Does SAQ training improve the speed and flexibility of young soccer players? A randomized controlled trial

Heading title: Effects of SAQ training in soccer

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Abstract

The aim of this study was to determine the effects of a 12-week speed, agility and quickness (SAQ) training program on speed and flexibility in young soccer players. One hundred and thirty-two soccer players were randomly assigned to experimental (EG; *n* = 66, Mean±SD: age: 18.5 ± 0.4 years (range 17-19 years); body mass: 71.30 ± 5.93 kg; stature: 177.2 ± 6.5 cm) and control groups (CG; *n* = 66, Mean±SD: age: 18.6 ± 0.6 years (range 17-19 years); body mass: 70.63 ± 4.87 kg; stature: 175.9 ± 5.7 cm). The experimental group performed SAQ training whilst the control group undertook straight-line sprint training matched for volume and duration. Sprint performance was assessed using 5 m and 10 m sprints and a further test including maximal speed, a 20 m sprint. Flexibility was assessed using sit and reach, V-sit and reach, leg lift from supine position and lateral leg lift while lying on the side tests. Sprints over 5, 10 and 20 m did not differ between groups at baseline, but by week 12, the 5 m sprint had significantly improved ($P < 0.05$) in the SAQ training group compared to the control group (1.40 ± 0.13 vs. 1.46 ± 0.12 s, respectively) although this improvement had a trivial effect size (ES=0.15). The 10 m sprint time had improved by 3.3% ($P < 0.01$) in the SAQ group with a moderate effect size (ES=0.66). No significant differences ($P > 0.05$) for all flexibility tests were found between experimental and control group at baseline and after the training programmes. Consequently SAQ training was found to be an effective way of improving sprint time for short distances over 5 and 10 m but not over 20 m (where maximum speed was achieved) or flexibility. These results indicate that SAQ training may be more effective for improving sprint performance for some soccer players but more research is required to determine ideal training methods for improving acceleration and flexibility in young soccer players.

Key words*: range of motion; specific agility; change of direction; youth soccer player*

1. Introduction

Soccer is a highly demanding game in which the players are subjected to numerous actions that require high aerobic and repeated sprint capacity, muscular strength and endurance, speed, agility, quickness, and flexibility (Bloomfield, Polman, O Donoghue, & McNaughton, 2007; Stolen, Chamari, Castagna, & Wisloff, 2005). Typically young soccer players have been shown to have similar VO_{2max}, expressed in mL/kg/min (Helgerud, Engen, Wisloff, & Hoff, 2001) but lower running economy and high-intensity performance (Bunc, Heller, Leso, Šprynarová, & Zdanowicz, 1987) in comparison to their senior counterparts. Typical movement categories undertaken by young soccer players during a match have be classified as: 3.1% standing, 53.9% walking, 34.0% running in low intensity and 9.0% running in high intensity (Stroyer, Hansen, & Klausen, 2004). Whilst there will be variations between players due to match conditions, playing position etc. high-intensity movements are not the most frequent activities during a match but they could be the critical parameter for a player's performance in decisive situations (Reilly, Bangsbo, & Franks, 2000). During these high-intensity movements the most frequent movement patterns are accelerations (up to 10 m) and changes of direction (agility) whilst maximal running speed is only reached by fullbacks (Di Mascio & Bradley, 2013). However, these specific movement patterns are independent, unrelated qualities with limited transfer between them (Little & Williams, 2003). A few studies (Jovanovic, Sporis, Omrcen, & Fiorentini, 2011; Milanović, Sporiš, Trajković, James, & Šamija, 2012; Polman, Bloomfield, & Edwards, 2009; Sporiš, Milanović, Jukić, Omrčen, & Molinuevo, 2010) have investigated the training methods that produce the integral effects on specific abilities.

SAQ training is thought to enable soccer players to become better at reacting to stimuli, improve acceleration, move effectively in multiple directions and change direction or stop quickly to make a play in a fast, efficient, smooth, and repeatable manner (Polman et al., 2009). Furthermore, SAQ training involves speed, agility and quickness through a range of soccer specific exercises such that exercises are performed with optimal movement patterns thought to optimise muscle recruitment and consequently save energy and time (Jovanovic et al., 2011). A typical SAQ session involves explosive movements with the goal of progression from fundamental movement patterns to highly positional specific movements. Hence this form of training is thought to encourage the adaptation of movement mechanics, length and frequency of steps and increased hip height in the pursuit of increased speed, agility and quickness (Pearson & International, 2001). These agility drills may also be an effective alternative to a basic strength and conditioning program for improving the power performance of soccer players (Jullien et al., 2008), either for pre- or in-season training (Jovanovic et al., 2011; Milanović et al., 2012).

