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Research article

Suitability of FIFA's "The 11" training programme for young football players - impact on physical performance

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Abstract
There is a paucity of evidence regarding the use of injury prevention programmes for preadolescents participating in sport. "The 11" injury prevention programme was developed by FIFA's medical research centre (F-MARC) to help reduce the risk of injury in football players aged 14 years and over. The aim of this study was to determine the suitability and effectiveness of "The 11" for younger football players. Twenty-four [12 experimental (EXP), 12 control (CON)] young football players (age 10.4 ± 1.4 yr) participated. The EXP group followed "The 11" training programme 5 days per week, for 6 weeks, completing all but one of the 10 exercises. Prior to, and after the intervention, both EXP and CON groups performed a battery of football-specific physical tests. Changes in performance scores within each group were compared using independent *t*-tests ($p \leq 0.05$). Feedback was also gathered on the young players' perceptions of "The 11". No injuries occurred during the study in either group. Compliance to the intervention was 72%. Measures of leg power (3 step jump and counter-movement jump) increased significantly (3.4 and 6.0% respectively, $p < 0.05$). Speed over 20 m improved by 2% ($p < 0.05$). Most players considered "The 11" beneficial but not enjoyable in the prescribed format. Given the observed improvements in the physical abilities and the perceived benefits of "The 11", it would appear that a modified version of the programme is appropriate and should be included in the training of young football players, for both physical development and potential injury prevention purposes, as well as to promote fair play. To further engage young football players in such a programme, some modification to "The 11" should be considered.

Key words: Injury, football, soccer, children, prevention, FIFA.

Introduction

Football is a high participation sport world-wide and like most sports is associated with a certain risk of injury for players, both at the competitive and recreational level (Junge and Dvorak, 2004). Several studies have shown that the incidence of football injuries can be reduced by adopting various injury prevention strategies including: warm-up, with an emphasis on stretching; proper medical attention for injuries; appropriate recovery methods and time; appropriate cool-down; use of protective equipment; good playing field conditions and adherence to existing rules (Berbig, 1997; Blaser and Aeschlimann, 1992; Caraffa et al., 1996; Dvorak et al., 2000; Ekstrand et al., 1983; Hawkins and Fuller, 1999).

In adults, the significant benefit of physical conditioning interventions in the prevention of injuries has been reported in several studies (Caraffa et al., 1996), particularly with respect to the reduction of Anterior Cruciate Ligament (ACL) injuries. Similarly, in younger adolescent male (Junge et al., 2002) and female football players (Heidt et al., 2000; Mandelbaum et al., 2005), and in other team sports (Emery et al., 2005; Hewett et al., 1999; Myklebust et al., 2003; Olsen et al., 2005), the usefulness of exercise-based conditioning programmes for injury prevention has been shown. However, whilst it is clear that sport-specific strength training programmes that include a balance training component are effective in improving physical condition and reducing the risk of injury in mature athletes, little research has considered such strategies in relation to children (preadolescent) and youth (MacKay et al., 2004)

Children are skeletally immature and when participating in sport, are susceptible to a range of hard- and soft-tissue injuries (Frank et al., 2007). Indeed, in a recent review (Spinks and McClure, 2007), the significant injury incidence in children participating in football (or soccer) was highlighted. In one study, the injury rate could be as high as 51.2 injuries per 100 player seasons for 11-14 year olds (Yde and Nielsen, 1990). To address this, Emery et al. (2005) recently highlighted the need to develop suitable injury prevention programmes for children and youths and to determine their effectiveness using a scientific approach. One such predominantly exercise-based, injury prevention programme that may be suitable for young children is "The 11", which was developed by F-MARC, the medical research centre of The Federation Internationale de Football Association (FIFA). "The 11" comprises ten physical exercises and also promotes Fair Play. The exercises focus on core stabilisation, eccentric training of thigh muscles, proprioceptive training, dynamic stabilisation and plyometrics with straight leg alignment. The programme requires no technical equipment other than a ball, and can be completed in 10-15 minutes (after a short period of familiarisation).

In New Zealand, all football players and coaches receive, or have free access to, "The 11". However, a large proportion of players are juniors (under 14 years of age), for whom "The 11" was not originally intended to be used by. Thus, the primary aim of this initial study was to determine the suitability and effectiveness of "The 11" injury prevention programme in developing physical competencies in young football players. A secondary aim

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was to gain an insight into young players' perceptions of "The 11" programme.

