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There are more football injury prevention reviews than randomized controlled trials. Time for more RCT action!

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INTRODUCTION

Football is the most popular sport worldwide and participation in football at any level is associated with numerous health benefits.¹ However, participation in football at any level incurs a risk of sustaining musculoskeletal injuries.^{2,3} Effective injury prevention strategies are needed.

The first formal injury prevention randomised controlled trial (RCT) in football was published in 1983.⁴ We performed a scoping systematic review to provide an overview of the published articles on injury prevention in football.

METHODS

A study protocol is available online at http://findresearcher.sdu.dk/portal/files/134191319/Protocol_scoping_revire_PURE.pdf. Although, we primarily focused on RCTs, we also included systematic reviews, and other studies investigating injury prevention strategies/interventions in football regardless of participant age, sex and level of participation.

RESULTS

Our literature search identified 3131 studies, with 98 studies being included after removal of those studies that did not satisfy the inclusion criteria (Supplementary figure A). Reviews were the type of study most often published (43%), followed by RCTs (35%), cohort studies (20%), and surveys (2%) (Supplementary figure B). Of the reviews 55% were narrative and 43% were systematic, of which 47% pooled data in the form of a meta-analysis.

When we assessed the RCTs, exercise-based injury prevention interventions were used in 29 out of 34 studies, of which 18 included warm-up exercises, 9 strength training exercises, and 5 balance training exercises. The populations included in exercise-based injury prevention studies were; children (age 8 to 12 years) in one study, adolescents (age 13 to 17 years) in 11 studies and adults (≥ 18 years old) in 12 studies. Five studies included both adolescent and adult players. Non-elite players were included in 21 studies (10 on male players only, 7 on female players only, 3 on male and female players, and finally 1 did not report the sex of players). Elite players were included in 7 studies (6 on male players only, and 1 on male and female players). One study included both elite and non-elite male players. For an expanded overview see Figure 1 and Supplementary table 1.

DISCUSSION

Regarding the types of studies published on injury prevention in football, there were more reviews than RCTs. Furthermore, the RCTs included heterogenous cohorts, interventions and settings all of which could affect implementation in otherwise homogenous groups of footballers. To our surprise, elite adolescent female players have only been included in one RCT so far. This is alarming as elite adolescent female players have greater risk of overall injuries than elite adult female players ([RR] 1.7; 95% CI (1.3 to 2.3)).⁵ To reduce the musculoskeletal injury burden in football, RCTs are needed to test injury prevention strategies in different populations and settings. As an example, the prevalence of ACL injuries amongst non-elite adolescent female football players is very low (<0.5% of all players),⁶ whereas the prevalence of these injuries amongst elite adolescent female football players exceeds 10% of players.⁵ This highlights an important issue; the majority of studies investigating the efficacy of injury prevention interventions in female football players have not been undertaken on those players with the highest risk of serious injury. We therefore urge the football research community and funders to increase their focus on RCTs, and demand that the target is set on high risk cohorts.

