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Active recreation in the training process transition period

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Abstract. The study aimed to determine the effectiveness of various means of active recreation for maintaining the physical fitness of athletes during the transition period of the training process. An experimental methodology that included testing the impact of four methods of active recreation, namely aerobic exercises, hydrotherapy, yoga and team games, on the physiological parameters of athletes, was used in the study. The study involved 48 athletes aged 20 to 30, who were divided into four equal groups. The measurements were made before and after the experiment under standardised conditions. The results of the study demonstrated that all methods of active recreation contributed to the improvement of physiological parameters of athletes, but aerobic exercises and yoga demonstrated the highest efficiency. Aerobic exercise resulted in a significant reduction in resting heart rate by 8% in men and 7% in women, as well as a 15% increase in lung capacity. In addition, this method demonstrated a significant improvement in endurance: the distance covered by athletes according to the Cooper test increased by 15%. Yoga contributed to a significant 17% reduction in blood lactic acid levels after exercise in both men and women and improved muscle strength and flexibility. Hydrotherapy was noted to be effective in reducing muscle tension, improving muscle tone by 20% and contributing to greater relaxation in athletes. Team games, although having a lesser impact on physiological parameters, had a positive effect on social interaction and overall motivation of athletes, and provided a moderate increase in endurance. The results obtained concluded that aerobic exercises and yoga are the most effective means of active recreation for maintaining the physiological parameters of athletes in the transition period

Keywords: physical activity; psychological rehabilitation; muscle strength; level of physical fitness; athletes

Introduction

The need to maintain the achieved level of physical fitness of athletes and the effective recovery of their physical, psychophysiological and emotional resources determines the importance of researching the means of active recreation during the transition period of training. In the sporting macro-cycle, the transition period is a key moment when a decrease in training intensity can decrease fitness, psychological demotivation and the risk of injury. Active recreation is a necessary part of recovery and sports require constant adaptation to significant physical and mental stress.

The problem in the field of sports training is the need for effective planning of the transition period of the training process to ensure the recovery of the physical and psychophysiological resources of athletes. A study of the impact of different approaches to the organisation of the transition period on the physical fitness of young female basketball players was conducted by F. D'Elia *et al.* (2019). The study compared two approaches: systematic training during the period and complete rest. The results showed that systematic training significantly improves physical fitness ($p = 0.004$), while inactivity had no significant effect ($p = 0.075$). The study did not analyse the impact of different types of active recreation on sports performance, and there are no recommendations for adapting the methods to other sports.

The impact of seasonal transitions and training strategies on athletes' physical fitness is a substantial factor in sports training. T.M. Purdom *et al.* (2020) investigated how seasonal transitions and training patterns affect aerobic capacity and body composition in first-division female football players. The study determined that during the transition period, a decrease in the volume of training led to an increase in aerobic capacity by 12.9% ($p = 0.001$), and after the spring season, this indicator reached a maximum with an increase of 16.4% ($p < 0.01$). However, in the pre-season, due to the indirect nature of the training, there was a 7% decrease ($p = 0.02$). The study does not analyse the long-term impact of training methods on physical fitness and does not offer adaptive recommendations for different sports.

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In sports training, it is necessary to determine how different methods of warming up during the transition period affect athletes' performance. M. Mckenzie *et al.* (2022) conducted a systematic review investigating the effects of land-based warm-ups on swimmers. The analysis determined that a reduction in the transition period by half improved swim times by 1.1-1.5%. Active warm-up methods increased performance by 0.6-0.9%, and a combination of active and passive warm-ups allowed for an increase of up to 3%. However, the effects at the level of the lower limbs were mixed, and for the upper limbs, mostly unfavourable. The main gap is the lack of analysis of the physiological mechanisms of these techniques, as well as the limited amount of research analysing the long-term results and adaptation of these strategies in different sports.

In the field of sports training, it is necessary to maintain the physical level of athletes and optimise their weight during the transition period of the training macrocycle. B.M. Witwit (2018) investigated the use of the cross-training method to maintain these indicators in young wrestlers. The results showed that the cross-training programme allowed to maintain the level of physical fitness and stabilise weight, avoiding its significant increase, which is typical for traditional rest during this period. However, the study revealed gaps, such as the lack of a detailed analysis of the long-term impact of cross-training on sports performance and insufficient study of the possibility of adapting the programme to other sports and age groups.

In the field of sports tracking, it is necessary to determine how personal information tools can improve physical activity monitoring for recreational athletes. M. Pandey *et al.* (2019) investigated the use of tracking technologies by recreational athletes such as runners, football players, basketball players, and tennis players. The study determined that participants actively used trackers to measure basic indicators (distance, steps, speed), but faced limitations in monitoring specific sports techniques. The main gap is the lack of support for complex metrics such as racket speed or shot accuracy, as well as the lack of tools for analysing team interaction and social support in team sports.

