



Effect of the FIFA 11+ Programme on Vertical Jump Performance in Elite Male Youth Soccer Players

Hadi Akbari^{1,2}, Mansour Sahebozamani¹, Ablolhamid Daneshjoo¹, Mohammadtaghi Amiri-Khorasani³

Affiliations: ¹Shahid Bahonar University of Kerman, Faculty of Sport Science, Department of Corrective Exercises and Sports Injuries, Kerman, Iran, ²University of Zabol, Faculty of Literature and Humanities, Department of Physical Education and Sport Science, Zabol, Sistan & Baluchestan, Iran, ³Shahid Bahonar University of Kerman, Faculty of Sport Science, Department of Sport Biomechanics, Kerman, Iran

Correspondence: H. Akbari, Shahid Bahonar University of Kerman, Faculty of Sport Science, Department of Corrective Exercises and Sports Injuries, Kerman, Iran. E-mail: h.akbari@uoz.ac.ir

ABSTRACT Despite the success of the FIFA 11+ programme in preventing injury, convincing coaches and players to do these exercises is difficult only in order to prevent injury, unless the programme can be shown to have a positive and direct impact on the performance. This study aims to investigate the effect of the FIFA 11+ programme on vertical jump performance in male elite-youth soccer players. Twenty-four male soccer players (mean \pm SD: age = 16.79 \pm 1.18 years, height = 174.17 \pm 8.12 cm, mass = 62.45 \pm 10.01 kg, experience = 6.96 \pm 1.26 years) participated in this study and were randomly divided equally into two groups, FIFA 11+ and control. The experimental group performed the FIFA 11+ programme three times per week for eight weeks whereas the control group just performed their regular warm-up programme. The mixed-repeated measures ANOVA showed that there was a significant improvement in the vertical jump performance between groups in post-test ($P=0.002$) while no significant improvement was found between groups after 1-month of stopping the FIFA 11+ programme ($P=0.076$). It can be concluded that performing the eight-week FIFA 11+ programme can enhance the jump height in male elite youth soccer players. It seems that the FIFA 11+ programme could be incorporated into regular soccer practice as a warm-up programme instead of a conventional warm-up programme. However, due to the failure to maintain the long-term effectiveness of the FIFA 11+ programme on the jump height of soccer players, the continuation of performing this programme is necessary.

KEY WORDS vertical jump height, performance, soccer, the FIFA 11+



@MJSSMontenegro

THE FIFA 11+ PROGRAMME AND VERTICAL JUMP PERFORMANCE

<http://mjssm.me/?sekcija=article&artid=158>

Introduction

Soccer is the most popular sport in the world, with close to 270 million participants (FIFA, 2007). Like most sports, soccer has a risk of injury for both professional and amateur levels in all age grades (Junge & Dvorak, 2004). Ninety percent of all soccer players are male, and young players account for 54.7% of the total population of players (Daneshjoo, Mokhtar, Rahnama, & Yusof, 2013). The consequences related to injury are greater for those who are in the stages of growth and maturation (Read, Oliver, De Ste Croix, Myer, & Lloyd, 2015). Therefore, preventing injury in soccer is essential, especially for young male soccer players.

One effective factor in the success of a prevention programme is the high rate of compliance with it. If an injury prevention programme has a positive and direct impact on the performance, in addition to positive effects on the factors related to injury prevention, the programme is easier to accept by coaches and athletes (Nakase et al., 2013). Recent studies have shown that there is an inverse dose-response relationship between compliance with prevention programs and incidence of ACL injury (Sugimoto et al., 2012). Therefore, multi-

Received: October 29 2017 | Accepted after revision: January 30 2018 | First published online: September 01 2018

© 2017 by the author(s). License MSA, Podgorica, Montenegro. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY).

Conflict of interest: None declared.

purpose training programs have been designed in the form of warm-up programs aimed at preventing injury and improving athletic performance.

Although soccer is a more aerobic sport, it has been observed that non-aerobic fitness seen in muscle power actions is related to determining activities during a game, such as jumps (Faude, Koch, & Meyer, 2012). Attention should be paid to the vertical jump performance in a soccer game because of its role in momentum activities such as heading in attacking or defending situations (Fradkin, Zazryn, & Smoliga, 2010). Therefore, the ability to perform vertical jumps is one of the key components for the soccer players.