Methods

Subjects

With ethical approval, twenty-four boys (mean ±SD: age 10.4 ± 1.4 yr; body mass: 35.2 ± 3.1 kg; stature: 1.34 ± 0.06 m) from a local football club, with 4.1 ± 1.2 years playing experience, participated. Players were randomly assigned to either an experimental (EXP, n = 12) or a control (CON, n = 12) group. Participant and parental informed consent was obtained prior to participation, and all participants completed a customised pre-exercise medical questionnaire.

Physical tests

After a familiarisation session, participants performed the following tests, before and after a 6 week intervention: 1) vertical counter-movement jump (CMJ, to measure leg power); 2) three-step horizontal jump (to measure co-ordination and explosive leg power); 3) prone hold (to measure core stability and muscular endurance); 4) 20 metre sprint (to measure speed) and 5) the Illinois agility test (to measure football-specific agility). Some of which are commonly used in the monitoring of football players (e.g. Chamari et al., 2004). Three trials of each assessment, except the prone hold (single trial), were performed and the mean of the best two trials determined and used for analysis. To improve reliability, one practice trial prior to each test was permitted. A standardized ten minute football-specific warm-up was conducted prior to each battery of physical tasks. Pre- and post-tests were performed at the same time of day (17:00 ± 0.5hrs), in the same indoor venue.

Running speed

Maximal running speed was measured over 20 m, using double laser beam electronic timing equipment (Swift Performance Equipment, Lismore, NSW, Australia). Timing gates were set at 0.75 m above ground level, two metres apart and facing each other, at the start line and at the 20 m mark. Participants started 0.50 m behind the first timing gate, with both feet in line with each other. Participants were instructed to lean forward into the sprint and that the first step must be forward of the body. All participants practiced this starting technique during the warm-up period and during the practice sprint immediately prior to performing the three trials. Participants were instructed to run as fast as possible and not to slow down until they had passed the last timing gate. Times were recorded to the nearest 0.01 s. Throughout the sprint, participants were given consistent verbal motivation from the test administrators. Between trials, each participant received adequate recovery time (approximately 3 to 5 min).

Vertical jump

Maximum vertical jump height was measured using a maximal double-leg counter-movement jump, accompanied by an arm swing, using a contact mat system (Swift Performance Equipment, Lismore, NSW, Australia). The contact mat system measures jump height, flight time and ground contact time and has been shown to demonstrate high reliability (flight time r = 0.95; contact time r = 0.99) when compared to a force platform (Cronin and McLaren, 1999). Participants positioned their feet approximately shoulder width apart on the contact mat before attempting the jump. Steps or run-ups into the jumping action were not permitted and the landing had to occur on the contact mat. Jump height was determined to the nearest 0.1 cm using the following formula:

$$\text{Jump Height (m)} = 0.5 \times g\,(t/2)^2 \qquad \text{Eq 1}$$

where g represents acceleration due to gravity (9.81 $m{\cdot}s^{-1}$); and t represents the flight time of the jump in seconds.

Participants performed three jump trials in succession, with approximately 15 to 30 s recovery between jumps. Jumps were considered void if the participant 1) went into extreme (>45 degrees) hip flexion during the flight time of the jump; 2) flexed the knees to the extent that the heel nearly touched the gluteal muscles; and/or 3) did not land centrally on the contact mat .

Horizontal 3-step jump

To assess a player's ability to transfer leg power in a horizontal direction, a 3-step jump for maximum distance was performed on a hard indoor surface. Participants started in a stationary position and were required to propel themselves forward, as far as possible, in three alternate leg steps. Participants initiated the movement using their dominant leg in each trial and three trials were performed. Distance was recorded to the nearest 0.5 cm, using a standard tape measure, from the start line to the rear heel position at landing. Reliability (intra-class correlation, ICC) of this test is very high (ICC = 0.97, Maulder and Cronin, 2005)