SAQ training has been the focus of some research studies, for example Jullien et al. (2008) found that 3-weeks agility training improved straight line sprinting over 7.32 and 10 meters in young soccer players. Also Jovanovic et al. (2011) found that 8-weeks SAQ training during the in-season produced significant improvements in countermovement (44.04 vs. 44.48 cm) and continuous jumps performed with legs extended (41.08 vs. 41.39 cm) in elite soccer players. Polman et al. (2009) also found that SAQ training produced a 6.9% better improvement in 5-m acceleration and 4.3% in 15-m mean running velocity compared to playing in small sided games (SSG). Finally, Polman, Walsh, Bloomfield, and Nesti (2004) concluded that SAQ training appeared to be effective in the physical conditioning of female soccer players and these principles could be implemented during whole team training sessions without the need for specialized SAQ equipment.

Other studies have provided evidence in support of the benefits of increased speed and agility albeit independently and without explicitly using SAQ training. For example, short sprints (~15-m) and brief physical exertions (~3 s) were shown to be the most common high-intensity actions during soccer matches (Meckel, Gefen, Nemet, & Eliakim, 2012) suggesting improvements in these abilities would be beneficial to performance. Appropriate levels of flexibility have been shown to be necessary to ensure optimal performance in soccer including reducing the likelihood of muscle injuries (Sporis, Vucetic, Jovanovic, Jukic, & Omrcen, 2011). Amiri-Khorasani et al. (2010) showed that different stretching methods improved agility performance in young soccer players. Similarly, many studies (Amiri-Khorasani, Sahebozamani, Tabrizi, & Yusof, 2010; Behm & Chaouachi, 2011; Gleim & McHugh, 1997; Herbert & Gabriel, 2002; Thacker, Gilchrist, Stroup, & Kimsey Jr, 2004) have shown that static and dynamic stretching improved flexibility in soccer players and reduced the risk of developing muscle injuries (Witvrouw, Danneels, Asselman, D'Have, & Cambier, 2003). However, recent studies (Cramer et al., 2005; Faigenbaum, Bellucci, Bernieri, Bakker, & Hoorens, 2005) have shown that both static and dynamic stretching can decrease soccer performance, especially high-intensity activities such as repeat sprint performance and sprint over 5-m to 30-m (Behm & Chaouachi, 2011). For this reason, it is important to test whether a training methodology can improve both speed and flexibility simultaneously. This would be particularly advantageous during the playing season as the high frequency of matches often limits the number of training sessions available. It is hypothesised the SAQ training may achieve this goal because of its multi-faceted nature which includes both dynamic flexibility (15-25% of total training time) and sprint performance.

Previous research studies have highlighted the benefits of SAQ training for improving sprint performance of elite soccer players (Jovanovic et al., 2011; Sporiš et al., 2010), agility with and without ball of young soccer players (Milanović et al., 2012) and the neuromuscular functioning of amateur players (Polman et al., 2009). This training method has also been shown to be effective for conditioning female soccer players (Polman et al., 2004). However, to the authors' knowledge, there has been no research investigating the effects of SAQ training on both the flexibility of different muscle groups and speed over 5, 10 and 20 m in young soccer players. The speed characteristics of young soccer players should adapt to training given that Haugen, Tonnessen, & Seiler (2013) suggested that sprint velocity peaked between the ages of 20 and 28 and Williams, Oliver, & Faulkner (2011) concluded that sprint performance showed a tendency for greater improvements during the early teenage period. Consequently, two specific measures of flexibility and speed were selected due to the high frequency of short sprints in soccer and the importance of flexibility in both injury prevention and performance in young soccer players (Herbert & Gabriel, 2002). Therefore, the aim of this research was to determine the effects of SAQ training on speed and flexibility in young soccer players.