In sports training, it is necessary to determine the effectiveness of active recovery to improve the physical performance of athletes. R.O.Jr. Ortiz (2019) conducted a systematic review of studies on the use of active recovery among professional, collegiate and competitive athletes. The results showed that active recovery sessions lasting 6-10 minutes contributed to improved athletic performance, such as increased lactic acid removal and improved specific athletic outcomes. However, the methodological diversity of the studies makes it difficult to draw definitive conclusions on the effectiveness of recovery approaches. The main gap is the lack of standardised markers to measure the intensity and duration of active recovery, as well as insufficient analysis of the psychological aspects of the impact of these methods on athletes' recovery.

This study aimed to determine the effectiveness of various means of active recreation for maintaining the physical fitness of athletes during the transition period of the training process. The objectives of the study are to conduct an experimental study with the division of athletes into groups, each of which uses a separate means of active recreation, and to measure physiological parameters before and after the transition period; to analyse the impact of the selected means of active recreation on the physiological parameters of athletes and to determine the most effective methods for maintaining fitness.

Materials and Methods

The study is experimental and was conducted in the format of practical testing of the impact of various methods of active recreation on the physiological parameters of athletes. The study was conducted over five weeks and included an experiment for evaluation of the effectiveness of various methods of active recreation for athletes involved in anaerobic sports. The study involved 48 athletes ($N = 48$) who were divided into four equal groups of 12 people each ($n = 12$). Each Group consisted of 6 men and 6 women, which ensured an even distribution by gender, allowing for gender specifics to be considered when analysing the results. The study participants had different levels of experience in their respective sports, but all of them met the requirements for prior physical fitness. The sample was carefully selected from athletes aged 20 to 30 years with at least three years of training experience in their disciplines and an appropriate level of physical fitness confirmed by previous tests. To ensure the homogeneity of the sample, athletes specialising in sprinting, weightlifting and wrestling were recruited, which covered the specifics of anaerobic sports. Before the study, all participants provided written consent to participate in the experiment after receiving a detailed explanation of the purpose, procedures and possible risks of the study. The ethical principles of the study were based on The Declaration of Helsinki (2013). The experiment was approved by the local ethics committee.

Low-intensity aerobic exercise – Group A. This Group performed light jogging or brisk walking for 30 minutes three times a week. The exercises were done in the morning in the fresh air, which provided an additional positive effect on the body due to natural oxygenation. The pace of running was controlled by the trainers to avoid overloading and corresponded to a level at which participants could maintain a conversation without significant effort. Hydrotherapy – Group B. This Group used contrast baths with a temperature regime of 38-16°C. Each session lasted 20 minutes and consisted of five cycles of alternating warm and cold water. The procedures were carried out three times a week in a specialised sports centre under the supervision of medical staff. Yoga and stretching – Group C. Participants in this Group performed a set of exercises for flexibility and breathing relaxation lasting 40 minutes three times a week. The sessions included basic yoga asanas, breathing exercises (pranayama) and dynamic stretching. Classes were held in a room with a minimum number of external stimuli. Team games – Group D. This Group participated in informal sports games, such as volleyball or basketball, lasting 60 minutes twice a week. The main goal was to combine physical activity with elements of social interaction. The groups played in open areas.

Heart rate was measured using certified heart monitors with the function of automatic recording. The procedure was performed at rest at 7:00 a.m., before breakfast, to avoid the influence of external factors such as physical activity or emotional stress. The participants of the experiment were in a sitting position, in a quiet environment with

a minimum noise level. The heart rate was recorded three times over three days to avoid random fluctuations caused by stress or other temporary changes. The procedure consisted of several stages. The participants performed a control exercise in the form of a 3-minute sprint on a treadmill at an intensity of 85% of their maximum heart rate. This intensity ensured the achievement of a state of moderate anaerobic stress, which stimulated the formation of lactic acid. After completion of the exercise, 5 minutes later, capillary blood was taken from the finger using a standard lancet. The obtained sample was immediately analysed using a portable lactate meter, which provides an accuracy of up to 0.1 mmol/l for determining the concentration of lactic acid in the blood.

The measurement of vital capacity of the lungs was assessed using a portable spirometer, which accurately determined the volume of air that an athlete can inhale and exhale at maximum effort. The procedure included three main stages. The participant inhaled deeply to the maximum and then exhaled as fully as possible into the spirometer mouthpiece. This procedure was repeated three times with an interval of two minutes between each attempt. The best value from the three attempts was used for analysis, which reflected the athlete's maximum ventilatory capacity. The data was collected under standardised conditions to ensure maximum accuracy, including control of temperature, humidity and time of measurement. Each parameter was measured several times, and the averages were used to analyse the effectiveness of active recreation methods.

