Methodology for using a set of exercises based on the circuit training method to develop the physical qualities of young table tennis players in the initial training period

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Abstract
The article describes a modular exercise program based on the circuit training method, aimed at developing the physical qualities of young table tennis players during the initial training period. The developed program consists of six consecutive stations designed to develop speed, agility, coordination, balance, flexibility, and special movement exercises specific to table tennis. The exercises at each station are performed for 30-40 seconds, with a 20-30 second rest interval in between. The training load was planned according to the age characteristics of the athletes, with the heart rate maintained at 130-145 bmp during the preparatory phase and 135-155 bmp during the developmental phase. The pedagogical effectiveness of the set of exercises was confirmed by a significant improvement in all physical qualities within the experimental group.
Keywords: table tennis, circuit training method, speed exercises, agility exercises, flexibility exercises, training stations, heart rate.

Introduction

Developing the physical qualities of young table tennis players during the initial training period is one of the most important and responsible stages of athletic preparation. It is during this phase that athletes adapt to the subsequent training process, and their fundamental motor skills and general physical fitness level are established. The consistent development of core physical qualities such as speed, agility, flexibility, strength, and endurance at this stage not only expands the functional capabilities of young athletes but also creates the necessary conditions for them to effectively master table tennis techniques and tactics.

Table tennis is a sport of unique coordinative complexity, requiring the athlete to execute fast and precise movements in a short amount of time, observe the opponent's actions, assess the ball's trajectory and speed, and select an appropriate motor response accordingly. For this reason, in the physical training of young table tennis players, speed and agility, movement coordination, the ability to change body position rapidly, and the ability to choose the optimal movement in a given situation are of particular importance. While flexibility helps to expand the range of motion and perform technical movements freely, strength and endurance serve to ensure the stability of motor activity during training and competition.

In the initial training phase, the development of physical qualities must be organized in accordance with the age characteristics, level of physical development, and training capacity of young athletes. It is important to gradually increase the complexity of exercises, progressively increase the workload, and harmoniously develop various physical qualities. Consistently using a variety of exercises, rather than one-sided training, allows for the comprehensive development of both general and specialized physical fitness in young athletes.

In particular, the circuit training method can be considered one of the most effective organizational and methodological tools for the comprehensive development of physical qualities during the initial training phase. This method makes it possible to sequentially perform exercises aimed at developing various physical qualities, control the volume and intensity of the workload, and increase the efficiency of training time. Organizing exercises at different "stations" helps maintain young athletes' interest in training, increases their motor activity, and makes the training process more engaging.

From this perspective, a key priority is to develop a specialized training program aimed at enhancing the physical qualities of young table tennis players during their initial training period. This involves systematically integrating exercises designed to develop speed, agility, strength, flexibility, and endurance, and implementing them based on the circuit training method. Such an approach not only improves the physical fitness of young table tennis players but also serves to build the foundational physical base necessary for the effective mastery of sports techniques and tactical actions in the future.

The aim of the study is to develop a modular set of exercises based on the circuit train-

ing method, aimed at developing the physical qualities of young table tennis players during the initial preparation period, and to substantiate the methodology for its application.

Objectives: to select and systematize special exercises that develop speed, agility, flexibility, balance, and coordination; to distribute the exercises among circuit training stations; and to plan the volume, intensity, and rest intervals of the training load in accordance with age-specific characteristics.

The object of the study is the training process of young table tennis players in the initial preparation group; the subject is the set of special exercises based on the circuit training method and its application methodology.

Methods

The study utilized the following methods: pedagogical observation, pedagogical experiment, the circuit training method, pulse oximetry (to monitor heart rate), determination of respiratory rate (RR), and methods of mathematical statistics.

Results and discussion

In the course of the study, a specialized program was developed to improve the physical fitness of young table tennis players. This program was structured based on modular technology and implemented using the circuit training method during training sessions. The program consists of six sequential exercise groups (stations): the first is aimed at developing speed, the second at agility, the third at coordination, the fourth at balance, the fifth at flexibility, and the sixth at developing special motor skills specific to table tennis. The exercises at each station were performed for 30–40 seconds with a 20–30 second rest interval in between. After completing all the stations, the athletes took a short break, and the cycle was repeated.

Among the exercises aimed at developing speed were: stepping on a partner's foot first within a small square, shuttle runs (4x10), quickly tapping central points on a square track, running between obstacles, hopping through a square track on one foot and returning, single-leg step-ups and step-downs on a 15 cm box, and reaction drills performed with partners using two balls. These exercises help develop athletes' quick reaction, movement coordination, and spatial orientation skills.

To develop agility, the following exercises were used: dividing the group in two to be the first to grab colored discs, lateral jumps over hurdles, a chasing game initiated by the "Go!" signal, a cone-gathering game, catching a rolling ball, and fetching markers from various distances. These exercises develop an athlete's ability to react quickly to visual cues, change direction rapidly, and make decisions.