The first studies on the physical performance of soccer players used the FIFA 11 programme have been made (Kilding, Tunstall, & Kuzmic, 2008; Steffen, Bakka, Myklebust, & Bahr, 2008). Kilding et al. (2008) stated no changes in body mass, agility, and core stability. However, they observed a significant improvement in leg power (3-step jump and vertical jump) and 20m sprint of young soccer players following the 30 sessions of the FIFA 11 programme. However, Steffen et al. (2008) concluded that the 10-week performance of the FIFA 11 programme was not able to improve soccer skill tests including 40m sprint running, speed tests and vertical jump among adolescent female soccer players. These contradictory results are among the reasons behind the development of the FIFA 11+ programme that incorporates an increase in intensity and exercise components.

As a comprehensive warm-up programme, FIFA 11+ is one of the most successful injury prevention programs in soccer (Silvers-Granelli, Bizzini, Arundale, Mandelbaum, & Snyder-Mackler, 2017). It seems to have the essential components of improving the vertical jump of soccer players. To our knowledge, very few publications can be found in the literature that address the performance effects of the FIFA 11+ programme on leg power. Some studies (Bizzini et al., 2013; Daneshjoo, Mokhtar, Rahnama, & Yusof, 2013) have demonstrated that the use of the FIFA 11+ programme can improve the physical performance (e.g., vertical jump height), indicating that performance improvement may be possible with this programme. However, these outcomes have not been observed by other authors (Impellizzeri et al., 2013; Steffen et al., 2013). Regarding the conflicting results derived from the very few studies, the effect of FIFA 11+ on vertical jump height performance remains in doubt. In contrast, one of the limitations of the previous studies is that they did not take into account the effect sustainability of the FIFA 11+ programme on athletic performance. Thus, it is not yet possible to know how long the results of this programme can be maintained. Given the importance of compliance to the preventive training programs' success, understanding the performance effects of the FIFA 11+ programme and its sustainability will enable soccer coaches and trainers to choose it as a warm-up programme. Therefore, the primary purpose of our study was to examine whether the advanced version of the FIFA 11 programme (i.e., the FIFA 11+) can improve vertical jump performance, as an influencing factor in soccer. Our secondary purpose was to examine the follow-up results one month after halting the FIFA 11+ programme in male elite youth soccer players.

Method

We conducted a randomized controlled trial to assess the effect of FIFA 11+ versus the routine warm-up programme on vertical jump performance in male soccer players. Twenty-four male elite soccer players under 19 years (mean \pm SD: age = 16.79 \pm 1.18 years, height = 1.74 \pm 8.12 m, mass = 62.45 \pm 10.01 kg, experience = 6.96 \pm 1.26 years) participated in this study. The inclusion and exclusion criteria were no lower extremity injury in the previous six months and no pain in the lower extremities. The participants were informed orally about the procedures they would undergo, and each of them voluntarily provided written informed consent before participating. Furthermore, we obtained written informed consent from parents or coaches, as caretakers, on behalf of the minors (for those under the age of 18) involved in this study. The study was approved by the Kerman University of Medical Sciences Ethics Committee (Reference number: Ir.kmu.rec.1395.352) and registered in the Iranian Registry of Clinical Trials (IRCT ID: IRCT2017010331754N1). Soccer players were randomly divided into two groups: intervention, and control (n = 12 per group). The FIFA 11+ group performed the programme 3 times a week for 8 weeks (24 sessions), whereas the control group just performed their regular warm-up programmes. Before data collection, a two-hour acquaintance meeting was held to explain the FIFA 11+ programme exercises. One of the researchers supervised all the training sessions to ensure that correct technique was used.

Participants were asked to wear minimal clothes (only spandex short) with their own soccer footwear. Before the performance assessment, the participants warmed up with a few dynamic stretching exercises, including slow jog, two-legged squat, and stretching exercises for hamstring, quadriceps, and calves.

Assessment of the maximum vertical jump: The subject stood beside a wall, started from a static standing position, reached up as high as possible with one hand and marks the wall with his fingertips. The jump was preceded by flexing the knees to approximately 90°; the subject jumped up with maximum effort as fast as he could and made a sign on the wall again with the same hand. The difference between these two marks in centimetres was considered as the maximum vertical jump height. The jump performance was monitored by one of the researchers. The mean of three vertical jump performance was calculated to analyse overall vertical jump height. The vertical jump test during pre-test, post-test and after one month were performed between 8 am and 1 pm. The vertical jump performance was assessed three days before and after intervention and also after one month without the FIFA 11+ training. The exercise programs were implemented during the 2016-2017 season.