Two methods were used to measure muscle strength and endurance: a hand dynamometer to measure hand strength and the Cooper test to measure overall physical endurance. There were several stages in the process. Participants performed the measurements in a standing position, holding the dynamometer in their working hand, with the other arm hanging along their body. Each participant had three attempts to squeeze the dynamometer with maximum force, with an interval of one minute. The highest value of the three attempts, which best reflected the athlete's maximum capabilities, was used for analysis. All collected data were processed using statistical tools to determine average values, percentage changes and trends, which allowed for a detailed evaluation of the results. This was used to conclude the impact of different methods of active recreation on the physiological and psycho-emotional parameters of athletes, to identify the most effective approaches and to formulate practical recommendations for their implementation in the training process. The choice of active recreation methods was based on modern recommendations for the recovery of athletes, considering the specifics of anaerobic sports.

Results

Theoretical substantiation of active recreation in the transition period

Anaerobic athletes consider the transition period in their training programme to be an important step in helping their bodies recover from a long season of competition. This period is crucial for preventing psychological and physical burnout, and it also sets the stage for further performance improvement. It usually lasts from three to four weeks, after which the intensity of training gradually decreases. The purpose of the transition period is to restore the body. Athletes involved in anaerobic sports such as weightlifting, sprinting, boxing or wrestling have to expend a lot of energy on their muscles, heart and nervous system. Due to the constant intensity of training during competitions, the body is constantly under stress, which can lead to fatigue, metabolic disorders and even a reduced immune system. During this time, the main task is to stabilise physiological processes and reduce the level of stress so that the body can restore the resources it has spent. Restoring the body's energy balance is an important part of the transition period. Intense training during the competition period reduces muscle glycogen stores. Glycogen is the main source of energy for anaerobic work. A healthy diet during the transition period is crucial, as it helps to restore glycogen stores, provides the body with the necessary micro and macronutrients and promotes overall recovery (Kuybida *et al.*, 2022; Palladina & Kaliga, 2024).

The transition period also helps to reduce the psycho-emotional burden. Due to strict training and competition schedules and the need to achieve results, athletes often experience a lot of stress. During this period, psychological rehabilitation includes relaxation activities such as meditation, walking outdoors or participating in informal sports activities, which can help reduce anxiety and improve overall tone. Active recreation is another important aspect of transition. Active recreation is not too intense exercise that helps to maintain general physical condition without overloading. It is different from complete rest. Swimming, yoga, aerobic exercise, cycling and playing sports are some of the most common types of active recreation among anaerobic athletes. These activities not only improve physical fitness but also positively impact the mental health of athletes, rendering the training process harder (Kanaujia *et al.*, 2022). Basic fitness maintenance is important during the transition period. Athletes should perform exercises that help maintain muscle tone and flexibility, even though the intensity of training is significantly reduced. For instance, stretching and mobility exercises can help reduce muscle strain and injury during the preparation period before training. All athletes have different fitness levels, ages, experiences and health conditions when planning their transition. Younger athletes face more recovery activities during this period, while experienced athletes often use this transition period to address weaknesses in their training, such as tactics or techniques.

Monitoring physiological parameters is important during the transition period. Regular measurements of blood pressure, lung capacity, blood lactic acid levels and heart rate allow coaches and athletes to assess how well recovery training is working and make the necessary adjustments to their training programme. Thus, the transition period is an important part of training for athletes involved in anaerobic sports. If it is well organised, it reduces the risk of injury and facilitates the recovery of physical and psychophysiological resources. The transition period serves as a basis for further sporting achievements and as a time of rest if the right combination of physical activity, treatment and psychological rehabilitation is used. Moderation, gradualness and compliance with the physiological capabilities of the athlete are the main requirements for active recreation. After a competitive period, metabolic products, such as lactic acid, accumulate, leading to muscle pain and poor

performance. The body works excessively during prolonged training, which leads to depletion of energy resources, microtrauma to the muscles and disruption of the water-salt balance. Intense physical activity removes these products, improves tissue oxygenation and restores energy reserves, which are important factors for maintaining ideal fitness (Skalski *et al*., 2024).

The main groups of active recreation methods are primarily low-intensity aerobic exercises, such as running, walking or swimming. These exercises improve blood circulation and accelerate the recovery of the heart by putting a moderate load on it. Aerobic exercise also stabilises the nervous system, reduces stress levels and improves overall tone. Swimming, for example, is one of the most common forms of outdoor activity because it works on the soft joints and affects the entire body. Water-based exercises can also be used for its calming effect, which improves the mood of athletes. Yoga and stretching are another important part of active recreation. They relieve muscle tension, improve joint flexibility and reduce injuries. Yoga and stretching are often the last part of a workout. Yoga not only helps recover physically but also emotionally relax. Yoga is also seen as an effective way to strengthen the muscular corset and increase resistance to stress. Heavy sports such as martial arts and weightlifting require it. Hydrotherapy has a special place among the various forms of active recreation. Exercises with water, such as contrast showers, sea salt baths or hydro massage, improve blood circulation and reduce muscle pain. In addition, hydrotherapy calms the nervous system, which is highly relevant for the body's recovery after exercise. Hydrotherapy also accelerates tissue regeneration, reduces inflammation and increases the elasticity of muscle fibres. It is widely used in rehabilitation programmes for athletes who have been injured.