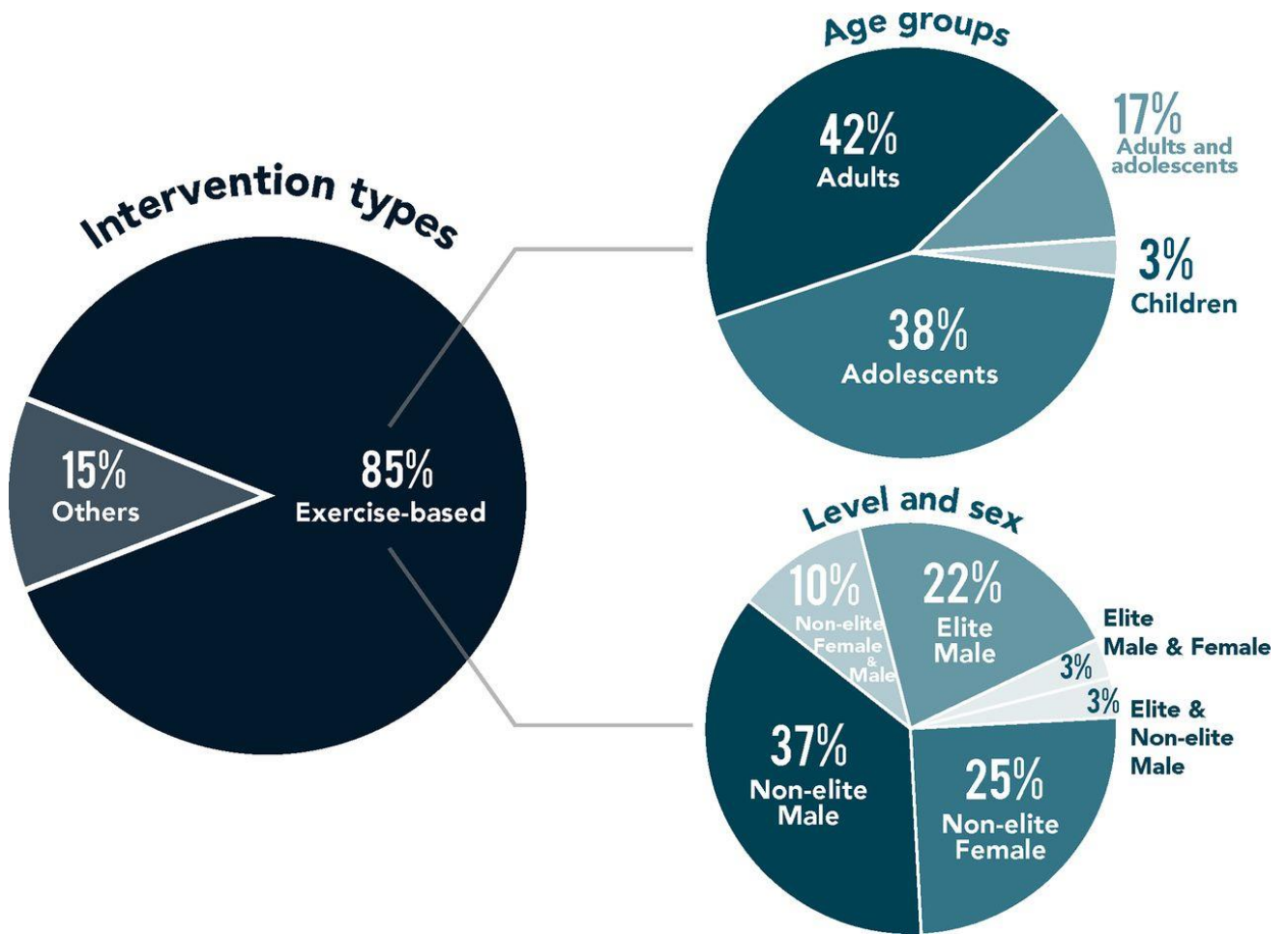
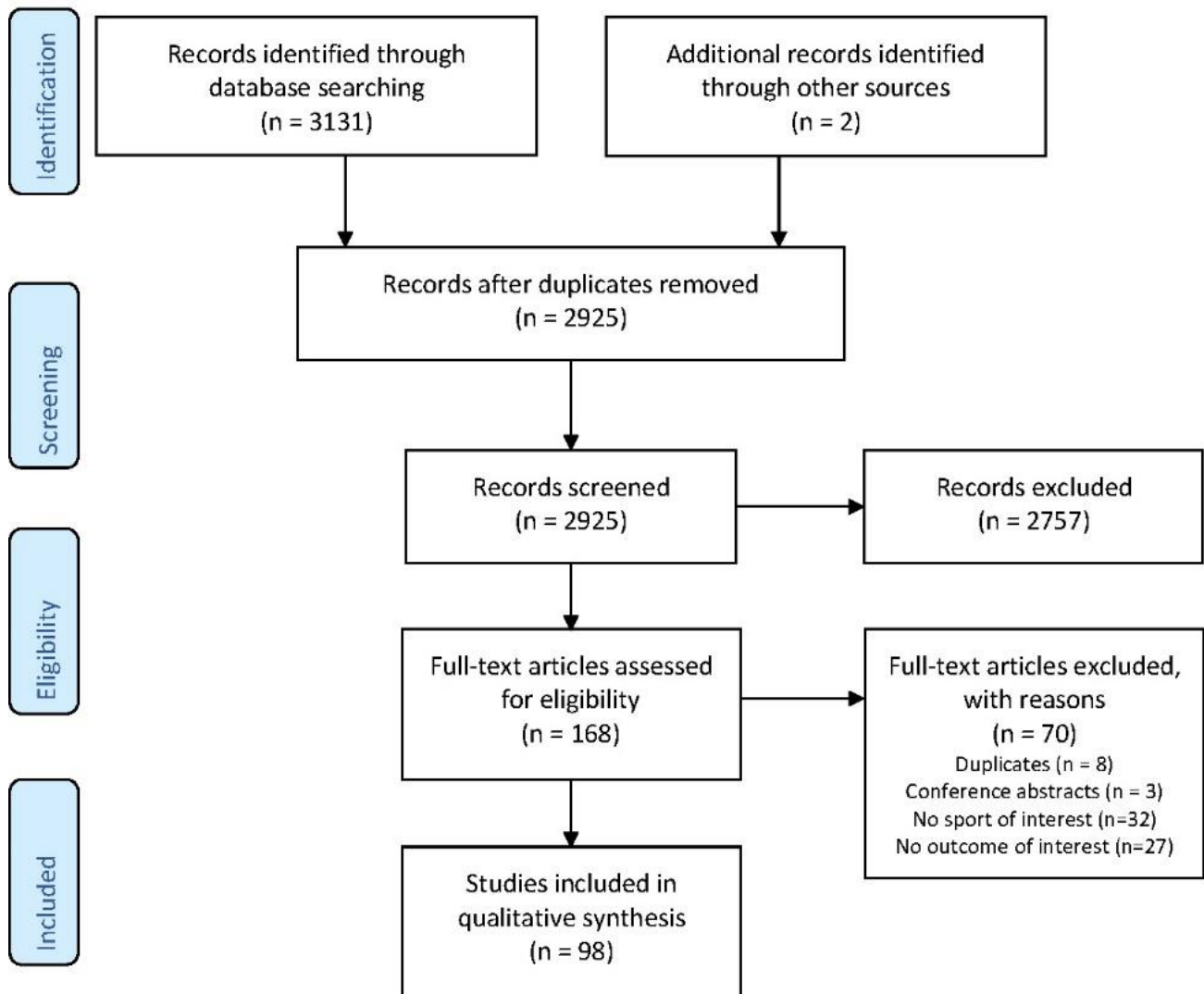