2. Methods

2.1 Participants

All participants were males playing in the First Croatian Junior U-19 League during the 2010/2011 season. Only six out of twelve clubs in this league fulfilled the requested conditions regarding equipment and facilities and these were randomly divided into the experimental (EG), 66 players from three (20, 22 and 24 players) clubs (mean±SD: age: 18.5 ± 0.4 years (range 17-19 years); body mass: 71.30±5.93 kg; stature: 177.2±6.5 cm) and control groups (CG), 66 players from three (21, 21 and 24 players) clubs (mean±SD: age: 18.6 ± 0.6 years (range 17-19 years); body mass: 70.63±4.87 kg; stature: 175.9±5.7 cm). All participants agreed to participate in the study and were familiar with SAQ training. None of the participants had been injured 6 months before the initial testing or during the training programme. Nutritional supplements were not included in their diets and participants were not taking exogenous anabolic-androgenic steroids or other drugs that might have affected their physical performance. The study was financed by the Croatian Football Federation and was approved by the Ethics Committee of the Faculty of Kinesiology, University of Zagreb according to the Helsinki Declaration. Participants or parents for the players under 18 years old were fully informed and signed a consent form that indicated they could withdraw from the study at any time.

Table 1. about here

Goalkeepers were not involved in this study due to potential differences in their morphological characteristics and motor ability (Taskin, 2008). Physical conditioning for all clubs started within one week of each other. Participants were only eligible for the study if they had played at least 10 matches and been involved in 70% of training sessions in the past season and had at least eight years of soccer experience. They were also required to undertake at least 75% of the training sessions during the experimental programme. The experimental group undertook four SAQ training sessions a week (information on the intensity and volume of the training programme is presented in Table 2. The control group was involved in regular soccer training that did not include elements of the SAQ training methods.

2.2 Procedure

Basic anthropometric parameters (stature and body mass) were registered in the study protocol. The initial testing took place before the beginning of the pre-season period while the final testing was performed after 12 weeks of intervention with the SAQ training method. To prevent unnecessary fatigue accumulation, players and coaches were instructed to avoid intense exercise for a 24-hour period before each testing session. Immediately prior to testing participants performed a standard 25-minute warm-up consisting of 10 min of light running, 10 min of dynamic stretching and 5 x 30m of running exercises. During testing, the air temperature ranged from 24°C to 27°C. Testing always commenced at 10 a.m. and was completed by 1 p.m. The physical load at given intensities was monitored by heart rate monitors (Polar S610, Kempele, Finland).

All sprint tests were performed on a grass sports field and the players wore soccer shoes in order to replicate the playing conditions. The ability to rapidly accelerate was measured over 5, 10 and 20 m initiated from a standing position (Chamari et al., 2004) and measured with infrared photoelectric cells (RS Sport, Zagreb, Croatia) positioned at exactly 5, 10 and 20 m from the starting line at a height of 1 m. Players were instructed to start with their feet behind the start line, holding this position for a minimum of three seconds, before starting on their own volition. They then ran as quickly as possible along the 20 m distance and told to initially adopt a forward lean. The time between trials was a minimum of 3 minutes to enable full recovery. Time was recorded in 100ths of a second and the average value from three sprint attempts was used as the final result. The intra-class correlation coefficient for test-retest reliability for 5, 10 and 20 m test were 0.98, 0.94 and 0.90, respectively.

Sit and Reach. The test was conducted indoors using a static sit and reach box, supplied with a tape measure. The participant was given the instruction to sit with legs together and extended in front of him, so that the feet (shoes off) touch the first step. Both knees were held together and flat on the floor. The scale (in centimeters) for measuring the distance was drawn on the first step. The end of the feet, that is, the beginning of the step represents the starting point of the scale, was regarded as point zero. All centimeters above zero were positive, whereas the ones below, toward the knees, were negative. The task was to perform the furthest possible front bend with arms extended, and hands on top of each other, palms facing downward. That position was held for 2 seconds in order to measure the distance. The test was performed 3 times (3 trials). The maximal reach distance was recorded in centimeters for all 3 trials. The purpose of this test was to assess the flexibility of the lower back and hamstring (Sporis et al., 2011). The intra-class correlation coefficient for test-retest reliability for the sit and reach test was 0.93.

V-Sit and Reach. The test was performed indoors. Two straight 2-m long lines were drawn on the floor in front of a wall at a 45^0 angle whose peak touches the wall. The tape measure was placed on the floor perpendicularly to the wall. The subject was given the instruction to remove his shoes and sit on the floor with his legs on the measuring lines, his head and back pressed against the wall. The legs were straddled under the 45^0 angle. The hands were placed on top of each other, palms facing downward, in front of the player. During the exercise, the legs remained extended on the floor. The task was to reach forward slowly as far as possible so that the fingers could slide along the tape measure on the floor. The task was performed 3 times. The result was the maximal reach length measured from the starting position to the ultimate reach distance on the tape measure. The results for all 3 measurements were recorded in centimeters. The purpose of this test was to assess the flexibility of the lower back and the corresponding girdle (Sporis et al., 2011). The intra-class correlation coefficient for test-retest reliability for the V-Sit and Reach test was 0.90.

