loss. In general, in this group, the average weight loss was 3-4% of the initial. The results in passing the control standards, which require the manifestation of such a physical quality as strength endurance, have improved markedly. Those who were overweight at the beginning of the experiment could not perform pull-ups on the crossbar even once, and at the end of the experiment they began to pull themselves up two to four times. The positive result was influenced by weight reduction and improvement in overall endurance, which in turn affected the increase in strength endurance. For the rest of the trainees in this group, the results in fulfilling the control norms also increased: in pull-ups by 25-30%, in push-ups - by 15-20%, in lifting the torso - by 12%, in long jumps from a place - by 3-4 %.

The third (control) group, consisting of 15 people, included students whose main goal was to increase muscle volume, so aerobic exercise took a short period of time: 5-10 minutes before the start of strength exercises with weights and on simulators. Those involved in the third group had the goal of increasing muscle volume, which is usually accompanied by an increase in their own weight. But at the same time, those involved in the 3rd group, as well as in the 1st and 2nd, sought to improve the results of passing control standards, which require the development of strength endurance.

As a result, at the end of the experiment in this group, the trainees slightly increased their muscle volumes and, at the same time, their weight increased by an average of 1.5-3%. And also the results of fulfillment of control standards improved in pull-ups by 10-15%, in push-ups - by 5-8%, in lifting the torso - by 4-5%, in standing long jumps - by 2-3%.

**Conclusions.** The conducted studies showed that the combination of power and aerobic load in the first group turned out to be more effective for preparing

for passing the control standards, since cross-country training was carried out on days free from power load and in the fresh air. During the run, the blood was saturated with oxygen, so muscle recovery took place faster for subsequent strength work in the gym. The work was more efficient, which gave the greatest increase in results when performing exercises related to the manifestation of strength endurance (pull-ups, push-ups, body lifts, long jump from a place).

The second group showed less significant results compared to the first. The reason is that the cardio load was performed immediately after the power load, but, unfortunately, ordinary students are not ready to physically perform both the power and aerobic load in full with a given intensity in one day.

The smallest quantitative increase in results when fulfilling the control standards was in the third group due to the low level of aerobic endurance development, which in turn affected the development of strength endurance, which is necessary when performing pull-ups, push-ups, body lifts. These results were influenced by the low volume of cardio loads in training.

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