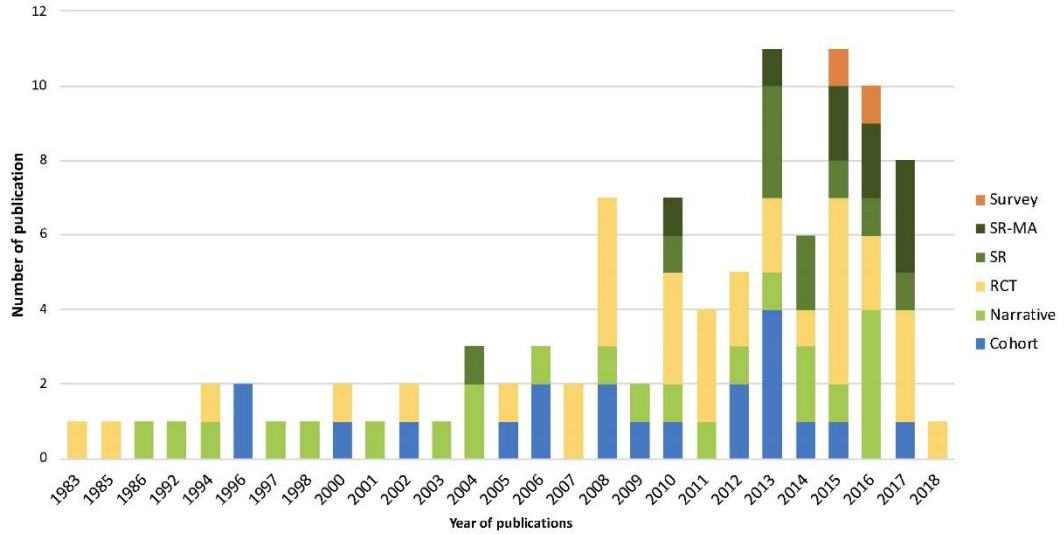