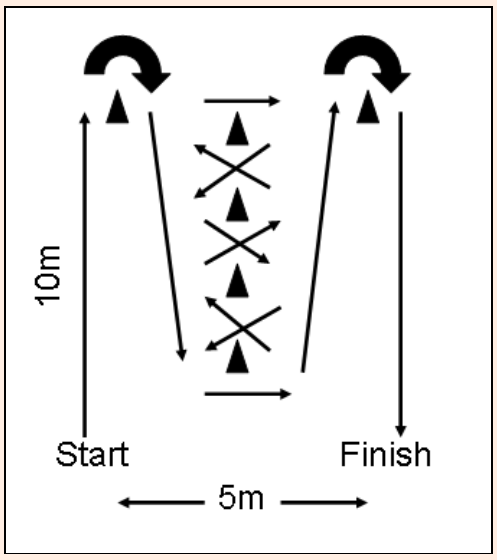

Figure 1. A schematic of the Illinois agility test.

Agility

Agility was determined using the Illinois agility test (Figure 1). Participants start the test lying face down, with the hands at shoulder level. Times were recorded to the

Table 1. Guidelines for performance of "The 11"

	Exercise Name	Guidelines	Figure 2
1	The bench	Hold for 15s each leg (1-2 times)	a
2	Sideways bench	Hold for 15s on each side, twice	b
3	Hamstrings	*Not performed*	-
4	Cross-country skiing	15 times on each leg	c
5	Chest-pass	10 times on each leg	d
6	Forward bend	10 times on each leg	e
7	Figure-of-eight	10 times on each leg	f
8	Jumps over a line	Side-side 10 times then forward-backward 10 times	g
9	Zigzag shuffle	Twice through course	h
10	Bounding	30 metres twice	i
11	Fairplay	N/A	-

nearest 0.01 s, using the aforementioned timing gate system, and the mean of the best two times recorded. Reliability of this test has been reported to be high, ICC = 0.88 (Gabbett, 2002).

Prone hold (core stability)

Participants were required to maintain a prone hold (commonly known as the 'plank') position for as long as possible. Participants were monitored during the trial to ensure good form was maintained. A linear horizontal position was desired throughout the test. To ensure consistency, the same researcher conducted both the pre- and post-test. The duration for which the required position was held was recorded as the test score.

Exercise intervention - "The 11"

The full version of "The 11" training programme can be viewed online on the FIFA website (www.fifa.com). Following discussions with physiotherapists and sports physicians, 9 of the 10 exercises were demonstrated to the EXP group, using the exact guidelines outlined by FIFA with respect to the number of repetitions or duration of each exercise (Table 1). The guidelines for completion of Exercise 3 (hamstrings) were not considered appropriate for this age group and as such, this exercise was excluded from the intervention. However, it is recognised that this exercise (often known as Nordic Hamstrings) and hamstring strength in general are important for football players. All other exercises are illustrated in Figure 2 (a-i). Players were instructed to perform the exercises 5 times per week (on separate days) for 6 weeks. To facilitate understanding, compliance, ongoing safety and correct execution, full instruction in the technique of each exercise was provided to participants, coaches and parents in week 1. Once each week, the EXP group performed their exercises under supervision. Other sessions were performed at home, with assistance from parents where necessary. Each player in the EXP group received their own copy of "The 11" DVD, the official instruction booklet and a personal diary to record their performance of "The 11" and all other training. Both groups were instructed to continue with their usual football-based training regime (3 days per week), with no intervention programme or additional training for the CON group.

Questionnaires

A short, custom-made questionnaire was administered to each player in the EXP group at the end of the intervention, to determine perceptions of the "The 11" programme. Questions focussed on 5 key areas: 1) enjoyment; 2) frequency of execution; 3) perceived benefits of participation; 4) intention to continue/adhere; and 5) feedback on specific exercises.

Statistical analysis

Means ± SD were calculated for all measures. A statistical software package (SPSS v14, Chicago, US) was used to compare groups. The differences between pre- and post-intervention scores, for both EXP and CON, were compared using independent *t*-tests. Significance was set at $p \leq 0.05$.

Results

There were no changes to body mass or stature during the study in either the EXP or CON group (Table 2). Training diaries revealed that participants completed the training, on average, 3.6 ± 0.4 times per week, resulting in an adherence rate of 72%. The pre- and post-intervention results for both groups are presented in Table 2. Measures of leg power (3 step jump and CMJ) increased significantly [3.4% ($p < 0.05$) and 6.0% ($p < 0.01$) respectively] in EXP, but not CON. Similarly, speed over 20 m improved by 2% ($p < 0.01$). Whilst there was a tendency for

Table 2. Pre- and post-intervention data, and percent changes, for all measures in both the experimental and control group. Values are mean (± SD).

