Original Article

Effect of selected types of warm-up on disjunctive reaction time of soccer goalkeepers

MARCO OBETKO¹, PAVOL PERÁČEK², MARTIN MIKULIČ³, MATEJ BABIC⁴

^{1,2,3,4}Department of Sports Games, Faculty of Physical Education and Sports, Comenius University in Bratislava, SLOVAKIA

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Abstract

Intensification of the game as one of the development tendencies in soccer is determining what direction we should take in improving players' game activities. The aim of our research, but also the training process in soccer, should be the shortening of time needed when making decisions by the implementation of game activities. This ability is essential mainly for goalkeepers since the speed of disjunctive reaction time is one of the key factors, which are determining the success rate of goalkeeper's interventions. The research group consisted of 24 elite youth soccer goalkeepers (average age 15.6 ±2.4 years). To evaluate the levels of disjunctive reaction time was used a specialized device FiTRO Agility Check. We used the Wilcoxon signed-rank test and Cohen's „d“ to find out the statistical significance. We found out that the goalkeepers achieved a significant improvement of disjunctive reaction time ($p < 0.01$) after a specific (match) type of warm-up. Besides we ascertained that the difference between the value of disjunctive reaction time of goalkeepers after the specific (match) or non-specific (athletic) warm-up is 190 ms ($p < 0.01$). There were found any significant improvement in the values of the disjunctive reaction time (n.s.) after completion of the non-specific (athletic) type of warm-up. Based on our findings, is our recommendation to always during preparation for training or match involve in the warm-up also the specific impulses characteristic for the player position as goalkeeper. It has positive effects not only on values of disjunctive reaction time but also on other motor skills and the overall preparation of soccer goalkeeper's organism.

Key Words: goalkeeper, soccer, disjunctive reaction time, warm-up

Introduction

As one of the displays of soccer game intensification, the constant acceleration of soccer game tempo is increasing the demands on the motor skills of a player in a match. That makes the player's ability to react quickly and right even more important. The position of a soccer goalkeeper is a specific position and the demands placed on quick and right reaction are even bigger. The reaction speed in soccer is for goalkeepers a limiting motor skill. Besides the reaction speed, puts Montesano (2016) emphasis also on explosive strength. Smpokos et al. (2018) and Dragijský et al. (2016) point out not only to the reaction speed but also to all the displays of speed abilities in soccer. According to them, all of these are important factors, which are limiting the game performance.

Otte et al. (2019) agree with this claim. They characterized the quick build-up of attack – constant reaction on the newly established game situation, diving and saves of shots, from which they emphasize the reflex close-range shots with hands and foot and also diving saves of final catching and punching crosses as the key game activities of a goalkeeper in a match.

In many research (Jevas & Yan 2001; Luchies et al. 2002; Rose et al. 2002; Birren & Schaie 2005; Der & Deary 2006; Chang et al. 2012; Hagovská & Nagyová 2017; Obetko et al. 2019a; Obetko et al. 2019b) was proved that the principal factor on which depends the level of player's reaction time is age. The disjunctive reaction time shortens during adolescence, reaches its height in adulthood and then with getting older starts to become longer. This is the natural course, which can be influenced by a soccer player. However, with the constantly increasing demands on the game, researches are searching for the means and ways, which would have, to a certain extent, impact on this motor skill as well.

It has been proved that we can influence the soccer players' disjunctive reaction time to a certain extent. Several scientific works dealt with the development of this motor skill using stimulation of various impulses. Rowe et al. (2005) and Attrill et al. (2008) focused in their research on the various colours of shirts, Ehlers et al. (2018) on the gained experience of soccer players and Ando et al. (2001) found out that also the implementation of the various sports (motor) games can have a positive effect on the length of the disjunctive

reaction time. The form of warm-up has a positive effect on the speed of reaction time as well (Dumitru 2010; Coledam et al. 2012; Neiva et al. 2014; Pardeiro&Yanci 2017; Kyranoudis et al. 2018; Silva et al. 2018). The effect of warm-up in soccer has been studied permanently over the years (Otte et al. 2020).