FIGURE 1. **Injury prevention randomized controlled trials in football: an overview.** Children=football players from 8 to 12 years old; adolescents=football players from 13 to 17 years old; adults=football players with ≥ 18 years old.



Supplementary Figure A. Flow chart of the included studies.

Supplementary Figure B. Historical graph reporting the number of publications investigating injury preventive strategies from 1983 to March 2018, stratified by publication type. SR=systematic review; MA=meta-analysis; RCT=randomized controlled trial.



Supplementary Figure B. Historical graph reporting the number of publications investigating injury preventive strategies from 1983 to March 2018, stratified by publication type. SR=systematic review; MA=meta-analysis; RCT=randomized controlled trial.

Supplementary Table 1. Randomized controlled trials characteristics. M=Male, F=Female.

Author and year ^(ref)	Country	Football players characteristics	Mean age or range (year)	Sex	Intervention	Control	Injury targeted	Injuries prevented
Ekstrand et al. (1983) ¹	Sweden	Non-elite adolescents and adults in the Div. IV Norra Östergötland	17 to 38	M	Multimodal including neuromuscular exercise, equipment and taping	Usual training	Any injury	Overall rate of any injury
Tropp et al. (1985) ²	Sweden	Non-elite adults in the Swedish national league division VI	-	M	Balance training or orthosis (Sport-Stirrup)	Usual training	Ankle sprains	Ankle sprain
Surve et al. (1994) ³	South Africa	Non-elite adults in the 4 divisions in the Western Province of South Africa	-	M	Brace (Sport-Stirrup orthosis)	Usual training	Ankle sprains	Ankle sprain
Söderman et al. (2000) ⁴	Sweden	Non-elite adults in the second and third Swedish divisions	20	F	Exercise (Balance board training)	Usual training	Traumatic injuries of the lower extremities	None
Arnason et al. (2005) ⁵	Island	Elite adults in the top 2 divisions in Iceland	-	M	Video-based awareness	Usual training	Acute injuries	None
McGuine and Keene (2006) ^{*6}	USA	Non-elite adolescents in high schools	16	M&F	Exercise (Balance board training)	Usual training	Incidence and severity of lower extremity injuries	Acute ankle injuries
Hägglund et al. (2007) ⁷	Sweden	Non-elite adolescents and adults in the 24 fourth-division team in Östergötland	15 to 46	M	Exercise (Ten-step rehabilitation program)	Usual training	Re-injuries	Overall rate of injury
Mohammadi (2007) ⁸	Iran	Elite adults in the first division of a men's league in Iran	24.6	M	Exercise (Proprioception or strength training or orthosis)	Usual training	Ankle sprains	Ankle sprains

Engebretsen et al. (2008) ⁹	Norway	Elite adults in the Norwegian 1st, 2nd, or the top of the 3rd division	-	M	Exercise (Balance and Nordic hamstring)	Usual training	Ankle, knee, hamstring and groin	None
Fredberg et al. (2008) ¹⁰	Denmark	Elite adolescents and adults in The Danish Super League	17 to 37	M	Exercise (eccentric training and stretching program)	Usual training	Achilles and patellar tendons	None
Gilchrist et al. (2008) ¹¹	USA	Non-elite adults in the National Collegiate Athletic Association Division I	20	F	Exercise (PEP Program)	Usual training	Non-contact ACL injuries	Non-contact ACL injuries
Steffen et al. (2008) ¹²	Norway	Non-elite adolescents in the southeast regions of Norway that registered to participate in the Under-17 league system	15.4	F	Exercise ('The 11+')	Usual training	Any injury	None
Emery and Meeuwisse (2010) ¹³	Canada	Non-elite adolescents in the Calgary Minor Soccer Association Club	13 to 18	M&F	Exercise (Neuromuscular warm-up)	Usual training	Any injury	Overall rate of injury
Hölmich et al. (2010) ¹⁴	Denmark	Non-elite adults in the Danish series 1–3	24	M	Exercise (Strength, coordination and core exercise)	Usual training	Groin injury	None
Soligard et al. (2008) ¹⁵	Norway	Non-elite adolescents in the 5-16 year divisions from the south, east, and middle of Norway	13 to 17	F	Exercise ('The 11+')	Usual training	Lower extremity injury	Overall rate of injury, overuse injuries, and severe injuries
LaBella et al. (2011) ^{*16}	USA	Non-elite adolescents in the Chicago public high schools	16.2	M&F	Exercise (KIPP: Knee Injury Prevention Program)	Usual training	Lower extremity injury	Gradual onset, acute onset and ankle sprains