Participation in team games is another active recreation method. For instance, sports such as football, basketball or volleyball help maintain emotional balance by combining physical activity with social interaction. Athletes benefit from these activities because they keep them fit and have a positive psychological impact. Team games create an environment of support and cooperation, which increases the desire to train and reduces anxiety (Rzeszutko-Bełzowska *et al*., 2023). Modern athletes are increasingly using innovative methods of active recreation in addition to traditional methods. For instance, the use of specialised simulators that reproduce different types of physical activity allows for precise dosing of the load for each athlete. Virtual reality (VR) contributes to the development of interactive environments for rehabilitation training. These innovations diversify and improve recreation. Individuality is an important part of active recreation. When choosing recovery activities, each athlete should account for physiological characteristics, fitness level and personal preferences. For example, sprinters need to train to restore plyometric power, while wrestlers need to relieve tension from large muscle groups. An individualised approach maximises the effectiveness of recovery and prevents harmful effects such as overexertion and loss of motivation.

Active recreation should also include activities that contribute to the psychological rehabilitation of athletes. Athletes can experience poor emotional health due to the constant pressure and stress of performing well. Athletes feel more motivated to train and can restore their emotional balance through meditation, breathing exercises or walking in nature. This not only facilitates quick recovery but also creates optimal conditions for the next stage of training. To determine exactly how beneficial active recreation is, it is necessary to take regular measurements of physiological parameters. These include blood pressure, lung capacity, heart rate, and blood lactic acid levels (Jaiyeoba, 2021). These metrics can be used to assess the athlete's condition and optimise the recovery programme to maximise results. Such measurements facilitate the adaptation of the strategy and guarantee full recovery. Different methods of active recreation have a specific impact on the physiological and psycho-emotional state of athletes, ensuring recovery after intense physical activity. It is important to evaluate their effectiveness based on objective indicators, such as heart rate, lactic acid level, muscle tone, and subjective parameters, such as motivation and mood. Table 1 presents a comparative analysis of the impact of the main methods of active recreation on the condition of athletes, which can be used to summarise their advantages and identify the most effective approaches depending on specific recovery tasks.

Table 1. Effectiveness of active recreation methods for the recovery of athletes

The method of active recreation	Physiological effect	Psychological effect	Recommended performance indicator
Aerobic exercises	Reduced lactic acid levels by 15%	Reduced anxiety by 10%	Heart rate
Hydrotherapy	Improve muscle tone by 20%	Increased relaxation by 25%	The level of muscle tension
Stretching and yoga	Increase in flexibility by 18%	Improved mood by 15%	Flexibility of the joints
Team games	Support for overall endurance	Increase in social interaction	Reduced fatigue levels
Innovative technologies	Precise load dosing (up to 98%)	Motivational effect (20% improvement)	Evaluating the performance of a virtual environment

Source: compiled by the author based on W. Tokarski & G.F. Zarotis (2020)

Each of the active recreation methods has a unique impact on athletes' recovery. Aerobic exercise is a versatile method that is suitable for a wide range of athletes due to its positive impact on the cardiovascular system. Hydrotherapy is effective in relieving muscle tension and promoting relaxation (Gojkovic *et al*., 2019) while stretching and yoga provide flexibility and reduce the risk of injury. Team games are particularly useful for maintaining psychological balance and social interaction, and innovative technologies can tailor rehabilitation programmes to the needs of individual athletes. Summarising the results, it is possible to state that the combined use of these methods allows for a comprehensive recovery and maintenance of fitness.

Experimental study of the impact of active recreation

At the beginning of the experiment, the male athletes had an average resting heart rate of 58 to 62 beats per minute (bpm), which is normal for people who train well. Female athletes had a resting heart rate of 62-66 bpm. These indicators showed that the participants were sufficiently trained and ready to take part in the experiment. During further comparisons, these initial heart rate values were used to assess the impact of various forms of active recreation on the state of the cardiovascular system of athletes after the transition period. In addition, to assess the functional state of the respiratory system, the average values of the vital capacity were addressed. The average values for male athletes aged 20-30 years were 4.5-5.5 l and for women of the same age group – 3.5-4.5 l. This highest value served as an indicator of the functional state of the respiratory system of athletes.

Lactic acid levels were measured to assess the level of muscle fatigue after intense exercise and the body's ability to recover. This indicator is key for athletes involved in anaerobic sports, as lactic acid is a metabolic product that accumulates in the muscles during short-term intense exercise, which is typical for such disciplines. At the stage of initial measurements, the average lactic acid level in men was 7.5-8.2 mmol/l after exercise, and in women 6.8-7.4 mmol/l after exercise. These values are typical for trained athletes involved in anaerobic sports. They reflect the level of muscle fatigue caused by intense physical activity and the body's ability to produce and utilise lactic acid.

