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Intervention for the Prevention of Football-Related Physical Performance and Ankle Sprains in Young Male Players

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Ahmed F. Farhan

Department of Physiotherapy, Faculty of Health Sciences,
UITM, Malaysia
ahmedfad2005@yahoo.com

Abstract

Ankle sprains are among the most common injuries in the physically active population. The number of injuries can be anticipated to increase because of the increasing popularity of the sport worldwide and the higher incidence of ankle injuries among young males compared with females. The prevention program (PP) has been designed to prevent the most common injury of ankle ligaments in football. The aim of this study was to investigate the effect of the ‘‘PP’’ on ankle sprains and performance after an 8-week training period. Forty-five adolescent male football players were randomly assigned to either an intervention (n=23) or a control group (n=22). The incidence of injury per 1000 hours of training and playing soccer was 7.3 in the intervention group and 9.2 in the control group, which equates to 23% fewer injuries in the intervention group. In conclusion, the ankle injuries can be reduced by preventive interventions, especially ankle ligaments. In addition, effects was observed on a series of performance tests in a group of adolescent male football players using the ‘‘PP’’ as a structured warm-up program.

Keywords: Ankle sprains, performance, football players, young males, prevention program.

1. Introduction

Football is probably the most popular sport worldwide, with a growing interest and an increasing number of young male players in particular (FIFA, 2006). It is a contact sport and challenges physical fitness by requiring a variety of skills at different intensities. Running is the predominant activity, and explosive efforts during sprints, duels, jumps and kicks are important performance factors, requiring maximal strength and anaerobic power of the neuromuscular system (Reilly & Gilbourne, 2003; Hoff & Helgerud, 2004; Steffen et al., 2008). Unfortunately, the game is associated with a high risk of injuries, which results in significant costs for the public health system (De Loes et al., 2000) and may even cause long-term disability for the injured player (Myklebust & Bahr, 2005).

Ankle sprains are among the most common injuries in the physically active population (Fong et al., 2007; Anandacoomarasamy and Barnsley, 2005). It is estimated that 23,000 ankle sprains occur daily in the United States, which translates to about 1 sprain per 10,000 people every day (Kannus and Renstrom, 1991). The primary predisposing factor to suffering an ankle sprain is a history of previous sprains (Beynnon et al., 2002). Although ankle sprains often are viewed as mild injuries, they represent a significant public health problem (Soboroff et al., 1984; Verhagen et al., 1995). It has been estimated that sprains to the ankle/foot account for 1.6 million physician office visits and over 8000 hospitalizations per year (Praemer et al., 1999).

Approximately 30% of those who suffer a first-time ankle sprain develop chronic ankle instability (CAI); however this rate has been reported as high as 70% (Smith and Reischl, 1986; Peters et al., 1991). Residual symptoms of ankle sprains can alter the health of individuals who suffer from recurrent instability significantly, causing them to become less active over the life span (McHugh et al., 2007). At the high school level, ankle sprains are the most common injury suffered out of all lower extremity injuries (Fernandez et al., 2007). The highest prevalence of ankle sprains was in boys' and girls' basketball and soccer, boys' football, and girls' volleyball (Nelson et al., 2007).

According to Injury Surveillance System data from the National Collegiate Athletic Association, ankle sprain was the most common injury in men's and women's basketball (Dick et al., 2007; Agel et al., 2007), men's and women's soccer (Agel et al., 2007; Dick et al., 2007), women's volleyball (Agel et al., 2007), and the second most common injury in men's football (Dick et al., 2007). In addition, ankle injuries have been reported to be a major cause of early development of osteoarthritis (Drawer and Fuller, 2001; Saltzman et al., 2005). Based on this information, ankle instability represents a major obstacle to the health and well-being of the physically active within the United States.

Although there has been considerable research on risk factors associated with ankle sprains (Beynnon et al., 2002), there is not a clear consensus on the most appropriate intervention strategies to prevent them. The epidemiological evaluation of risk and the identification of risk factors establish the contributing causes of this major problem. The development and implementation of prevention programs that alter identified risk factors and the systematic evaluation of the efficacy of those interventions are essential in the direction towards problem resolution (van Mechelen et al., 1992). We hypothesized that an intervention program that was specifically designed to improve physical performance would reduce the incidence of ankle injuries among male soccer players aged 10 to 11 years. The exercise portion was designed to be soccer-specific and easy to include during regular practice sessions at no cost.