	EXP (n = 12)			CON (n = 12)			
	Pre	**Post**	**Δ%**	**Pre**	**Post**	**Δ%**	**P value**
Stature (m)	1.31 (.08)	1.32 (.10)	.76 (.81)	1.36 (.05)	1.37 (.07)	.76 (.54)	.336
Body Mass (kg)	34.2 (2.1)	34.4 (2.5)	.58 (.34)	36.2 (4.3)	35.9 (4.8)	-.83 (.9)	.301
3 step jump (m)	4.61 (.34)	4.77 (.20)	3.4 (2.3)	4.80 (.23)	4.79 (.23)	.2 (1.0)	.043
CMJ (m)	.33 (.13)	.35 (.15)	6.0 (3.1)	.36 (.11)	.36 (.05)	-.1 (.1)	.001
Agility (s)	14.81 (.72)	14.52 (.53)	-2.0 (1.7)	15.51 (.93)	15.43 (.86)	-.6 (2.2)	.275
Core stability (s)	45.2 (16.1)	64.5 (10.2)	42.7 (18.8)	34.3 (14.9)	43.3 (11.9)	26.2 (16.3)	.097
20m sprint (s)	3.60 (.35)	3.52 (.36)	-2.2 (2.0)	3.74 (.07)	3.81 (.98)	1.9 (2.7)	.008

Δ = change. P value reflects differences between the change scores for each group

Figure 2. "The 11" exercises (with permission, FIFA/F-Marc, 2007).

both agility and core stability to improve in EXP (-2-2 ± 2.0% and 42.7 ± 18.8% respectively, Table 2), this was not significant when compared to changes in the CON group.

The response rate for the questionnaire was 100%. Eighty-nine percent of participants rated "The 11" programme as 'enjoyable'. Most participants (90%) felt it preferable that the programme be performed less than five times per week. Some players (64%) felt that not all exercises were helpful, but most (83%) felt that the programme, was, overall, beneficial. Exercises 1 and 2 (Bench and Sideways Bench) were considered particularly challenging by most players (91%).

Discussion

Performance of "The 11" resulted in significant changes in several of the physical performance abilities assessed. The largest improvement was observed for counter-movement jump (CMJ) height (EXP = 6.0 ± 3.1%; CON = -0.1 ± 0.1%, $p < 0.05$, Table 2). In football, leg power (a product of force and velocity) would likely be associated with improved jumping and sprinting ability on the pitch. However, it may also serve to reduce the risk of ankle, knee and other lower limb injuries (Chandy and Grana, 1985). Chandy and Grana (1985) showed that jump training programmes, incorporating plyometric exercises and weight lifting, both increased performance and decreased injury risk in competitive high school athletes (age: 15 ± 0.6 years). Also, positive effects of a six week training programme incorporating strength, power and agility training, alongside the development of correct and maximal jumping technique, are apparent in volleyball (Hewett et al., 1996). Hewett et al. (1996) found that such a programme improved technique and decreased peak impact forces by 22% when landin and reduced medial and lateral directed forces by 50%. The performance benefit was a 10% increase in vertical jump height, which was greater than that observed in the present study (6%, Table 2). This could have been due to the greater volume (3 x 2 hour sessions/week) of the intervention used by Hewett et al., (1996) and a much greater emphasis on explosive exercises. Subsequently, in a later study, Hewett et al. (1999) reported prospectively that a similar

conditioning programme prior to sports participation resulted in reduced injury risk in young female football players. The single-leg bounding and jumping exercises of "The 11" are likely contributors to the observed improvement in leg power in this study since it is has been shown that such exercises improve the strength and neuromuscular recruitment and co-ordination of muscle (Chimera et al., 2004). Such adaptations could help reduce lower limb (ankle and knee) injuries in this population, though the latter was not measured in the present study.