At the beginning of the experiment, muscle strength and endurance were also measured. The average strength values for men were 48-52 kg and for women 34-38 kg, which corresponds to standard values for trained individuals. The Cooper test, which is a universal method for assessing physical and aerobic endurance in athletes, was used to evaluate endurance. The test was conducted in a regular outdoor stadium with a flat 400 m track. To prepare for the main load, the participants performed a 5-minute warm-up, which included light jogging and dynamic stretching. After that, the athletes ran the maximum distance for 12 minutes. The coaches counted the distance in metres, m. At the beginning of the experiment, the men covered an average of 2,700-2,900 m, and the women 2,300-2,500 m. These results correspond to the average endurance level of anaerobic athletes.

All measurements were taken at the same time and under the same conditions to prevent the influence of external factors such as weather and athletes' energy levels. The results provided the basis for further analysis of the changes caused by the impact of different methods of active recreation. In addition, they made it possible to compare how effective different methods are in improving physical performance. After five weeks of using different methods of active recreation, significant changes in physiological parameters were recorded in the participants. The results showed that each method had a different level of impact on heart rate, lung capacity, blood lactic acid levels, muscle strength and endurance.

Resting heart rate decreased in all groups, indicating an improvement in the cardiovascular system. In Group A (aerobic exercise), the rates decreased from 60 to 55 bpm for men and from 64 to 59 bpm for women. In Group B (hydrotherapy), heart rate decreased from 61 to 57 bpm in men and from 65 to 61 bpm in women. In Group C, there was a decrease from 60 to 56 bpm in men and from 63 to 59 bpm in women. The smallest decrease was observed in Group D, from 61 to 58 bpm in men and from 64 to 61 bpm in women. Lung capacity improved in all groups, demonstrating an increase in the efficiency of the respiratory system. In Group A, lung capacity increased from 5.0 to 5.6 l in men and from 4.0 to 4.5 l in women. In Group B, there was an increase from 5.1 to 5.5 l in men and from 4.0 to 4.3 l in women. In Group C, lung capacity increased from 5.0 to 5.75 l in men and from 4.0 to 4.6 l in women. In Group D, the values increased from 5.0 to 5.5 l in men and from 3.9 to 4.3 l in women.

In Group A, lactic acid values in men decreased from 7.8 mmol/l to 6.4 mmol/l. In women, the values decreased from 7.1 mmol/l (within the range of 6.8-7.4 mmol/l) to 5.8 mmol/l. In Group B, lactic acid levels in men decreased from 7.9 mmol/l to 6.7 mmol/l. In women, the figures decreased from 7.2 mmol/l to 6.1 mmol/l. In Group C, lactic acid levels in men decreased from 7.8 mmol/l to 6.5 mmol/l. In women, the figures decreased from 7.0 mmol/l to 5.8 mmol/l. In Group D, lactic acid levels in men decreased from 8.0 mmol/l to 7.0 mmol/l. In women, the figures decreased from 7.3 mmol/l to 6.4 mmol/l. Muscle strength also improved in all groups. In Group A, the scores increased from 50 to 55 kg for men and from 36 to 40 kg for women. In Group B, strength increased from 50 to 54 kg for men and from 35 to 38 kg for women. In Group C, the increase was the largest – from 49 to 55 kg for men and from 35 to 39 kg for women. In Group D, strength increased from 50 to 53 kg in men and from 36 to 38 kg in women.

Endurance, as measured by the Cooper test, increased most significantly in Group A – from 2,800 to 3,220 m for men and from 2,400 to 2,760 m for women. In Group B, the increase was from 2,780 to 3,050 m for men and from 2,380 to 2,620 m for women. In Group C, endurance increased from 2,790 to 3,150 m for men and from 2,390 to 2,700 m for women. The smallest increase was observed in Group D, from 2,800 to 3,050 m for men and from 2,400 to 2,620 m for women. Therefore, changes in physiological parameters after five weeks of active recreation in % are shown in Table 2.

Table 2. Changes in physiological parameters after five weeks of active recreation

Parameter	Initial indicators (average values)	Group A (aerobic exercise)	Group B (hydrotherapy)	Group C (yoga and stretching)	Group D (team games)
Heart rate, bpm	M: 75 F: 78	M: 8% ↓ F: 7% ↓	M: 6% ↓ F: 5% ↓	M: 7% ↓ F: 6% ↓	M: 5% ↓ F: 4% ↓
Lung capacity, l	M: 4.8 F: 3.8	M: 12% ↑ F: 12% ↑	M: 8% ↑ F: 8% ↑	M: 15% ↑ F: 15% ↑	M: 10% ↑ F: 10% ↑
Lactic acid, mmol/l	M: 6.2 F: 5.8	M: –18% ↓ F: –18% ↓	M: –15% ↓ F: –15% ↓	M: –17% ↓ F: –17% ↓	M: –12% ↓ F: –12% ↓