The FIFA 11+ is a comprehensive warm-up programme with six running exercises at the beginning and with three exercises to activate the cardiovascular system at the end, and six specific preventive exercises focusing on core and leg strength, balance and agility with three progressive levels for each exercise, as well as lower extremity and trunk alignment cues. It takes about 20-25 min to complete and requires a minimum of equipment (a set of cones and balls).

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 21. For data analysis and to compare the vertical jump performance between intervention programme (the FIFA 11+ vs routine warm-up) among the pre-intervention, post-intervention and one-month follow-up (times), a 2×3 (groups vs time) mixed repeated-measures ANOVA was used. If the interaction between time and group is significant, 'simple effects' analysis is used for exploring this relationship further. We screened the data to ensure that assumptions were met for statistical analysis. The Shapiro-Wilk, the Runs, and Levene's tests were used to assess the normality of data distribution, the hypothesis of independence and the homogeneity of variance between the groups, respectively ($p > 0.05$). Furthermore, homogeneity of variance-covariance was confirmed using Box's M table data ($p > 0.001$). The guidelines for interpreting the effect size value using eta squared data are: .01=small effect, .06=moderate effect, and 0.14=large effect (Cohen, 1988; Pallant, 2010). Significance was accepted at the 95% confidence level for all statistical parameters ($p < 0.05$).

Results

There was no significant difference between the FIFA 11+ and control groups for height, weight, age, or pre-training vertical jump performance ($p > 0.05$). Means (\pm SD) of vertical jump height in the subjects of the two groups in the pre-intervention and post-intervention are presented in Table 1.

TABLE 1 Vertical Jump Height Measures over Three Times Phases

Training groups	Pre-intervention	Post-intervention	After 1-month stopping the FIFA 11+ training
FIFA 11+	45.33 \pm 5.06	51.00 \pm 4.95	48.50 \pm 5.60
Routine warm-up	44.25 \pm 4.78	44.58 \pm 3.75	44.66 \pm 4.41

The table Tests of Within-Subjects Effects showed that the interaction between time and group with large effect size is significant ($F(2, 44) = 23.491, p < 0.001, \eta^2 = 0.51$). Since the interaction between time and group was obtained, "simple effects" analysis was used, which showed that the FIFA 11+ group had significantly more improvement in vertical jump performance after interventions ($p = 0.002$) than the routine warm-up programme did, but there were no differences between groups one month after stopping the FIFA 11+ programme ($p = 0.076$).

As shown in Table 1 and also Figure 1, the vertical jump performance of soccer players in the pre-test was the same, but by performing the FIFA 11+ programme for the intervention group, the closer we come to the