In the present study, 'The 11' resulted in improved speed (EXP = 2.2 ± 2.0%; CON = 0.1 ± 0.1%, $p < 0.05$, Table 2) and horizontal jump leg power (EXP = 3.4 ± 2.3%; CON = 0.2 ± 1.0%, $p < 0.05$, Table 2) which are both desirable changes regardless of a players age or playing level. The ability to jump higher to head the ball in attacking or defensive situations, as well as running with or to meet the ball in attacking play or to close down a player during defensive play are critical to the prevention and scoring of goals respectively. Physical training interventions that can improve these measures are likely to result in enhancement of player performance.

Whilst no changes in body mass or height were observed over the duration of the present study, the general increase in body size during maturation should be considered when designing physical training programmes for children (e.g. Dollard et al., 2006) and, as in the present study, interpreting changes in physical performance after a training intervention. It is possible that over a given time period any training benefits may be superseded by changes caused by growth and maturity. However, given the relatively short duration of the current intervention (6 weeks) we ascribe the improvements in performance primarily to physical development as a result of the programme, especially since percent change scores were compared to a non-training control group.

It is unfortunate that arguably one of the most effective own body weight exercises for football players (Arnason et al., 2008) had to be excluded from the training programme based on *a-priori* medical advice. Physiotherapists and sports physicians considered the recommended 5 repetitions inappropriate and potentially unsafe for this age group, with gradual progression to this point required. Given the effectiveness of the Nordic hamstring exercise to improve hamstring strength and reduce hamstring injuries in adult players (Arnason et al., 2008), future programmes should consider the appropriateness and integration of this and/or similar exercises for younger players.

Studies have shown that the incidence of injuries in youth football increases with year/grade at school (Malina et al., 2006) and age (Schmidt-Olsen et al., 1991) and that a previous injury is a major risk factor for future injury (Hagglund et al., 2006). Therefore, it is important that steps are taken early to prevent a young player's first injury, as this could potentially lead to long-term functional disability and deformity (Frank et al., 2007). If performance benefits can also be obtained, using the same intervention, and at the same time, then this is a desirable outcome. The specificity of "The 11" appears to offer these performance benefits to young football players.

To our knowledge, the effectiveness of FIFA's "The 11" to actually reduce injury incidence and physical performance in football has yet to be determined, for any age group or level of player. The impact of "The 11" programme on actual injury risk is not possible to determine from the data collected in the present study. However, the observed improvements in physical attributes and findings of previous longitudinal studies (Hart, 2001; Heidt et al., 2000; Mandelbaum et al., 2005) would suggest that ''The 11'' has the potential to reduce injury risk across the age range. Whilst no data currently exists showing the efficacy of exercise-based injury prevention programmes for young players, data from slightly older players is considered. However, we acknowledge the limitations in speculating on injury prevention using different populations drawn from other studies. In a study involving 42 female high school football players aged 14-18 years, Heidt et al. (2000) demonstrated that a 7-week individualised, football-specific, pre-season training programme (focusing on cardiovascular conditioning, plyometrics, strength training and flexibility) was successful in significantly ($p < 0.01$) decreasing the frequency and severity of all injuries. Likewise, Hart et al. (2001) observed a significant reduction of ACL injuries, in adolescent women playing competitive football, following a preseason conditioning programme involving proprioceptive and plyometric exercises, similar in nature to those included in "The 11". More recently, Mandelbaum et al. (2005) investigated the effectiveness of a neuromuscular and proprioceptive training programme in adolescent football players over a 2 year period and reported a reduction in ACL injury of 88% (Year 1) and 74% (Year 2) compared to a control group. Collectively, these studies clearly show the effectiveness and usefulness of such programmes for injury prevention purposes in adolescent sport participants. Whilst speculation can only be made until further studies are conducted, it is possible that the "The 11" would offer similar benefits to previous conditioning interventions, specifically to young players, and importantly, across the age/experience continuum.

The suitability of the "The 11" programme for children was assessed *a-priori* via discussions with medical professionals, and *post-hoc* using responses from the player questionnaires. Such a training programme could be considered suitable for junior players if it is safe, enjoyable and/or engaging, easy to perform and easy to administer. The adherence rate for completion of all exercises of 72% indicates that players were relatively committed to "The 11" programme, although comments from some participants suggest that players did not particularly enjoy it. For example, feedback highlighted that whilst participants initially found the exercises challenging, and in general beneficial, the repetitiveness of the programme resulted in a degree of boredom. This highlights the need to investigate improvements to the structure (e.g progression and variation of exercises, and individual target setting) and presentation of "The 11", which could further improve adherence and enjoyment for young players. The importance of variety and stimulation in any conditioning programme aimed at improving performance and/or preventing injuries in children should be acknowledged, to maximise adherence and enjoyment. With such modifica-

tion, it is possible that young players will be more motivated to complete such exercises on a regular basis, with and without (where appropriate) supervision, as part of their own and team training sessions. This may result in greater physical gains that are transferrable to actual competition play. Though not assessed in this study, further gains could, based on findings from previous work (Schmidt-Olsen et al., 1991; Hagglund et al., 2006; Malina et al., 2006), help reduce injury risk.