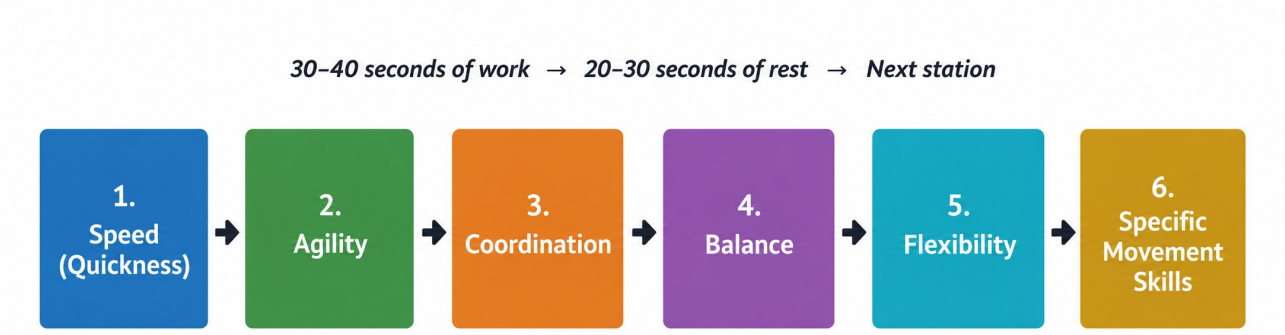
To improve flexibility, static stretching exercises were used in the final part of the training session, such as a seated forward bend, holding the soles of the feet together, side bends while standing, bending the torso forward to hold the calf muscles, and leaning forward to touch the floor. These exercises serve to increase muscle and tendon elasticity and reduce the risk of injury.

The intensity of the training load for athletes aged 10–12 was planned taking into account their age-specific characteristics and functional capabilities. Observations revealed that it is advisable for the average heart rate to be within the range of 130–145 beats/minute during the preparatory and learning stages, and 135–155 beats/minute during the developmental stage of training. Providing adequate rest intervals between exercises helped restore the

Table 1. Structure of stations based on the circuit training method

Station	Focus/Exercise Type	Execution Time	Rest
Station 1	Speed exercises	30–40 s	20–30 s
Station 2	Agility exercises	30–40 s	20–30 s
Station 3	Coordination exercises	30–40 s	20–30 s
Station 4	Balance exercises	30–40 s	20–30 s
Station 5	Flexibility exercises	30–40 s	20–30 s
Station 6	Table tennis-specific movement exercises	30–40 s	20–30 s

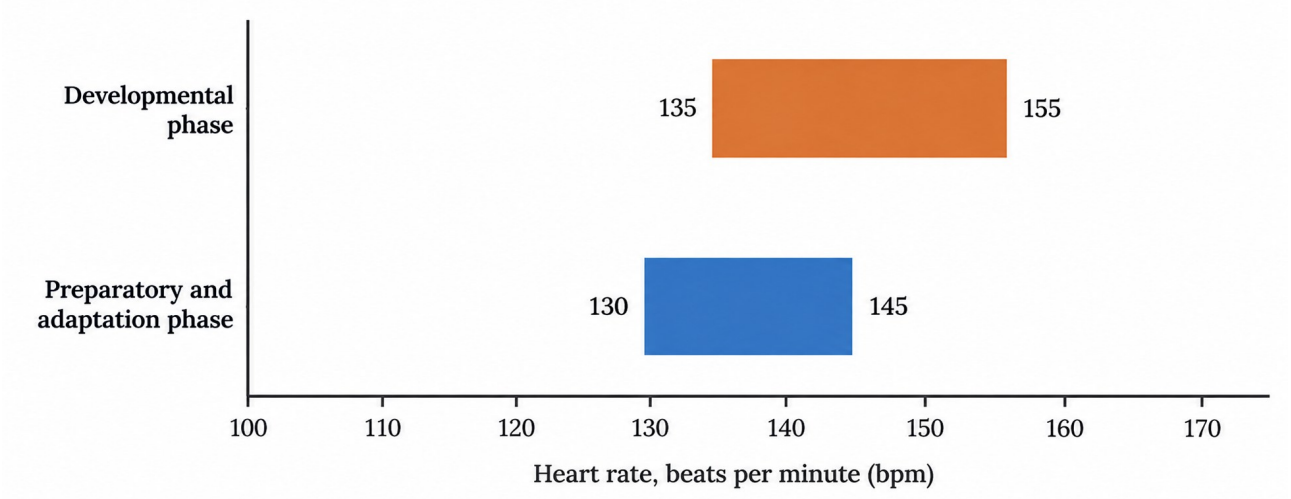
Fig 1. **Structure of the circuit training stations**



athletes' work capacity and increased the effectiveness of the training.

The research results showed that a modular program aimed at developing the physical qualities of young table tennis players during the initial training period increases the effectiveness of the training process. The circuit training method ensured the active participation of athletes in the training process and had a positive impact on the development of physical qualities such as speed, agility, and flexibility.

Fig 2. **Recommended heart rate (HR) range for each training stage**



Conclusion

A six-station modular exercise program based on the circuit training method, developed for young table tennis players in their initial training period, is an effective way to develop physical qualities, form motor skills, and improve athletes' overall physical fitness. The program includes stations for speed, agility, coordination, balance, flexibility, and movements specific to table tennis. A cycle of 30-40 seconds of exercise followed by 20-30 seconds of rest at each station ensured the active participation of the athletes. Adapting the load intensity to age-specific characteristics by controlling heart rate—maintaining it between 130-145 bpm during the preparatory and learning stages, and 135-155 bpm during the developmental stage—ensured the athletes' optimal development without excessive strain. The research findings indicated that the circuit training method increased athletes' active participation in the training process and had a significant positive impact on the development of physical qualities such as speed, agility, and flexibility. The developed set of exercises, with its six-station structure and heart rate-based load control, is fully recommended for practical application in the training process of beginner-level table tennis groups.

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