Leg Lift from Supine Position. The test was conducted indoors near a wall on which a scale in degrees has been drawn, with the accuracy of $\pm 5^0$. The scale was stretched from 0^0 to 180^0, so that the x-axis (abscissa) was 10 cm above the floor. The participant was given the instruction to lie down in a supine position on the floor, parallel with the wall, in such a way that his right side could touch the wall and that the superior part of his hip was at the same level with the line marking the 90^0 angle. The legs were held together and extended, while the hands touched the upper legs. The task was to raise slowly a fully extended right leg along the wall (as if performing a frontal leg lift in a standing position) as far as possible and to hold this extreme position for several seconds. The task was performed 3 times with short breaks between the trials. The test result was the angle between the subject’s leg and the abscissa, and it was expressed in degrees. The results of all 3 trials were recorded. The purpose of this test was to assess the flexibility of the hamstring muscles (Sporis et al., 2011). Leg lift from supine position test was measured with the left and right legs. The intra-class correlation coefficient for test-retest reliability for the leg lift from supine position test was 0.95.

Lateral Leg Lift while Lying on the Side. The test was performed indoors near a wall on which the $0–180^0$ scale, with a $\pm 5^0$ accuracy, has been drawn in such a way that the abscissa starts 10 cm above the floor. The subject was instructed to lie down on his left side, body facing the wall and against the wall in such a way that the line marking 90^0 was at the same level with the pelvis apexes. The head was placed on the left arm that was extended along the floor in line with the longitudinal axis of the body. The right arm was bent in front of the chest, breastbone-high, and the right forearm and hand were placed on the floor. From the starting position, the subject lifted his extended leg as far as possible. The task was performed 3 times with short breaks between the trials. The test result was the angle between the lifted leg and the horizontal, and it was expressed in degrees. The results of all 3 trials were recorded. The purpose of the test was to assess the flexibility of the abductor and adductor muscles (Sporis et al., 2011). Lateral leg lift while lying on the side test was measured with the left and right legs. The intra-class correlation coefficient for test-retest reliability for the lateral leg lift while lying on the side test was 0.89. All flexibility tests used in this study have previously been shown to be reliable and valid (Sporis et al., 2011).

Table 2. about here

2.3 Training programme

The experimental group performed a total of 48 SAQ workouts (4 x 12) while the control group undertook approximately the same volume of regular training. Training for the control group consisted of straight line sprinting exercises with same duration, volume, intensity, number of repetitions and rest periods as for the SAQ training. The control group did not use any additional equipment such as hurdles, parachutes or ladder for speed training. It was therefore assumed that there was no significant difference in the training volume between the two groups. In addition to the specific training each group undertook technical, tactical and strength training. During the preparation period participants from experimental and control group participated in 8–10 training sessions per week each lasting 90–105 minutes. Strength training was conducted in a gym twice a week for both groups, each session lasting 90 minutes (30 minutes of warm up; 40 minutes of circuit training; 20 minutes of stretching exercises). Endurance training was performed three times a week during the preparation period. The intensity of training was monitored using polar heart rate monitors (Polar S-610; Polar Electro, Kempele, Finland) and supervised by team coaches. The in-season strength training program targeted the major muscle groups and was undertaken twice a week (i.e. legs, back, chest) and consisted of varied workouts with exercises focusing on muscular power development (e.g. jump squats, back squats, bench throws) using loads of up to 75–85% of 1 repetition maximum (1RM). Endurance training was performed once a week. The high intensity training consisted of 4 x 4 minute maximal running using different drills at exercise intensity levels of 90–95% of the maximal heart rate, separated by 3 minute ‘rest’ periods where technical drills were undertaken at 55–65% of the maximal heart rate. During the 3 minute technical drills, participants were required to work in pairs and perform inside-of-the-foot passes (first drill), control the ball on the chest (second drill), and perform headers (third drill).