2. Methodology

2.1 Participant

Forty-five boys (mean ±SD: age 10.7 ± 1.3 yr; body mass: 37.1 ± 4.2 kg; stature: 1.35 ± 0.13 m) from local football school in Iraq, with 3.9 ± 1.4 years playing experience, participated. Players were randomly assigned to either an experimental (EXP, n = 23) or a control (CON, n = 22) group. Participant and parental informed consent was obtained prior to participation, and all participants completed a customised pre-exercise medical questionnaire.

2.2 Physical tests

Before the start of the intervention period and 1 week after the end of the intervention, the players took part in a testing procedure to assess the performance effects of the ‘‘PP’’. Participants performed the following tests, before and after an 8 week intervention: 1) vertical jump height (measure leg power); 2) horizontal jump (measure coordination and explosive leg power); 3) prone hold (measure core stability); 4) 20 metre sprint (measure speed) and 5) the Illinois agility test (measure football-specific agility). Some of which are commonly used in the monitoring of football players (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 (16:00 ± 0.8hrs), in the same indoor venue.

2.3 The intervention program

The prevention program, the ‘‘PP,’’ was designed as a warm-up program. The exercises were chosen based on previous research on injury prevention. The 17-min program includes 13 exercises focusing on core stability, hamstrings strength and agility. Players were instructed to perform the exercises 3 times per week (on separate days) for 8 weeks. To facilitate understanding, compliance, ongoing safety and correct execution, full instruction in the technique of each exercise was provided to participants, coaches in week 1. 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.

2.4 Statistical analysis

Means ± SD were calculated for all measures. A statistical software package (SPSS v19, 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 $p \leq 0.05$.

3. Results and Discussion

The pre- and post-intervention results for both groups are presented in Table 1. Measures of leg power (horizontal jump and vertical jump height) increased significantly [4.1% ($p < 0.05$) and 5.9% ($p < 0.01$) respectively] in EXP, but not CON. Similarly, speed over 20 m improved by 3.6% ($p < 0.01$). Whilst there was a tendency for both agility and core stability to improve in EXP (-2.2 ± 3.1% and 46.8 ± 15.6% respectively), this was not significant when compared to changes in the CON group. The incidence of injury per 1000 hours of training and playing soccer was 7.3 in the intervention group and 9.2 in the control group, which equates to 23% fewer injuries in the intervention group Figure 1.

Table (1)
Pre- and post-intervention data, and percent changes, for all measures in both the EXP and CON group. Values are mean (± SD)

Variables	EXP (n = 23)			CON (n = 22)			P value
	Pre	Post	Δ%	Pre	Post	Δ%	
Vertical jump height (m)	.32 (.17)	.34 (.11)	5.9 (3.1)	.33 (.17)	.33 (.04)	-.1 (.2)	.001
Horizontal jump (m)	4.36 (.51)	4.82 (.28)	4.1 (2.3)	4.54 (.23)	4.53 (.23)	.1 (1.7)	.004
Agility (s)	15.69 (.72)	14.31 (.41)	-2.2 (3.1)	15.56 (.48)	15.68 (.17)	.7 (2.5)	.031
Core stability (s)	47.3(12.6)	69.8 (13.5)	46.8 (15.6)	41.1 (19.2)	42.5 (17.1)	1.3 (14.3)	.026
20m sprint (s)	3.82 (.41)	3.47 (.23)	-3.6 (4.3)	3.69 (2.5)	3.92 (5.6)	2.8 (7.3)	.009

Δ = change.

