

structured according to the FIFA 11+ program which is already being successfully used to prevent injuries.

**Objective** To investigate the effectiveness of the FIFA 11+S in reducing the incidence of upper extremity injuries

**Design** Randomised controlled trial.

**Setting** Amateur soccer.

**Patients (or Participants)** Male goalkeepers aged 14 to 35 years were randomly assigned to the experimental group (n = 360) or the control group (n = 366).

**Interventions (or Assessment of Risk Factors)** Experimental groups performed FIFA 11+S exercises for 20–25 minutes. The control group practiced their usual warm up.

**Main Outcome Measurements** The incidence of upper extremity injuries, mechanism, type and severity of injury.

**Results** During one season, 50 injuries (0.62 injuries/1000 exposure hours) were reported in the experimental group and 122 injuries were reported in the control group (1.94 injuries/1000 hours). The FIFA 11+S significantly reduced the total number of upper extremity injuries (RR = 0.42 [0.31–0.56];  $p < 0.00001$ ; Number Needed to Treat = 5.1), the incidence of contact injury (RR = 0.39 [0.27–0.55];  $p < 0.00001$ ), the incidence of initial injury (RR = 0.43 [0.31–0.59];  $p < 0.00001$ ) and the incidence of recurrent injury (RR = 0.32 [0.12–0.86];  $p < 0.05$ ) more than the usual warm up. Minor injury severity (RR = 0.41 [0.29–0.58];  $p < 0.00001$ ) and moderate injury severity (RR = 0.44 [0.20–0.94];  $p < 0.05$ ) were significantly reduced in the experimental group (FIFA 11+S) compared to the control group.

**Conclusions** This is the first study investigating the effectiveness of the FIFA 11+S in reducing the incidence of upper extremity injuries. This randomised trial provides evidence that implementation of the FIFA 11+S can reduce the incidence of upper extremity injuries among goalkeepers more than usual warm-up.

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**THE FÉDÉRATION INTERNATIONALE DE FOOTBALL ASSOCIATION (FIFA) 11+ REFEREES INJURY PREVENTION PROGRAM: AWARENESS, IMPLEMENTATION AND OPINION OF WORLDWIDE SOCCER REFEREES AND ASSISTANT REFEREES**

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**Background** Soccer referees and assistant referees have a significant risk of injury, particularly to the lower extremity. A growing body of research supports the use of injury prevention programs to prevent such injuries, yet participation rates in these programs by soccer referees and assistant referees remains largely unexplored.

**Objective** To assess soccer referees and assistant referees' awareness, implementation and opinion of the Fédération Internationale de Football Association (FIFA)11+ referees injury prevention program.

**Design** A cross-sectional study.

**Setting** An online survey for all continental football federations.

**Patients (or Participants)** A total of 727 soccer referees and assistant referees completed the survey.

**Interventions (or Assessment of Risk Factors)** The questionnaire consisted of questions relating to the awareness level, implementation rate, and opinion of the FIFA 11+ referees injury prevention program. Questions development was guided by several authors whose expertise is in sport medicine and injury prevention.

**Main Outcome Measurements** The primary outcomes were awareness level, implementation rate, and opinion of the effectiveness of the FIFA 11+ referees injury prevention program in reducing injuries.

**Results** A total of 234 (32.2%) participants reported awareness of the FIFA 11+ referees injury prevention program and 208 (28.6%) reported implementing the FIFA 11+ referees injury prevention program in their current practice. Participants who implemented the FIFA 11+ referees injury prevention program reported a positive attitude towards the program efficacy, with a score of 7.5 ± 1.3 out of 10.

**Conclusions** In order to increase the awareness and implementation of the FIFA 11+ referees injury prevention program, the football federations should focus on improving referees and assistant referees education, courses that emphasize injury prevention programs should be mandatory for all soccer referees, soccer assistant referees, and their coaches.

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**THE FÉDÉRATION INTERNATIONALE DE FOOTBALL ASSOCIATION (FIFA) 11+ SHOULDER INJURY PREVENTION PROGRAM: AWARENESS, IMPLEMENTATION AND OPINION OF WORLDWIDE SOCCER GOALKEEPERS AND GOALKEEPERS' COACHES**

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**Background** Soccer goalkeepers are more likely than outfield players to injure their upper extremity. The Fédération Internationale de Football Association (FIFA)11+ Shoulder injury prevention program (FIFA 11+S) was developed to prevent upper extremity injuries.

**Objective** To assess soccer goalkeepers and goalkeepers' coaches' awareness, implementation, and opinion about the FIFA 11+S injury prevention program.

**Design** Cross-sectional study.

**Setting** An online survey for all continental football federations.

**Patients (or Participants)** A total of 722 goalkeepers and goalkeepers' coaches completed the survey.

**Interventions (or Assessment of Risk Factors)** The questionnaire consisted of questions covering the awareness, implementation, and goalkeepers and goalkeepers' coaches' opinion of the FIFA 11+S injury prevention program. Questions development was guided by several authors expert in sport medicine and injury prevention programs.