Conclusion

In conclusion, the results of this study show that "The 11", with minor modification, is an appropriate and effective tool for improving football-specific physical performance characteristics of young football players. Given adherence levels and player feedback, further adaptation/modification of the current programme may be required to fully realise the performance enhancement and potential injury prevention benefits of "The 11", via improved player adherence and enjoyment.

References

Arnason, A., Andersen, T.E., Holme, I., Engebretsen, L. and Bahr, R. (2008) Prevention of hamstring strains in elite soccer: an intervention study. *Scandanavian Journal of Medicine and Science in Sports* **18,** 40-48.

Berbig, R. (1997) Die Verletzungsgefährdung im Spitzenfußball aus der Sicht des Sporttraumatologen. *Schweizer Zeitschrift für Sportmedizin und Sporttraumatologie* **45,** 127-130. In German.

Blaser, K.U. and Aeschlimann, A. (1992) Unfallverletzungen beim Fußball. *Schweizer Zeitschrift für Sportmedizin* **40,** 7-11.

Caraffa, A., Cerulli, G., Projetti, M., Aisa, G. and Rizzo, A. (1996) Prevention of anterior cruciate ligament injuries in soccer. A prospective controlled study of proprioceptive training." Knee *Surgery Sports Traumatology Arthroscopy* **4,** 19-21.

Chamari, K., Hachana, Y., Ahmed, Y.B., Galy, O., Sghaier, F., Chatard, J.C., Hue, O. and Wisloff, U. (2004) Field and laboratory testing in young elite soccer players. *British Journal of Sports Medicine* **38,** 191-196.

Chandy, T.A. and Grana, W.A. (1985) Secondary school athletic injury in boys and girls: A three-year comparison. *Physician and Sports Medicine* **13,** 106-111.

Chimera, N.J., Swanik, K.A., Swanik, C.B. and Straub, S.J. (2004) Effects of plyometric training on muscle-activation strategies and performance in female athletes. *Journal of Athletic Training* **39,** 24-31.

Cronin, J. and McLaren, A. (1999) Functional measurement of leg extension musculature: protocols, research and clinical applications. *New Zealand Journal of Sports Medicine* **27,** 40-43.

Dollard, M.D., Pontell, D. and Hallivis, R. (2006) Preconditioning principles for preventing sports injuries in adolescents and children. *Clinics in Podiatric Medicine and Surgery* **23,** 191-207.

Dvorak, J., Junge, A., Chomiak, J., Graf-Baumann, T., Peterson, L., Rosch, D. and Hodgson, R. (2000) Risk factor analysis for injuries in football players. Possibilities for a prevention program." *American Journal of Sports Medicine* **28,** S69-74.

Ekstrand, J., Gillquist, J. and Liljedahl, S.O. (1983) Prevention of soccer injuries. Supervision by doctor and physiotherapist. *American Journal of Sports Medicine* **11,** 116-120.

Emery, C.A., Meeuwisse, W.H. and Hartmann, S.E. (2005) Evaluation of risk factors for injury in adolescent soccer: implementation and validation of an injury surveillance system. *American Journal of Sports Medicine* **33,** 1882-1891.

Frank, J.B., Jarit, G.J., Bravman, J.T. and Rosen, J.E. (2007) Lower extremity injuries in the skeletally immature athlete. *Journal of the American Academy of Orthopaedic Surgeons* **15,** 356-66.

Gabbett, T.J. (2002) Physiological characteristics of junior and senior rugby league players. *British Journal of Sports Medicine* 36, 334-339.

Hagglund, M., Walden, M. and Ekstrand, J. (2006) Previous injury as a risk factor for injury in elite football: a prospective study over two consecutive seasons. *British Journal of Sports Medicine* **40,** 767-772.