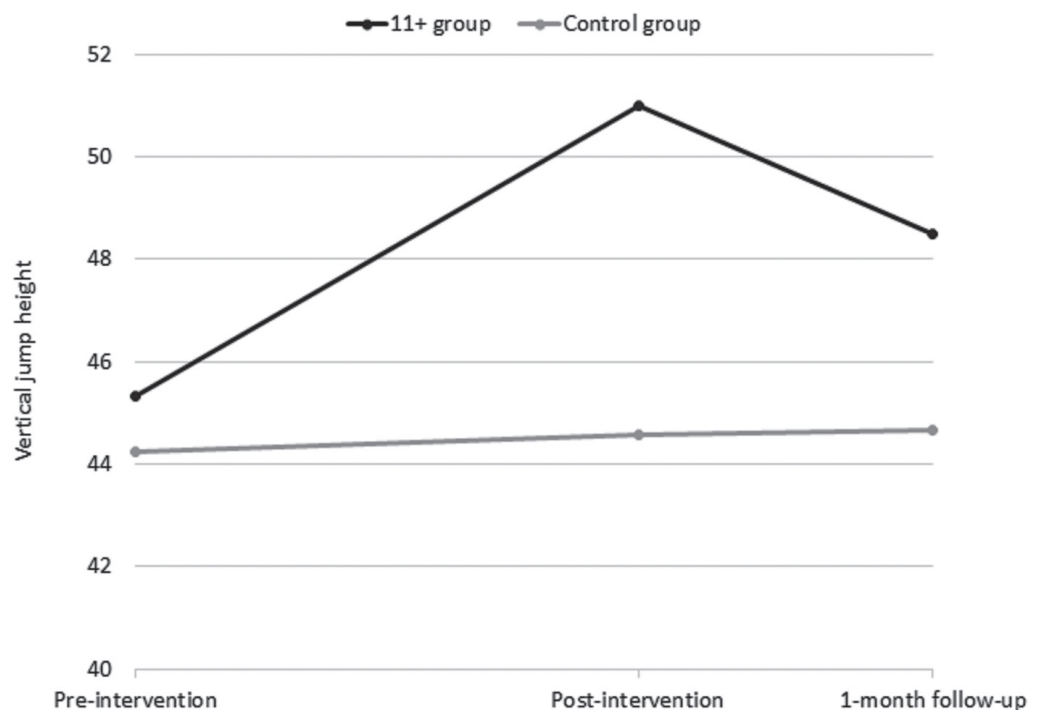


FIGURE 1 The Vertical Jump Height Performance of the Two Groups at Different Times

post test, the greater the difference between the two groups in terms of vertical jump height performance and also after the FIFA 11+ programme is stopped, the discrepancy will be lessened closer to the retention test.

Discussion

The current study aimed to compare the performance of the vertical jump height between the FIFA 11+ and the routine warm-up programme groups as well as the follow-up results obtained in terms of improving the jump height one month after stopping the FIFA 11+ programme. The findings of this study indicated that the effects of the FIFA 11+ programme exercises on the performance of soccer players' vertical jump were remarkable, and the vertical jump of the intervention group eight weeks after performing the FIFA 11+ programme exercises improved in comparison to the control group. Although this performance improved in the intervention group, one month after stopping the FIFA 11+ programme, it gradually lost its positive effects.

There are several possible explanations for this result. As a multicomponent training programme using a series of exercises such as bench, sideways bench, single-leg stance, squats and jumping, FIFA 11+ can induce the activity of core and hip muscles and thus improve neuromuscular control (Bizzini & Dvorak, 2015), which enhance functional performance efficiency of activities (Kibler, Press, & Sciascia, 2006). On the other hand, it could be mentioned that Nordic hamstring curl (the hamstring muscles are stretched during an eccentric contraction) and plyometric exercises of the FIFA 11+ programme are probably effective for improving the stretch-shortening cycle (SSC) function, which is one of the key factors for enhancing vertical jump performance (Kyröläinen & Komi, 1995). Similarly to the present study, Bizzini et al. (2013) studying on 20 amateur male soccer players (aged 25.5) and Daneshjoo et al. (2013) investigating 36 male elite soccer players (aged 17-20), reported significant improvements on the vertical jump performance of male soccer players because of performing the FIFA 11+ programme (Bizzini et al., 2013; Daneshjoo et al., 2013). A recent review study demonstrated that squats and plyometric exercises can improve vertical jump height (de Villarreal, Kellis, Kraemer, & Izquierdo, 2009). Furthermore, performing squat and walking lunge exercises can be effective in increasing vertical jump height (Jönhagen, Ackermann, & Saartok, 2009; Wisløff, Castagna, Helgerud, Jones, & Hoff, 2004). Thus, the underlying effectiveness of the FIFA 11+ programme on vertical jump performance may be caused by using core, plyometric, and jump exercises.

However, Steffen et al. (2013) with 4.5 months of training with 226 tier 1-3 level female soccer players (aged 13-18) and Impellizzeri et al. (2013) with 9 weeks of training with 81 male amateur soccer players (aged 23.5) did not report significant differences in the vertical jump between the control and the FIFA 11+ groups, with male and female samples, respectively (Impellizzeri et al., 2013; Steffen et al., 2013). These differences in the results of studies can be attributed to factors such as gender, age, and the skill levels of the soccer players.