The warm-up has changed constantly over the years. It has been developing, adjusting and innovating due to the development tendencies, soccer technologies but also rules. That's why the goalkeeper's warm-up as a specific player position is still in soccer the current and discussed topic. We are familiar with many researchworks (Jeffreys 2008; Fradkin et al. 2010) which studied the effect of the warm-up mainly from the physiological point of view. But as we already know, in soccer are deciding not only motor skills and their level, but also the mental preparation and physiological factors have a significant impact on the player's preparedness and his performance (Bishop 2003; Tsolakis&Bogdanis 2012; McGowan et al. 2015; Abdullah et al. 2016; Menegassi et al. 2018).

Thus, we see that the effect of warm-up on the mental and physiological side of game performance has been studied sufficiently. However, the goalkeeper's game performance in a match contains also the specific (soccer) activities, which player has to perform during a match. The effect of warm-up on this field of game performance has not been yet extensively studied.

The disjunctive reaction time can be affected not only in a positive way but also negatively. Besides the adolescence, which is a natural part of our life and cannot be influenced, the researchers proved also the negative effect of fatigue. It influences not only the reaction time values but also the effective muscle work and proprioception (Gowtami 2016), the maximal strength of the lower limbs, as well as the exactness when performing selected game activities such as passing (Lyons et al. 2006).

Material & Methods

This research is aimed to find out the effect of various types of warm-up on the level of the disjunctive reaction time of soccer goalkeepers.

Research hypothesis:

The disjunctive reaction time of soccer goalkeepers will be significantly different after implementing various types of warm-up.

1. We assume that the disjunctive reaction time of soccer goalkeepers will not be statistically significantly shorter after the completion of the non-specific (athletic) warm-up.
2. We assume that the disjunctive reaction time of soccer goalkeepers will be statistically significantly shorter after the completion of the specific (match) warm-up.
3. We assume that the impact of the specific (match) warm-up type on the disjunctive reaction time of soccer goalkeepers will be statistically significantly higher than the effect of the non-specific (athletic) type of warm-up.

The research group consisted of the elite youth soccer goalkeepers ($n = 24$). The calendar age of observed goalkeepers during the measurement was 15.6 ± 2.4 years. The main method of acquiring the research data

was the measurement of disjunctive reaction time using the FiTRO Agility Check device. We created for each measurement an individual record sheet to prevent misrepresentation of results by goalkeepers.

The first day took the observed goalkeepers part in the entrance measurement (t_0).

The second day underwent the goalkeepers a measurement after the completion of the non-specific (athletic) warm-up (t_1). The athletic warm-up consisted of the five-minutes long individual warm-up run. Subsequently, the goalkeepers completed ten swing exercises for flexibility and expansion of the range of joint motion of the entire body.

Then the goalkeepers did the dynamic stretching of lower limbs (front and back thigh muscles, calf muscles). The last part of the warm-up was made of five short maximum-speed sprints with a load of 3 to 4 seconds and a rest interval of 30 seconds (muscle toning). After the warm-up, the goalkeepers got a three minutes long rest interval for the replenishment of energy sources (ATP, CP).

The third day underwent the players the measurement after the completion of specific warm-up (t_2). This specific warm-up was comprised of a goalkeeper's before match warm-up. It was done on the soccer field and took approximately 20 minutes. During this warm-up performed the goalkeeper a standard part of the warm-up (dynamic stretching) and then he did all of the specific game activities, which a goalkeeper performs also in a match.

We maintained the same order of goalkeepers, the same testing time, the same surface and conditions in each measurement (t_0 - t_2), so we could prevent the misrepresentation of results.

To find out the statistical significance was used the Wilcoxon's signed-rank test and Cohen's „ d “ (effect size). The selected level of statistical significance was $p < 0.05$.

Results

In this part of our work are mentioned the results of individual measurements, as well as the comparison of the measurements made.

Fig. 1 Disjunctive reaction time of goalkeepers after completion of non-specific warm-up

After the completion of the non-specific warm-up was not found any statistically significantly shorter disjunctive reaction time of goalkeepers (t₁) ($M = 1297.13$; $SD = 128.53$) than they had in the entrance measurement (t₀) ($M = 1327.57$; $SD = 134.59$), $z = -1.3143$; $p > 0.05$; $r = 0.27$.

Fig. 2 Disjunctive reaction time of goalkeepers after the completion of specific warm-up

We found out that the disjunctive reaction time of goalkeepers was after the completion of specific warm-up was statistically significantly shorter (t₂) ($M = 1207.95$; $SD = 96.91$) than in the entrance measurement (t₀) ($M = 1327.57$; $SD = 134.59$), $z = -4.2857$; $p < 0.01$; $r = 0.88$.