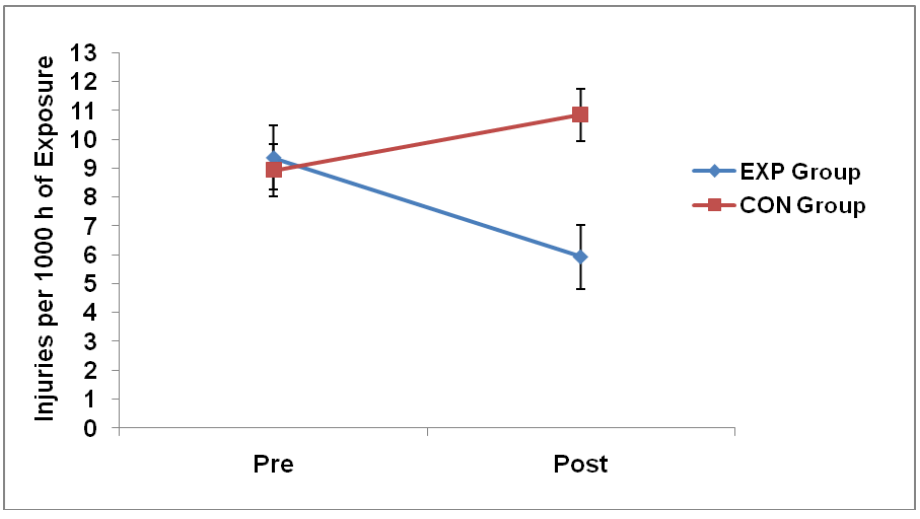

Figure 1. Comparison of injury rates between the EXP and CON groups

Performance of "PP" resulted in significant changes in several of the physical performance abilities assessed. The largest improvement was observed for vertical jump height (EXP = 5.9 ± 2.3%; CON = -0.21 ± 0.3%, $p < 0.05$). In football, leg power would likely be associated with improved jumping and sprinting ability on the field. However, it may also serve to reduce the risk of ankle, knee and other lower limb injuries (Chandy and Grana, 1985). In the current study, the exercises were used as a warm-up program, and we therefore limited the duration of the whole program to 17 min. This restricted the ability to increase the number of repetitions substantially and the progression of the training stimulus was clearly lower than Askling et al. (2003).

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 exercise component of our program focuses on motor skills and body control.

The training program stressed technique perfection for each exercise. Preventive programs in other injury-prone sports were also effective when all these factors were included (Aaltonen et al., 2007; Olsen et al., 2005). In a cluster randomized study of female floor ball players (mean age, 24 years), noncontact injuries to the legs but not to the knees were reduced by a multifactor training program (Pasanen et al., 2008). A similar cluster randomized trial in handball players (mainly girls aged 15-17 years) demonstrated an 80% reduction of acute knee ligament injuries (rate ratio, 0.20; 95% CI, 0.06-0.70) (Olsen et al., 2005). No previous soccer-specific preventive programs have included all components deemed important for successful results (Renström et al., 2008). Preventive programs including some of these components yielded conflicting results. A neuromuscular and proprioceptive training program in a cohort study of female soccer players aged 14 to 18 years reduced the ACL injury incidence by 88% during the first year and by 74% during the second year (Mandelbaum et al., 2005).

Despite the evidence to support conservative functional treatment of ankle sprains, the recurrence of ankle instability after initial sprain and the propensity for developing post-traumatic osteoarthritis (Drawer and Fuller, 2001; Saltzman et al., 2005), are noteworthy. From the structural framework of the ICF model and the evidence presented previously, it is apparent that the application of external support and the implementation of balance training programs have a positive influence at the activity limitations and participation restrictions in those with ankle instability. The structural and functional changes associated with these improvements that occur with these interventions remain unclear. Based on a review of evidence, Struijs and Kerkhoffs, (2006) found that functional treatment was the superior approach for reducing the sequelae of ankle sprain such as recurrent instability, pain, and significant time loss from work or sport.

Football players with a previous ankle injury are at a several- fold higher risk of reinjury (Steffen et al., 2008). Therefore, all injured players were asked about previous injuries, and only new ankle injuries were included in our analyses. Teams participating in the present study could be more prone to work in a preventive manner with ankle injuries. If teams in the control group did engage in preventive training, it was not identical to our intervention program, which is not yet publicly available. Any training causing protective effects among controls would result in weaker estimates for the effect of our preventive program.

4. Conclusion

The prevention program focused on improvement of physical performance and reduces ankle sprains. Significant effects were observed on different performance variables among adolescent male football players participating in an 8-week injury prevention program, compared with players who trained as usual. Participation in the program reduced the incidence of ankle injury by 23%. Players need better education regarding injury prevention strategies and should include such interventions as a part of their regular training program.

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