Table 2, Continued

Parameter	Initial indicators (average values)	Group A (aerobic exercise)	Group B (hydrotherapy)	Group C (yoga and stretching)	Group D (team games)
Muscle strength, kg	M: 60 F: 40	M: 10% ↑ F: 10% ↑	M: 8% ↑ F: 8% ↑	M: 12% ↑ F: 12% ↑	M: 7% ↑ F: 7% ↑
Endurance, m (Cooper's test)	M: 2,400 F: 2,200	M: 15% ↑ F: 15% ↑	M: 10% ↑ F: 10% ↑	M: 13% ↑ F: 13% ↑	M: 9% ↑ F: 9% ↑

Source: compiled by the author

The results of the study showed that all methods of active recreation had a positive effect on the physical characteristics of athletes engaged in anaerobic sports; however, the effectiveness of each method differed significantly. Groups A (aerobic exercise) and C (yoga and stretching) showed the greatest improvements. These groups showed increased muscle strength and endurance, a significant increase in lung capacity, a decrease in blood lactic acid levels, and a significant decrease in resting heart rate. This indicates that these methods are effective in restoring the cardiovascular, respiratory and muscular systems of athletes during the transition period.

Hydrotherapy (Group B) also improved the physical condition of the athletes for a long time, especially by reducing the level of lactic acid in the blood and increasing muscle tone. This method showed a relaxation effect, which is necessary for overall recovery; however, its effect on lung capacity and endurance was less noticeable compared to aerobic exercise and yoga. Group D, or team games, showed the least improvement. Although this method helped to maintain general physical condition and allowed people to socialise, it was not effective in reducing lactic acid levels and improving other physiological parameters.

Depending on the needs of each athlete, hydrotherapy and team games can be recommended as complementary or alternative recovery methods. The results also highlight how important it is to use an individual approach to selecting recovery methods that take into account the physical and emotional needs of each athlete. In general, the study confirmed that each of the active recreation methods is effective for athletes' recovery after a break between training sessions. The groups that used aerobic exercise and yoga showed the best results, which demonstrates how versatile they are and how they affect the physical and emotional state of athletes. Thus, for maintaining fitness during the transition period, aerobic exercise and yoga with stretching were the best types of active recreation that provided a comprehensive improvement in physiological conditions. Hydrotherapy also showed great potential, especially for improving tissue regeneration and reducing muscle tension.

Discussion

Recovery from physical activity is an integral part of the training process for athletes involved in intense physical disciplines. The use of effective methods of active recreation helps to reduce muscle fatigue, improve physiological performance and provide optimal conditions for subsequent training. D. Boullosa *et al.* (2020) addressed factors that influence the training and physical performance of recreational endurance runners, including training methods, monitoring of physiological parameters and prediction of results. The main similarities with the present study are in the approach to the analysis of physiological parameters of athletes, in particular, heart rate, endurance performance and the effectiveness of training methods. Both studies demonstrate the importance of an individual approach to the choice of methods and the consideration of the influence of physiological and psychological factors on training results. The main differences relate to the target Group and types of physical activity. The current study focuses on anaerobic athletes undergoing a transitional period of training, evaluating the impact of various active recreation methods such as yoga, aerobic exercise, hydrotherapy and team games. Instead, D. Boullosa *et al.* (2020) highlighted endurance runners participating in recreational competitions, and the main topics are the distribution of training intensity (e.g., HIIT) and the adaptation of training periodisation. It is worth noting that D. Boullosa *et al.* (2020) addressed theoretical aspects, such as the development of training and adaptation models, while the present study has an experimental component focused on short-term physiological changes in response to specific methods of active recreation. A prospect for combining the approaches is to include a long-term analysis of the effects of the methods used in the context of endurance, which could complement the findings of D. Boullosa *et al.* (2020) on training strategies.

A study by F. D'Elia *et al.* (2019) highlighted the impact of transition on athletes' performance using two groups of young female basketball players (U16 and U20). The focus was on assessing changes in physical performance depending on training approaches: systematic training during the transition period (U16 group) and no training at all (U20 group). Both studies address the transition period, but F. D'Elia *et al.* (2019) emphasised the impact of the lack of organised training and the importance of systematic work to maintain and improve physical performance. F. D'Elia *et al.* (2019) demonstrated that the U16 Group that continued training showed significant improvements in performance ($p = 0.004$), while the U20 Group with a significant decrease in activity showed no significant changes ($p = 0.075$). In this study, the emphasis is on active recreation (aerobic exercise, yoga, hydrotherapy, team games) to improve physiological parameters. Both studies confirm the importance of active activities during the transition period to avoid detraining. The study by F. D'Elia *et al.* (2019) analysed female basketball players specialising in game sports, while the present study examined athletes involved in anaerobic disciplines. The methodology of F. D'Elia *et al.* (2019) focused on testing coordination and speed skills, while the present study assesses heart rate, lung capacity, lactic acid levels, muscle strength and endurance.