**Main Outcome Measurements** The primary outcomes were awareness level, implementation rate, and opinion of the

effectiveness of the FIFA 11+S injury prevention program in reducing upper extremity injuries.

**Results** The vast majority (97.60%) of the participants were goalkeepers. A total of 204 (28.25%) of the participants were aware of the FIFA 11+S injury prevention program, 155 (21.46%) were implementing the FIFA 11+S injury prevention program in their current practice. Participants who implemented the FIFA 11+S injury prevention program reported a positive opinion about the program efficacy, with a score of  $8.19 \pm 0.93$  out of 10.

**Conclusions** The awareness level was low, but the implementation rate among aware participants was acceptable. Goalkeepers and coaches reported a positive score regarding the effectiveness of the FIFA 11+S injury prevention program in reducing upper extremity injuries.

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### INCREASED ACUTE EXPOSURE TO SOCCER BALL HEADING SHOWS NO RESPONSE FROM BIOCHEMICAL MARKERS FOR AXONAL INJURY

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**Background** There is limited research quantifying the response of biochemical markers for axonal injury to an acute bout of soccer heading, especially when individual impact biomechanics are considered, and overall heading dose manipulated.

**Objective** To investigate if individual impact biomechanics or different heading doses affect the reaction of serum neurofilament light (NF-L).

**Design** Randomized control trial.

**Setting** Laboratory study.

**Participants** Forty-four male university students with no history of head injury and currently not active in head-impact sports, randomly split into a control group (n=8), 10 (n=12), 20 (n=12) or 40-header group (n=12).

**Interventions (or Assessment of Risk Factors)** Blood samples were taken at baseline, then six hours, 24-hours and 7-days post heading. After baseline samples, participants completed either 10, 20 or 40 headers whilst impact biomechanics were quantified using a three-dimensional motion capture system sampling at 1000Hz. NF-L was quantified using Quanterix NF-L assay kit on the Simoa HD-1 Platform.

**Main Outcome Measurements** NF-L concentrations, cumulative linear and cumulative angular head acceleration. For NF-L concentrations, time, group and interaction effects were assessed via mixed-effects ANOVA. The relationship between cumulative linear and angular head accelerations and percentage change in NF-L across timepoints was assessed via Pearson product moment correlations.

**Results** There were no significant time, group or interaction effects for NF-L. There was no significant relationships between cumulative linear or angular head accelerations and percentage change of NF-L at any timepoint. At 6hrs, 24hr and 7-days post heading, control group showed 61.8%, 41.7% and 30% NF-L change from baseline respectively; 10

header group 30%, -0.6% and 15.2% change respectively, 20 header group -2.6%, -3.2% and 7.4% change respectively, and 40 header group 18.6%, 33.5% and 29.6% change respectively. Large inter-individual variation in NF-L response was observed.

**Conclusions** Individual impact biomechanics or increasing heading doses did not effect NF-L response. Further study is required to evaluate chronic loading effects of heading that also considers individual impact biomechanics.

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### ABSTRACT WITHDRAWN

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### THE EFFECT OF A 90-MIN SOCCER MATCH AND FATIGUE ON ECCENTRIC HAMSTRING STRENGTH: IMPLICATIONS FOR HAMSTRING INJURY RISK

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**Background** Hamstring injury (HI) is the most prevalent muscle injury in both amateur (van Beijsterveldt et al., 2015) and professional (Ekstrand et al., 2011; Hawkins et al., 2001) soccer (football) players. Worryingly, the annual incidence of HI increased by 2.4% annually between 2010 and 2014 (Ekstrand et al., 2016)

**Setting** Professional football.

**Patients (or Participants)** Twenty-two semi-professional football players (Mean  $\pm$  SD: Age:  $19.3 \pm 2.9$  year; Height  $185.0 \pm 8.7$  cm; Body Mass  $81.6 \pm 6.7$  kg) participated in this study.

**Design** All players were right dominant (defined as their preferred 'kicking' leg). Subjects were included in the study if they were not injured or rehabilitating from an injury at the time of testing.

**Main Outcome Measurements** The eccentric hamstring strength of players was examined using the Nordbord (Vald Performance, Queensland, Australia) device prior to soccer match and immediately following 90 minutes of football friendly match. The season period of the research project was the second half of the season.

**Results** There was a significant difference of moderate effect in eccentric strength before a match (M = 306.91, SD = 59.26) compared and to after the match (mean =  $277.77 \pm 60.35$  p = .000, Cohen's d = .50) (table 1). The eccentric force before training (mean =  $306.91 \pm 59.26$ ) and after training (M =  $277.77$ , SD = 60.35 demonstrated a significant moderate effect (p = .000, Cohen's d = .50).

**Conclusions** Etiological risk factors attributed to an increased risk of muscular injury include poor muscular strength, particularly eccentric strength deficits, and ipsilateral muscular strength imbalances. Resistance to fatigue and eccentric strength, particularly at high speeds should be given greater consideration in conditioning for soccer. The small number of participants limits the global generalization of our findings. However, this limitation is tempered by the inclusion of professional players in our study.