Table 3. about here

2.4 Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (v13.0, SPSS Inc., Chicago, IL, USA). Mean and SE, Kolmogorov–Smirnov (normality of the distribution) and Levene’s (homogeneity of variance) tests were calculated for all experimental data before inferential testing. Cohen *d* effect sizes (ES) were also calculated to determine the magnitude of the group differences in speed and flexibility. ES were classified as follows: <0.2 was defined as trivial, 0.2–0.6 was defined as small, 0.6–1.2 was defined as moderate, 1.2–2.0 was defined as large, and >2.0 was defined as very large (Hopkins, 2003). Changes in sprint and flexibility were compared over the training period for players in the experimental and control groups using two factor (group x time) univariate analysis of variance (ANOVA). Statistical significance was set at $p < 0.05$.

3. Results

The Kolmogorov-Smirnov tests showed that data were normally distributed and no violation of homogeneity of variance found using Levene’s test. The experimental and control group were well matched on the pre-training tests with no significant differences found for any variable between the two groups.

Sprint over 5, 10 and 20 m did not differ between groups at baseline, but by week 12, 5-m sprint significantly improved ($P < 0.05$) in the SAQ group compared to the control group (1.40 ± 0.13 s vs. 1.46 ± 0.12 s) respectively (Table 3) which was a trivial effect size (ES=0.15). Compared with pre-training, there was a statistically significant ($P < 0.01$) 3.3% improvement in 10-m sprint after SAQ training with a moderate effect size (ES=0.66) but no significant improvement in the 20 m sprint (3.35 ± 0.13 s pre-training vs. 3.34 ± 0.13 s post training). The effect size for change in sprint time over 5, 10 and 20 m for the control group was -0.17 (trivial), -0.29 (small) and 0.00 (trivial), respectively.

No significant differences for any of the flexibility tests were found between experimental and control groups at baseline or following the training programmes. The SAQ training led to small improvements in all flexibility tests, but these improvements were not significant ($p>0.05$). Effect sizes were similar (trivial) among flexibility tests for the experimental group (ranging from 0.07 for sit and reach to - 0.14 for leg lift from supine position) which meant the highest percentage improvement was observed for the sit and reach test (3.0%). In comparison, flexibility decreased in the control group for all tests, although not significantly, with trivial effect sizes (ranging from 0.02 for left lateral leg lift to 0.14 for right lateral leg lift).

4. Discussion

The purpose of this study was to determine the effect of a 12-week SAQ training programme on speed and flexibility in young soccer players. The main reason for this being the finding that static and dynamic stretching can decrease soccer performance, especially high-intensity activities such as repeat sprint performance and sprint over 5-m to 30-m (Behm &

Chaouachi, 2011). The main finding of this study was that SAQ training led to significant improvements in speed over 5 and 10 meters, but not 20 meters, and flexibility improvements were not significant. In comparison, a control group undertaking similar training with straight line sprinting substituted for the SAQ element of training did not show any significant changes in the measured parameters. These results are taken to indicate that the SAQ training enhanced speed and quickness but not maximal speed (invoked during the 20 m sprint) corroborating Bloomfield et al.'s (2007) view that SAQ is an important training method for the improvement of speed and quickness. The strongest effect (d = 0.66) in this study was the improvement in 10-m sprint time which is particularly important for soccer given that players typically perform between 17 and 81 sprints with a mean duration between 2 and 4 s with the vast majority of sprint distances less than 20 m (Haugen, Tonnessen, Hisdal, & Seiler, 2014). Furthermore, Weineck (2004) suggested that agility along with quickness and speed during the first three steps represent the most significant motor ability of a soccer player.

Hopkins, Marshall, Batterham, & Hanin (2009) suggested that worthwhile performance changes in team sports were 0.2 of the between subject standard deviation. In relation to this study this corresponds to ~ 0.07 s over a 20 m sprint whereas the SAQ group produced this improvement over 10 meters. However, Haugen et al. (2014) reported that a 30-50 cm difference (~0.04 – 0.06 s over 20 m) is probably enough to be decisive in a 1 vs. 1 duel as having the body/shoulder in front of an opposing player increases the chance of dribbling the opponent or successfully defending an attacker. From these points of view the improvements in sprint tests, particularly over 10 meters, may be seen as worthwhile, especially in comparison to the control group whose speed remained unchanged.

