# The impact of a particular warm-up on the demonstration of a badminton player's reactive agility in game scenarios

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**Abstract**

**Objective of the study** was to experimental validation of the efficacy of specific warm-up drills in enhancing the player's reactive agility in tactical badminton scenarios.

**Methods and structure of the study.** The study included 25 experienced male badminton players aged 20,3±1,6 years. They underwent a modified agility test twice – once without and once after a specific dynamic warm-up. The study measured the time it took for the players to respond to a visual signal.

**Results and conclusions.** Following a preliminary specialized warm-up, all participants demonstrated improved reaction times. The mobilization stimuli provided by a series of specialized warm-up exercises, specifically designed to prepare for reactive coordination tasks, enhance the speed of motor response and the successful execution of coordination skills in badminton players.

***Keywords:*** *badminton, positional readiness, reactive agility, dynamic warm-up, tactical situations of badminton.*

**Introduction.** Badminton places high demands on neuromuscular coordination of movements and requires rapid motor reactions of players to unpredictable game situations. With the initial flight speed reaching 300 km/h, players have only a split second to assess the direction, trajectory angle, speed, negative acceleration of the shuttlecock and perform a controlled hit to the required point of the opponent's court. A successful combination begins with the player's positional readiness [2]. Positional readiness is a multi-component quality expressed in the badminton player's ability to occupy an advantageous position, ensuring the possibility of performing accurate hits at a high speed of movement and tempo of the game. A badminton player who spends most of the game time in an advantageous position, all other things being equal, has the highest chance of winning the match. The qualities that ensure the positional readiness of a badminton player are an instant assessment of the game situation, speed of motor reaction, and high-speed coordination [3]. The specificity of agility in badminton is manifested in rapid movement in response to a game stimulus with a change in speed or direction of movement in order to take an advantageous position for further game actions. As a rule, the motor basis for the implementation of reactive abilities in badminton is a lateral lunge of the leg in one direction or another in the form of a «one step» reaction, which requires high elasticity of the structural components of muscle-ligament tissues and mobility in the joints [1].

It has been established that for the performance of athletes in sports that require a high level of agility development, dynamic stretching of ligaments and muscles during the warm-up is most effective. Compared with the use of only passive stretching, dynamic warm-up significantly improves the indicators of special agility and has a positive effect on the reaction time of «one step» [4].

The relevance of developing positional readiness skills based on coordination and reactive abilities radically changes the approach to building a specialized

dynamic warm-up for a badminton player before the start of a competitive match.

**Objective of the study** was to experimental validation of the efficacy of specific warm-up drills in enhancing the player's reactive agility in tactical badminton scenarios.

**Methods and structure of the study.** The study involved 25 qualified male badminton players aged 20,3±1,6 years. The badminton players performed a modified reactive agility test twice – without and after a specialized dynamic warm-up.

A general five-minute warm-up included exercises for static and dynamic stretching of ligaments and muscles. After a general warm-up, the badminton player performed a set of special game exercises for 15 minutes with a gradual increase in the complexity of their performance during counter-hits from the right and left.

The test for coordination and reactive abilities included 16 pulses of a visual light signal (4 in each direction) with random generation of their localization and a fixed generation time of 2000 m/s. The test result was counted as the average reaction time in each of the four directions from the moment the signal passed until the touch of the mats with a limb, the upper mats with a hand, and the lower ones with a foot.

The subjects began the test standing in the middle of the court. The task was to touch one of four target mats as quickly as possible, two of which were located on the court in the right and left service zones at a distance of 2 m from the center line each, and the other two were in a vertical position on the racks at a distance of 4 m from each other symmetrically from the center line. The mats were touched with a racket or a foot in accordance with the passage of a visual light signal appearing in one of the corners of the screen. The location of the mats corresponded to the specific tasks of badminton.

Testing was carried out in the middle of the playing season.

Reaction time in tests to determine the time of a simple motor reaction was measured using the Reaction Time Test (RTT) computer program [5].

The obtained data were statistically processed using basic descriptive statistics and a test for normal distribution. The data obtained with and without the use of a set of special warm-up exercises (motor reaction time of the legs, arms and total reaction time) were compared based on the t-criterion. Statistical calculations were performed using Statistica 12 statistical software. Statistical significance was set at $p<0,05$.

**Results of the study and discussion.** The results of the modified sensorimotor response test to a light signal are presented in the table.

The average reaction time of players' movement without specialized warm-up was 276,4±64,9 m/s; with preliminary specialized warm-up – 242,8±97,7 m/s, a reliable improvement of 33,6 m/s (12,2%) was noted. The average reaction time of «one step» in directions involving the use of upper limbs, without specialized warm-up was 305,4±51,4 m/s, with specialized warm-up – 261,1±43,6 m/s, a reliable improvement of 44,3 m/s (14,5%) was observed. The average reaction time of movement in directions using the lower limbs without specialized warm-up was 261,2±38,6 m/s, after specialized warm-up – 225,7 ± 38,7 m/s with an improvement of 35,5 m/s (13,6%).

All subjects improved their reaction time after preliminary specialized warm-up.

Being essentially a situational sport, badminton allows for systematic management of resonances of adaptation to speed-reactive loads at the upper limits of the sensory-motor sphere of badminton players. The linearity of determinations between tactical positional readiness and high sports results is ensured by the high speed of the player's motor reaction.

*Indicators of the time of the player's sensorimotor reaction to a light signal, m/s*

| Localization of visual signal | Without warming up | With a warm-up | t |
|---|---|---|---|
| Top left | 313,5 ± 82,7 | 273,6 ± 36,5 | 6,8 |
| Top right | 297,3 ± 79,5 | 248,5 ± 68,2 | 4,2 |
| Average reaction time to the signal of the upper localization | 305,4 ± 51,4 | 261,1 ± 43,6 | 3,7 |
| Bottom left | 259,1 ± 34,7 | 231,9 ± 77,3 | 2,9 |
| Bottom right | 263,2 ± 65,9 | 219,5 ± 56,8 | 5,2 |
| Average reaction time to the signal of the lower localization | 261,2 ± 38,6 | 225,7 ± 38,7 | 3,1 |
| Average total time | 276,4 ± 64,9 | 242,8 ± 97,7 | 2,8 |

Additional opportunities for activating components of reactive agility are provided by using preliminary special warm-up immediately before participation in competitions. The study showed a general statistically significant improvement in the sensory-motor reaction time indicators at a level of almost 12%, which ensures the achievement of peak values of reactive agility in badminton game situations. The phenomenal nature of phase transitions to the state of optimal positional readiness of a player when using a set of special warm-up exercises indicates the resonant nature of the morphofunctional training of the athletes' body in reactive-coordination work. Statistically significant differences between the reaction time using the upper and lower extremities were not established. In this regard, it can be stated that the impact of a special warm-up on achieving an urgent effect in improving the neurophysiological state of badminton players is complex.

**Conclusions.** Mobilization stimuli of the complex of special warm-up exercises, maximally focused on preparation for specific reactive-coordination work, ensure the speed of motor reaction and successful implementation of badminton players' coordination abilities.

The effectiveness of special motor warm-up is due to the activation of the sensory-motor systems of the athletes' body, achieved through the use of exercises corresponding to the specific tasks of badminton.

The representativeness of positive settings of the sensory-motor sphere of badminton players is expressed in the achievement of high indicators of coordination-reactive abilities, the growth of the implementation efficiency of the game technique and the performance of game techniques and actions in the conditions of tactical situations of badminton.

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