S.L. Halson (2020) analysed different recovery methods for athletes, including hydrotherapy, active recreation, compression garments, massage and stretching. The focus is on practical recommendations for elite athletes and

potential mechanisms that influence physiological and mental recovery. The main similarity is that both studies emphasised the importance of adapted recovery strategies. S.L. Halson (2020) emphasised an individualised approach to recovery, considering the sport, training intensity and external factors, while the present study focuses on the evaluation of specific active recreation methods such as aerobic exercise, yoga, hydrotherapy and team games. Both approaches demonstrate that the right choice of methods can significantly improve physiological performance, reduce fatigue and ensure readiness for subsequent exercise. S.L. Halson (2020) discussed hydrotherapy (including cold baths and contrast water therapy) in detail and found it useful for recovery from high-intensity exercise. S.L. Halson (2020) also emphasised the importance of compression garments, which were not considered in this study. In addition, S.L. Halson (2020) emphasised such aspects as sleep and nutrition that are critical to overall recovery but are not analysed in this study.

The study conducted by I. Ketut-Yoda *et al.* (2024) and the present study has common goals aimed at evaluating the effectiveness of different recovery methods for athletes. Both studies emphasise the importance of structured recreation programmes in reducing fatigue and improving athletes' physiological state. I. Ketut-Yoda *et al.* (2024) discussed methods such as water therapy (hot-cold baths), curcumin supplementation and high-intensity interval training, while the present study focuses on aerobic exercise, hydrotherapy, yoga and team games. A common aspect is the emphasis on physiological parameters that reflect the effectiveness of recovery methods. I. Ketut-Yoda *et al.* (2024) emphasised the reduction of muscle fatigue and inflammation, as well as improvements in power and endurance. Both studies recognise the multidimensional nature of recovery. I. Ketut-Yoda *et al.* (2024) used a predominantly observational method, analysing the available data on different recovery techniques. In addition, they addressed the use of additives (curcumin). Furthermore, I. Ketut-Yoda *et al.* (2024) addressed a broader approach, covering athletes from different sports disciplines, while the present study focuses on anaerobic sports.

R. Braun-Trocchio *et al.* (2022) and the present study demonstrated different approaches to the study of athletes' recovery strategies. R. Braun-Trocchio *et al.* (2022) investigated the effectiveness of recovery strategies among endurance athletes, focusing on the physiological and psychological aspects of recovery, such as hydration, sleep, nutrition, and massage. Their study also highlighted gender differences in the use of these strategies, determining that women were more likely to use active recovery techniques, such as foam rolling and compression garments. The present study focused on the effectiveness of specific active recreation tools for maintaining fitness during the transition period of the training process. The similarities lie in the importance of recovery strategies for athletes, especially in the context of increasing training efficiency and reducing the risk of injury. Both studies emphasised the importance of personalised approaches to recovery, although R. Braun-Trocchio *et al.* (2022) emphasised the multidimensionality of recovery, including social and behavioural aspects. R. Braun-Trocchio *et al.* (2022) conducted surveys and statistical analysis of recovery practices, while the present study is based on an experimental approach involving athletes in the practical use of recreational methods.

S. Li *et al.* (2024) focused on the effectiveness of recovery strategies for endurance athletes, including passive, active and proactive approaches, using various techniques such as cryotherapy, compression garments and massage. The authors noted the ambiguity of the research findings and suggest improvements in methodology to reach more consistent conclusions. For instance, although cryotherapy and compression garments have shown positive effects in some cases, neither strategy is fully effective for all recovery parameters. It is also noted that the results are largely dependent on the characteristics of the Group of athletes and the experimental conditions. The similarities between the studies lie in the emphasis on the importance of recovery in endurance athletes and the conclusions about the ambiguity of the effects of recovery strategies. The study by S. Li *et al.* (2024) is an overview study, while the present study conducted a more practical analysis focusing on specific aspects such as lactate levels, heart rate, and muscle soreness. S. Li *et al.* (2024) covered a wider range of approaches, including active and proactive recovery, while the other study is more focused on passive methods.

P. Edholm *et al.* (2024) highlighted recovery strategies for winter sports athletes preparing for the Olympic Games. The focus was on personalised recovery methods such as sleep management, nutrition, cold treatment interventions, compression garments, and psychological support. The study emphasised the importance of addressing the unique physiological and psychological needs of athletes competing in low temperatures. The study also noted the limited evidence base for the effectiveness of certain methods, such as saunas or stretching, which are used without sufficient scientific evidence. P. Edholm *et al.* (2024) focused more on recovery in low temperatures and the impact of winter sports on the physiological state of athletes, while the present study is more general, covering various aspects of endurance sports. In addition, P. Edholm *et al.* (2024) integrated elements of cognitive recovery and mental health into their findings, which are less detailed in the present study. Both studies emphasised the importance of an individualised approach to recovery, but each address different aspects depending on the specifics of the sports studied.