One of the factors that can be noted for the loss of training-induced performance adaptations for the vertical jump of soccer players is that the factors affecting vertical jump performance, such as strength, are likely to be retained for less than one month. The results of studies have shown that durability of strength is less than four weeks. For example, the ability to apply force to the water in trained swimmers was considerably reduced during four weeks of inactivity (Neufer, Costill, Fielding, Flynn, & Kirwan, 1987). Therefore, it can be concluded that by stopping the FIFA 11+ programme, the stimulating effective forces on vertical jump performance were reduced so that after one month there is no difference in terms of performance between groups.

As noted, improving the ability to jump vertically in a soccer game is critical for activities, such as heading in offense or defense situations. According to the results of this study, the FIFA 11+ programme has been effective in improving the vertical jump performance. This result is great for soccer coaches and trainers because the FIFA 11+ warm-up programme can be done without adding time as well as imposing additional financial costs compared to routine warm-up exercises. Given that our findings are based on a small sample size and that our results are related to young male soccer players aged between 16 and 19, the results from such analyses should thus be treated with considerable caution. The present results merely show the effect of the FIFA 11+ on the young grade, and additional studies on other grades, as well as female athletes, to fully realize the effect of the FIFA 11+ on vertical jump performance in other populations, are recommended.

The FIFA 11+ programme can improve the performance of male elite youth soccer players, but the maintaining of the training-induced performance adaptations is less than one month. Therefore, these findings suggest to soccer coaches and trainers that the inclusion of FIFA 11+ in the training routine would be beneficial to leg power and could improve the ability of vertical jump performance. However, the necessity of continuing to implement the FIFA 11+ programme exercises to maximize the benefits of this programme on the performance is noted.

What does this study add?

To date, because of few and contradictory studies, little is known about the effects of the FIFA 11+ programme on vertical jump performance. There is no study in this area to employ follow-up the results. Through this study, the database in this research area has been increased, and there is information on the

effect of this programme on the vertical jump performance after a one-month follow-up. The results of this study indicated that FIFA 11+ improves performance in the vertical jump test, but the improvement was not maintained after one month of halting training. Data from this research can be helpful for soccer coaches and trainers in choosing the FIFA 11+ programme to enhance jump performance in elite male youth soccer players.