Hart, L.E., Silvers, H.J. and Mandelbaum, B.R. (2001) Preseason conditioning to prevent soccer injuries in young women. *Clinical Journal of Sport Medicine* 11, 206.

Hawkins, R.D. and Fuller, C.W. (1999) A prospective epidemiological study of injuries in four English professional football clubs. *British Journal of Sports Medicine* **33,** 196-203.

Heidt, R.S., Jr., Sweeterman, L.M., Carlonas, R.L., Traub, J.A. and Tekulve, F.X. (2000) Avoidance of soccer injuries with preseason conditioning. *American Journal of Sports Medicine* **28,** 659-662.

Hewett, T.E., Lindenfeld, T.N., Riccobene, J.V. and Noyes, F.R. (1999) The effect of neuromuscular training on the incidence of knee injury in female athletes. A prospective study. *American Journal of Sports Medicine* **27,** 699-706.

Hewett, T.E., Stroupe, A.L., Nance, T.A. and Noyes, F.R. (1996) Plyometric training in female athletes. Decreased impact forces and increased hamstring torques. *American Journal of Sports Medicine* **24,** 765-773.

Junge, A. and Dvorak, J. (2004) Soccer injuries: a review on incidence and prevention. *Sports Medicine* **34,** 929-938.

Junge, A., Rosch, D., Peterson, L., Graf-Baumann, T. and Dvorak, J. (2002) Prevention of soccer injuries: a prospective intervention study in youth amateur players. *American Journal of Sports Medicine* **30,** 652-659.

MacKay, M., Scanlan, A., Olsen, L., Reid, D., Clark, M., McKim, K. and Raina, P. (2004) Looking for the evidence: a systematic review of prevention strategies addressing sport and recreational injury among children and youth. *Journal of Science and Medicine in Sport* **7,** 58-73.

Malina, R.M., Morano, P.J., Barron, M., Miller, S.J., Cumming, S.P. and Kontos, A.P. (2006) Incidence and player risk factors for injury in youth football. *Clinical Journal of Sports Medicine* **16,** 214-222.

Mandelbaum, B.R., Silvers, H.J., Watanabe, D.S., Knarr, J.F., Thomas, S.D., Griffin, L.Y., Kirkendall, D.T. and Garrett, W., Jr. (2005) Effectiveness of a neuromuscular and proprioceptive training program in preventing anterior cruciate ligament injuries in female athletes: 2-year follow-up. *American Journal of Sports Medicine* **33,** 1003-1010.

Maulder, P. and Cronin, J. (2005) Horizontal and vertical jump assessment: reliability, symmetry, discriminative and predictive ability. *Physical Therapy in Sport* **6,** 74-82.

Myklebust, G., Engebretsen, L., Braekken, I.H., Skjolberg, A., Olsen, O. E. and Bahr, R. (2003) Prevention of anterior cruciate ligament injuries in female team handball players: a prospective intervention study over three seasons. *Clinical Journal of Sports Medicine* 13, 71-78.

Olsen, O.E., Myklebust, G., Engebretsen, L., Holme, I. and Bahr, R. (2005) Exercises to prevent lower limb injuries in youth sports: cluster randomised controlled trial. *British Medical Journal* **330,** 449.

Schmidt-Olsen, S., Jorgensen, U., Kaalund, S. and Sorensen, J. (1991) Injuries among young soccer players. *American Journal of Sports Medicine* 19, 273-275.

Spinks, A.B. and McClure, R.J. (2007) Quantifying the risk of sports injury: a systematic review of activity-specific rates for children under 16 years of age. *British Journal of Sports Medicine* **41,** 548-557.

Yde, J. and Nielsen, A.B. (1990) Sports injuries in adolescents' ball games: soccer, handball and basketball. British *Journal of Sports Medicine* **24,** 51-54.

Key points

- Children who participate in recreational and competitive sports, especially football, are susceptible to injury.
- There is a need for the design and assessment of injury prevention programmes for children.
- "The 11" improves essential physical performance characteristics and has the potential to reduce the risk of injury.
- It may be prudent to implement a 'child-friendly' version of "The 11", to enhance long-term programme adherence and to ensure progressive physical development of players as they progress from junior to senior football.

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