Summary

The ability to generate power by a player has a significant impact on the sporting result and is one of the main factors guaranteeing success in sports competitions. The use of the PAP effect in resistance training allows maximizing speed and explosive strength in team sport players. There is no doubt that speed in modern soccer is the key to success. Developing explosive power in soccer should therefore be an important element of the strength training.

The use of the phenomenon of post-activation potentiation (PAP) in developing explosive strength in soccer is a unique and innovative solution. The fundamental anatomical, physiological and motor differences between women and men exclude their competition in soccer at the professional level (Basiuk and Basiuk 2011). Despite these differences, the conditioning along with tactical and technical preparation include the basic objectives of the training process for both women and men. In soccer, explosive movement activities predominate, and the level of speed and strength determines success. One of the modern methods of training muscular strength used in team sports is comprehensive training using the mechanism of post-activation potentiation (PAP). In studies comparing the utilization of the PAP effect by men and women, no significant differences were found between them. When it comes to the relative value of the PAP effect, both women and men react similarly to activating stimuli. The differences in physical potential between the two sexes, determined by the level of strength and endurance variables, do not diverge, if we take the resting values as a reference point (Stolen 2005). This was significant for this work, as it made it possible to relate the results obtained to those obtained by soccer players in others experiments.

Research on the possibility of using the PAP effect in strength training of soccer players shows that it can have a positive effect on improving sprinting ability (Alves et al. 2010, Chatzopoulos 2007, Dello Iacono and Seitz 2018, Garcia-Pinillos et al. 2014, Low et al. 2015, Nealer et al. 2017, Nickerson et al. 2018, Requena et al. 2011, Till and Cooke 2009, Vanderka 2016). The improvement in sprint speed, however, will depend on many factors, such as the type of activating stimulus used, the level of external load used, or the interval between the activating exercise and the sprint.

The main purpose of this work was to determine the impact of the PAP effect on the starting (5 m) and absolute (20 m) speed in elite soccer players. In addition, an assessment of the effectiveness of three selected strength exercises on the PAP effect and determination of individual and group passive rest intervals (IPW, OPW) was undertaken.

The research covered a group of elite soccer players. In the experiment took part 29 competitors (age 20.9 years ± 2.1; height 166.2 cm ± 3.9; body weight 56.4 kg ± 3.7) representing similar sports level and with similar experience in resistance training. The selection of participants in the experiment was random. The test protocol was approved by the University Bioethics Committee for Scientific Research of the Jerzy Kukuczka Academy of Physical Education in Katowice. The tests were carried out at the Strength and Power Laboratory at the Jerzy Kukuczka Academy of Physical Education in Katowice.

There were two stages of the tests. In the first stage, lower limb power tests were administrated for three activation exercises (half squat, leg curls, toe raises) with the use of Air Squat and Air Leg Curl devices after individual and optimal rest intervals for 4 different field positions (goalkeeper, striker, defender, midfielder). In the second stage of the experiment starting (5 m) and absolute (20 m) speed were evaluated after applying three activation exercises using IPW and OPW.

The obtained results of the research indicate that the use of both OPW and IPW improves power generated by the players, however, it is the IPW that allows the players to effectively use the PAP phenomenon and achieve better results in all tests. Due to their position on the field, goalkeepers, defenders and midfielders most effectively use the PAP effect after applying IPW.

Statistically significant differences were found in the results of starting speed tests (5 m) after PP activation with the use of IPW for goalkeepers, strikers and midfielders and with the use of OPW for goalkeepers. The use of IPW after PP favourably influenced the results achieved by goalkeepers, strikers and midfielders in the 5 m sprint.

Analysis of the results recorded over the distance of 20 m after using the PP exercise showed a statistically significant improvement in the absolute speed of goalkeepers, defenders and midfielders after using both IPW and OPW, while goalkeepers and defenders were more advantageous to use IPW, and for OPW midfielders. The obtained results indicate that the PP exercise allows to use the PAP phenomenon more efficiently than the PU exercise, both in the whole studied group and taking into account the players' positions. At the same time, PW exercises should be considered as not fulfilling the activation function in the context of improving starting and absolute speed of the examined group of players.

In summary, the activation stimulus used in the research protocol, in the form of a half squat with a load of 60% 1RM seems to be an exercise that allows the most effective use of the PAP phenomenon in the studied female soccer players, significantly improving starting and absolute speed of the entire group of female players.

In the future, it would be worth focusing on diversifying strength training in terms of players' positions. Perhaps the use of complex training consisting of all three activating exercises, with the load and intensity of their performance varied for each of the four positions on the field, would bring greater benefits for the entire studied group, translating not only into the improvement of lower extremity power variables of players, but also to a more important than shown in this experiment, improved starting and absolute speed.