Owoeye et al. (2014) ¹⁷	Nigeria	Elite adolescents in the Premier League division of the Lagos Junior League (LJL)	17.8	M	Exercise ('The 11+')	Usual training	Any injury, injuries by type of exposure and injuries specific to the lower extremities	Overall rate of injury and lower extremities injuries
Petersen et al. (2011) ¹⁸	Denmark	Elite and non-elite adult in the Danish football leagues	23	M	Exercise (Nordic hamstring)	Usual training	Hamstring injuries	Overall, new, and recurrent hamstring injuries
van Beijsterveldt et al. (2012) ¹⁹	Holland	Non-elite adults in high level amateur teams	24	M	Exercise ('The 11+')	Usual training	Injury incidence and severity	None
Waldén et al. (2012) ²⁰	Sweden	Non-elite adolescents U-14 to U-18 series in Swedish Football Association	12 to 17	F	Exercise (Neuromuscular warm-up)	Usual training	Acute knee injury (i.e. ACL)	ACL injuries
Asklings et al. (2013) ²¹	Sweden	Elite adults in the elite football leagues in Sweden	15 to 37	M&F	Exercise (Strength training rehab program)	Strength training rehab program	Re-injures	None between groups
Steffen et al. (2013) ²²	Canada	Non-elite adolescents in the Calgary and Edmonton Minor Football Associations or the Edmonton Interdistrict YouthFootball Association	13 to 18	F	Exercise ('The 11+')	The 11+ with physiotherapists attention	All injuries and lower extremities injuries	None between groups
Silvers-Granelli et al. (2015) ²³	USA	Non-elite adults in the Division I and Division II of the NCAA	21	M	Exercise ('The 11+')	Usual training	Overall number of ACL injuries	Total injuries and knee injuries
de Hoyo et al. (2015) ²⁴	Spain	Elite adolescents and adults in Spain	16 to 18	M	Exercise (Eccentric-Overload Training Program)	Usual training	Muscle injury incidence and severity	Muscle-injury incidence

								and severity
Hammes et al. (2015) ²⁵	Germany	Non-elite adults in veteran football teams in the county Saarland	45	M	Exercise ('The 11+')	Usual training	Injury incidence	Severe injuries
Horst et al. (2015) ²⁶	Holland	Non-elite adults in the Dutch high-level amateur soccer leagues	25	M	Exercise (Nordic hamstring exercise)	Usual training	Incidence and severity of hamstring injuries	Hamstring injury incidence
Ivarsson et al. (2015) ²⁷	Sweden	Elite adolescent football players in Sweden	16 to 17	M&F	Psychological (Mindful-based program)	Sport psychology presentations with a particular focus on soccer	Any injury	None
Zakaria et al. (2015) ²⁸	USA	Non-elite adolescent high school players	Up to 18	M&F	Stretching (Dynamic stretching protocol)	Dynamic and static stretching protocol	Lower-extremity, core, and low-back injuries	None
Ammendolia et al. (2016) ²⁹	Italy	Non-elite adults (division not specified)	-	M	Multimodal (Ankle taping + neuromuscular exercise)	Neuromuscular exercise	Ankle sprains	Ankle sprain incidence
Zouita et al. (2016) ³⁰	Tunisia	Elite adolescents in a player development program in Tunisia	13 to 14	M	Exercise (Strength training + nutritional guidelines)	Nutritional guidelines	Overall injury incidence	Overall injury incidence
Al Attar et al. (2017) ³¹	Australia	Non-elite adolescents and adults in the Amateur Premier Leagues and State League in New South Wales, Australia	14 to 35	M	Exercise ('The 11+')	The 11+ pre- and post-training	Overall injury incidence	Overall rate of injury

Olmedilla-Zafra et al. (2017) ³²	Spain	Elite adolescents in the National youth league in Spain	17.5	M	Psychological (stress management program)	Usual training	1) increasing its acceptance by coaches and players; 2) extending its adoption by including the program's modules as a part of the regular training routines; 3) improving compliance using an individually-based follow up of goals and achievements.	Overall injury incidence
Rössler et al. (2017) ³³	Switzerland	Non-elite children from Switzerland, Germany, the Czech Republic and the Netherlands	8 to 12	-	Exercise ('11+ Kids')	Usual training	Overall injury incidence	Overall injury incidence
Foss et al. (2018) ^{*34}	USA	Non-elite adolescents and middle school players in USA	14	F	Exercise (Neuromuscular warm-up)	Sham training (running using elastic bands)	Injury incidence	None between groups

*=Included other sports besides football

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