REFERENCES

- Bizzini, M., & Dvorak, J. (2015). FIFA 11+: an effective programme to prevent football injuries in various player groups worldwide—a narrative review. *British journal of sports medicine*, 49(9), 577-579. doi:10.1136/bjsports-2015-094765
- Bizzini, M., Impellizzeri, F. M., Dvorak, J., Bortolan, L., Schena, F., Modena, R., & Junge, A. (2013). Physiological and performance responses to the “FIFA 11+” (part 1): is it an appropriate warm-up? *Journal of sports sciences*, 31(13), 1481-1490. doi:10.1080/02640414.2013.802922
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.
- Daneshjoo, A., Mokhtar, A., Rahnama, N., & Yusof, A. (2013). The effects of injury prevention warm-up programmes on knee strength in male soccer players. *Biology of Sport*, 30(4), 281-288. doi:10.5604/20831862.1077554
- Daneshjoo, A., Mokhtar, A. H., Rahnama, N., & Yusof, A. (2013). Effects of the 11+ and Harmoknee Warm-up Programs on Physical Performance Measures in Professional Soccer Players. *The Journal of Sports Science and Medicine*, 12(3), 489-496. doi:10.1371/journal.pone.0050979
- de Villarreal, E. S.-S., Kellis, E., Kraemer, W. J., & Izquierdo, M. (2009). Determining variables of plyometric training for improving vertical jump height performance: a meta-analysis. *The Journal of Strength & Conditioning Research*, 23(2), 495-506. doi:10.1519/jsc.0b013e318196b7c6
- Faude, O., Koch, T., & Meyer, T. (2012). Straight sprinting is the most frequent action in goal situations in professional football. *Journal of sports sciences*, 30(7), 625-631. doi:10.1080/02640414.2012.665940
- FIFA. (2007). FIFA Big Count 2006: 270 million people active in football. Retrieved 2/16, 2017, from http://www.fifa.com/mm/document/fifafacts/bcoffsurv/bigcount.statspackage_7024.pdf.
- Fradkin, A. J., Zazryn, T. R., & Smoliga, J. M. (2010). Effects of warming-up on physical performance: a systematic review with meta-analysis. *The Journal of Strength & Conditioning Research*, 24(1), 140-148. doi:10.1519/jsc.0b013e3181c643a0
- Impellizzeri, F. M., Bizzini, M., Dvorak, J., Pellegrini, B., Schena, F., & Junge, A. (2013). Physiological and performance responses to the FIFA 11+ (part 2): a randomised controlled trial on the training effects. *Journal of sports sciences*, 31(13), 1491-1502. doi:10.1080/02640414.2013.802926
- Jönhagen, S., Ackermann, P., & Saartok, T. (2009). Forward lunge: a training study of eccentric exercises of the lower limbs. *The Journal of Strength & Conditioning Research*, 23(3), 972-978. doi:10.1519/jsc.0b013e3181a00d98
- Junge, A., & Dvorak, J. (2004). Soccer injuries. *Sports medicine*, 34(13), 929-938. doi:10.2165/00007256-200434130-00004
- Kibler, W. B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. *Sports medicine*, 36(3), 189-198. doi:10.2165/00007256-200636030-00001
- Kilding, A. E., Tunstall, H., & Kuzmic, D. (2008). Suitability of FIFA's “The 11” Training Programme for Young Football Players – Impact on Physical Performance. *Journal of Sports Science & Medicine*, 7(3), 320-326.
- Kyröläinen, H., & Komi, P. V. (1995). The function of neuromuscular system in maximal stretch-shortening cycle exercises: comparison between power- and endurance-trained athletes. *Journal of Electromyography and Kinesiology*, 5(1), 15-25. doi:10.1016/S1050-6411(99)80002-9
- Nakase, J., Inaki, A., Mochizuki, T., Toratani, T., Kosaka, M., Ohashi, Y., . . . Tsuchiya, H. (2013). Whole body muscle activity during the FIFA 11+ program evaluated by positron emission tomography. *PloS one*, 8(9), e73898. doi:10.1371/journal.pone.0073898
- Neufer, P. D., Costill, D. L., Fielding, R. A., Flynn, M. G., & Kirwan, J. P. (1987). Effect of reduced training on muscular strength and endurance in competitive swimmers. *Medicine and Science in Sports and Exercise*, 19(5), 486-490. doi:10.1249/00005768-198710000-00011
- Pallant, J. (2010). SPSS survival manual, 4th. *England: McGraw-Hill Education*.
- Read, P., Oliver, J. L., De Ste Croix, M. B. A., Myer, G. D., & Lloyd, R. S. (2015). Injury Risk Factors in Male Youth Soccer Players. *Strength & Conditioning Journal*, 37(5), 1-7. doi: 10.1519/ssc.0000000000000171
- Silvers-Granelli, H. J., Bizzini, M., Arundale, A., Mandelbaum, B. R., & Snyder-Mackler, L. (2017). Does the FIFA 11+ injury prevention program reduce the incidence of ACL injury in male soccer players? *Clinical Orthopaedics and Related Research*, 1-9. doi:10.1007/s11999-017-5342-5
- Steffen, K., Bakka, H. M., Myklebust, G., & Bahr, R. (2008). Performance aspects of an injury prevention program: a ten-week intervention in adolescent female football players. *Scandinavian Journal of Medicine & Science in Sports*, 18(5), 596-604. doi: 10.1111/j.1600-0838.2007.00708.x
- Steffen, K., Emery, C. A., Romiti, M., Kang, J., Bizzini, M., Dvorak, J., . . . Meeuwisse, W. H. (2013). High adherence to a neuromuscular injury prevention programme (FIFA 11+) improves functional balance and reduces injury risk in Canadian youth female football players: a cluster randomised trial. *British journal of sports medicine*, 47(12), 794-802. doi:10.1136/bjsports-2012-091886

- Sugimoto, D., Myer, G. D., Bush, H. M., Klugman, M. F., McKeon, J. M. M., & Hewett, T. E. (2012). Compliance with neuromuscular training and anterior cruciate ligament injury risk reduction in female athletes: a meta-analysis. *Journal of athletic training*, 47(6), 714-723. doi:10.4085/1062-6050-47.6.10
- Wisløff, U., Castagna, C., Helgerud, J., Jones, R., & Hoff, J. (2004). Strong correlation of maximal squat strength with sprint performance and vertical jump height in elite soccer players. *British journal of sports medicine*, 38(3), 285-288. doi:10.1136/bjism.2002.002071