Similar to previous studies SAQ training was shown to be effective for improving 5-m and 10-m sprinting but not over 20 m (Bloomfield et al., 2007; Jovanovic et al., 2011; Polman et al., 2004). This supports the contention that agility, acceleration and maximal speed are specific qualities that are relatively unrelated to one another (Little & Williams, 2003). Young, McDowell, & Scarlett (2001) assessed the training response to straight sprint or agility training over a 6-week period and found that a training method specific to one speed test produced limited transfer to the other. Interestingly in this study the control group who trained using straight sprints did not improve their sprint times whereas the SAQ group did for the 5 and 10-m tests. This may have been due to the specific agility drills during SAQ training which consisted of several changes of directions between 3 and 10 m but contradicts the findings of Young, McDowell, & Scarlett (2001). Clearly, more research is required to understand the mechanism of the adaptation seen in this study.

The fact that the SAQ training did not improve the flexibility of the lower back, hamstring, pelvic girdle, adductor and abductor following a 12-week training program suggests that increased flexibility was not necessary to elicit the speed improvements found in these young soccer players. All of the players (control and experimental groups) performed the same warm-up and cool down protocols during the training program, including the same stretching exercises. Indeed, this protocol is the normal routine for these players and thus their flexibility levels were good and perhaps unlikely to be changed significantly during this relatively short training programme. These results are contrary to Polman et al. (2004) who found a positive impact of SAQ training program on flexibility of the lower back and hamstring muscles in female soccer players but this may be due to the low level of flexibility in their participants because improvements in flexibility were found in both experimental and control groups. Carling

(2009) also found that women were more flexible than men and were much easier to improve. Sporis, Jukic, Milanovic, & Vucetic (2010) reported that the best period for flexibility development is between 8 and 12 years of age and that flexibility peak values are typically attained in the late teenage years.

Despite the fact that flexibility is an integral component of fitness, training adaptations are not well understood (Gleim & McHugh, 1997). SAQ training in our study did not lead to the improvement in flexibility despite the dynamic flexibility training involved. Several reasons could explain this with the relatively low level of dynamic flexibility, declining from 25.0% of training in the first week to 16.7% in the last week, being a major cause. A second consideration is that some studies have shown that static stretching is more efficient than dynamic stretching e.g. Samson, Button, Chaouachi, & Behm (2012a) showed a 2.8% improvement in lower back and hamstring flexibility for static over dynamic stretching, and SAQ training employs a predominance of dynamic flexibility. Finally the tests used in this study were tests for static flexibility assessment, which are reliable and valid (Sporis et al., 2011), but perhaps not best suited for dynamic flexibility assessment (Gleim & McHugh, 1997). This maybe the reason why flexibility was not found to have improved and more suitable dynamic flexibility tests, more specific for soccer and that consider muscle stiffness necessary for running economy (Gleim & McHugh, 1997) need to be used in the future.

Conclusions

To our knowledge, this was the first study to examine the effects of SAQ training on speed and flexibility in young soccer players. Whilst changes in speed were detected in runs up to 10 meters improvements in flexibility weren't found. Future studies should consider how flexibility is both trained and assessed to determine the effectiveness of SAQ training. Similarly further research is required to establish whether SAQ training impacts on actual soccer performance. This may be determined by a notational analysis of performance with respect to player movements to determine how much impact increased speed over short distances has on performance. This approach would also help justify specific conditioning training that closes the gap between the position demands of match play and the actual individual capacity of the players (Haugen et al., 2014). Thus, soccer coaches could use this information in the process of planning both pre- and in-season training to make training more specific in such a way that the transfer of training effects to game efficiency will be improved. Anecdotally it seems that some coaches do not use this approach because they are afraid that overtraining is going to occur but it may be that contrary to this belief overtraining actually occurs because too much non-specific endurance and power training is used.

Haugen et al. (2014) reported that, in practical terms, individual differences in sprinting performance are more critical than mean differences among groups of players. However the large sample size in this study precluded individual data interpretation. Hence a limitation of this study was that we did not analyse improvements occurring for players with poor starting values, players with less training prior to the training regime as well as playing position specific changes. Finally the intensity of training in both groups was not individualized according to a player's individual capacity.

To conclude, SAQ training appeared to be an effective way of improving sprint time over 5-m and 10-m but not for increasing maximal speed and flexibility in young soccer players. The results indicate that SAQ training was more effective for improving sprint performance than a traditional conditioning programme.

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TABLES CAPTIONS

Table 1. Training programs for the experimental and control group

Table 2. Specific speed and agility training program (SAQ)

Table 3. Differences between experimental and control group