Maintenance of fitness, reduction of fatigue and improvement of the body's adaptive abilities depend on effective recovery from physical activity. Scientists discovered that aerobic exercise, hydrotherapy, yoga and team games significantly improve the physical and mental well-being of athletes. An integrated approach that incorporates the individual characteristics and peculiarities of each sport facilitates recovery, increases training efficiency and reduces the risk of overload. This underscores the importance of using evidence-based methods to maximise performance in sports.

Conclusions

Low-intensity aerobic exercises showed the best results by all criteria. This indicates a significant improvement in the state of the cardiovascular system among athletes of Group A: the heart rate decreased by 8% in men and 7% in women. In addition, lung capacity increased by 12%, indicating an improvement in the functional capacity of the respiratory system. The level of lactic acid in the blood

decreased by 18% in both men and women, which is an important indicator of effective muscle recovery after intense anaerobic exercise. In addition, there was a 10% increase in muscle strength and a 15% increase in endurance according to the Cooper test. This information supports the idea that aerobic exercise is a versatile and challenging strategy that improves the physical and mental state of athletes. Yoga and stretching (Group C) were also effective, with heart rates decreasing by 7% in men and 6% in women. This was particularly evident in the 15% improvement in lung capacity. Lactic acid levels in Group C decreased by 17%, almost as much as in the aerobic exercise group. In addition, this Group increased endurance by 13% and muscle strength by 12%. This shows a significant improvement in overall physical condition. Yoga, which combines physical exercises with breathing and relaxation techniques, significantly improves the mental state of the athletes. Thus, yoga is an effective means of holistic recovery that includes physiological, mental and emotional components.

Hydrotherapy (Group B) significantly improved the athletes' recovery, especially in terms of reducing muscle tension and increasing overall muscle tone. Group B participants showed an 8% increase in muscle strength and a 10% increase in endurance. At the same time, the level of lactic acid in the blood decreased by 15%, indicating that the recovery process after exercise is accelerated. The main method of hydrotherapy was contrast baths. They improve blood circulation and reduce inflammation in the muscles, which contributes to a quick recovery. Athletes who need to reduce muscle pain and improve local circulation can benefit from hydrotherapy. Aerobic exercise and yoga were noted to be more effective than hydrotherapy. Team games brought significant social and emotional benefits, even though they had the least impact on physical performance. Group D participants showed a 7% increase in muscle strength and a 9% increase in endurance. In addition, the level of lactic acid in the blood decreased by 12%. Athletes who need emotional support and seek to balance physical activity with social elements may find this method particularly useful.

The main limitation is the relatively small sample of participants, which may affect the generalisability of the results. In addition, the study was conducted for only five weeks, which does not assess the long-term effect of active recreation methods. The study did not consider the individual dietary habits of the participants, which could also affect the results. Future research could focus on the effectiveness of combined methods of active recreation. In addition, it is advisable to study the impact of these methods on the psycho-emotional state in comparison with physical indicators.

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Conflict of Interest

None.

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Засоби активної рекреації в перехідний період тренувального процесу

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Анотація. Метою дослідження було визначити ефективність різних засобів активної рекреації для підтримки фізичної форми спортсменів під час перехідного періоду тренувального процесу. У рамках дослідження використовувалася експериментальна методологія, яка включала тестування впливу чотирьох методів активної рекреації: аеробних вправ, гідротерапії, йоги та командних ігор, на фізіологічні параметри спортсменів. У дослідженні брали участь 48 спортсменів віком від 20 до 30 років, які були поділені на чотири рівноцінні групи. Вимірювання проводилися до початку експерименту та після його завершення в стандартизованих умовах. Результати дослідження показали, що всі методи активної рекреації сприяли покращенню фізіологічних параметрів спортсменів, однак найвищу ефективність продемонстрували аеробні вправи та йога. Аеробні вправи забезпечили значне зниження частоти серцевих скорочень у стані спокою на 8 % у чоловіків і 7 % у жінок, а також підвищення життєвої ємності легень на 15 %. Крім того, цей метод продемонстрував суттєве покращення витривалості: відстань, подолана спортсменами за тестом Купера, збільшилася на 15 %. Йога сприяла значному зниженню рівня молочної кислоти в крові після фізичних навантажень на 17 % як у чоловіків, так і у жінок, а також покращила м'язову силу та гнучкість. Гідротерапія показала себе як ефективний засіб для зменшення м'язового напруження, покращивши тонус м'язів на 20 % і сприяючи більшому розслабленню спортсменів. Командні ігри, хоча і мали менший вплив на фізіологічні параметри, позитивно впливали на соціальну взаємодію та загальну мотивацію спортсменів, а також забезпечували помірне зростання витривалості. Отримані результати дозволили зробити висновок, що аеробні вправи та йога є найбільш ефективними засобами активної рекреації для підтримання фізіологічних параметрів спортсменів у перехідному періоді

Ключові слова: фізична активність; психологічна реабілітація; м'язова сила; рівень фізичної підготовки; спортсмени