Fig. 3 Comparison of the effect of non-specific and specific warm-up on the disjunctive reaction time of goalkeepers

We found out that the disjunctive reaction time of goalkeepers was after the completion of specific warm-up was statistically significantly shorter (t_2) ($M = 1207.95$; $SD = 96.91$) than after completion of the non-specific warm-up (t_1) ($M = 1297.13$; $SD = 128.53$), $z = -3.6571$; $p < 0.01$; $r = 0.80$.

Discussion

In our research, we proved that the disjunctive reaction time, which is a significant factor especially for the soccer goalkeepers and has a significant impact on their game performance, can be influenced by the external influences. Moreover, we proved that it can be influenced in a positive way (Fig. 1 and Fig. 2). We did not find any significant changes after the completion of the non-specific warm-up. But based on the substantive significance, we claim that the non-specific warm-up has an impact on the disjunctive reaction time, though not so considerable. It means that we did not stimulate the cognitive centres of the organism by applying the non-specific warm-up of goalkeepers sufficiently. Because of that, there was not found any statistically significant progress in the level of the goalkeepers' disjunctive reaction time. Kyranoudis et al. (2019) came to similar results. They also found out that the static, non-specific warm-up has a moderate impact on the level of the selected motor skills of Greek soccer players ($n = 24$), although these changes were not statistically significant and noticeable. Turki et al. (2012) and Silva et al. (2018) also proved a positive impact of the warm-up. They found out a positive effect of the warm-up on the speed abilities of soccer players, or more precisely on the level of the explosive power of the lower limbs.

Based on the research works, it is obvious that if the training process is similar to the player's training load in sports, then the transfer of achieved skills from the training process into a match is bigger. This theory is called the adequate coverage theory and can be applied also to the warm-up. Above mentioned authors proved using the non-specific (not related to soccer) impulses that the warm-up affects the level of selected motor skills. However, the warm-up in soccer aims to adequately prepare a soccer player to have all skills needed to deliver performance. In our research was proved that the disjunctive reaction time is statistically significantly shorter after the completion of specific warm-up, which has an affinity with soccer and contains the specific – soccer impulses (Fig. 3). When comparing to the non-specific warm-up, the average improvement was at the level of 120 ms, so we proved both the high statistical and substantive significance.

In several foreign research can be found the same conclusion. Kyranoudis et al. (2018) found out that the specific warm-up has a 5 % higher impact on the speed abilities of Greek soccer players than the non-specific warm-up. Van den Tillaar et al. (2019) confirmed the positive effect of the specific warm-up on the soccer players' speed abilities as well. Soccer players run the 40 m sprints and after the implementation of the specific warm-up, they achieved a significant improvement in their best (improvement of 0.12 sec.), average (0.12 sec.) and total time (0.35 sec.). Zois et al. (2011) noticed a significant improvement of the explosive power of the lower limbs by Italian soccer players. It was measured using a countermovement jump. After the implementation of the non-specific warm-up, they recorded the improvement of 2 % and after completion of the specific warm-up was the improvement 6 %.

Conclusions

We did not succeed in confirming the statistically significant impact of the non-specific type of warm-up on the disjunctive reaction time of soccer goalkeepers. This type of warm-up manifested the improvement, which proved also the substantive significance, but the changes were minor.

We found out a significant effect ($p < 0.01$) of the specific type of warm-up on the disjunctive reaction time of soccer goalkeepers. The changes in disjunctive reaction time values of monitored goalkeepers were considerable.

We recorded a significant difference ($p < 0.01$) between the impact of the specific and non-specific types of warm-up on the disjunctive reaction time of soccer goalkeepers. This difference was considerable in many cases (average value, maximal, minimum value, the range within the research group).

Based on the acquired data, we successfully proved that the specific type of warm-up has an impact not only on the specific (soccer) skills. It has also an overall effect. It means that it can also significantly and positively influence the motor skills, in our case the disjunctive reaction time of goalkeepers. Our recommendation is to involve the specific warm-up, or the specific elements into each warm-up, before training or match. This way it is possible to achieve the complex preparedness and soccer player's (goalkeeper's) adaptation of the organism to the oncoming load.

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