

High Performance Development Plan to Decrease the Prevalence of Lower-Body Non-Contact Injuries in Under-15 Elite Male Academy Football Players

Eoin Collins • MSc Performance Coaching



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1 ABSTRACT

As previous muscle injury is the greatest predictor of future injury, **preventing initial occurrence is crucial**. The U15 age category has the **highest frequency of severe injuries** of all age groups within the academy pathway. While considered somewhat preventable, **the prevalence of lower-body non-contact injuries in elite U15 male footballers continues to rise**, despite advanced training methodologies, diagnostics and therapies. This paper investigates injury prevention within this population from a holistic perspective, exploring common contributors to injury risk, and ways in which they may be reduced.

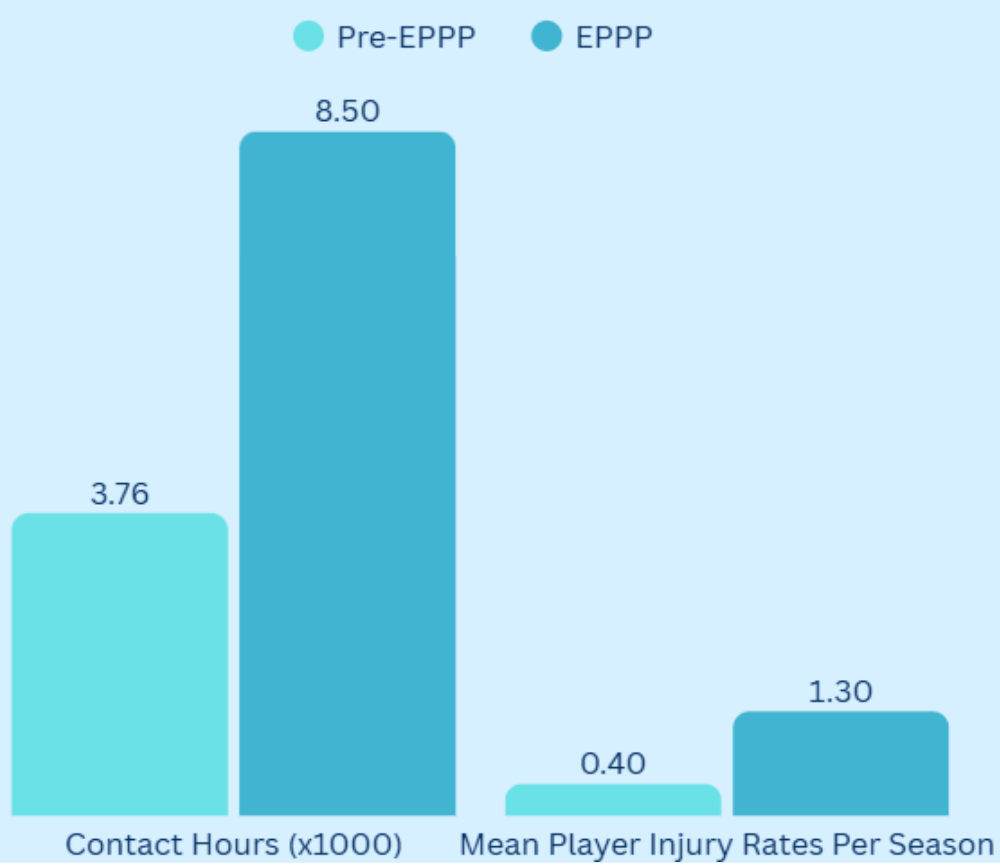
2 INTRODUCTION

- Professional football clubs invest significant time, expertise and finances into their academies, tasked with recruiting and developing youth players. These players undertake specialised training in preparation for the increasing demands of senior level football. Remaining injury free increases the athlete's likelihood of progressing through the academy pathway into professional play. However, **these academy programmes have been associated with significant injury risk**.
- Adolescence is a sensitive stage in a footballer's career, with injury potentially disrupting development, mental health and sporting ambitions. Injury risk among adolescent footballers is greater than that of their professional counterparts, with frequencies of 2.0-19.4 and 2.48-9.4 per 1,000 hours of play, respectively. With 40% of players expected to sustain one per season, **muscle injuries are the most prevalent injuries in youth football**. These injuries commonly affect the lower extremities, specifically the quadriceps, hamstrings, calves and groin muscles.
- Properly implemented Injury Prevention Programmes (IPPs) targeting modifiable injury risk factors, such as training workload, muscular strength, interlimb strength imbalances and flexibility, have **reduced injury risk by 50%** in youth footballers. However, common barriers to IPP use include non-sport-specific activities, a lack of transferability to other settings and time-consumption during training. It is recommended that these programmes are modified to address barriers and increase their implementation.

3 LITERATURE REVIEW

Elite Player Performance Plan (EPPP)

- Academy football in the United Kingdom has been greatly influenced by the EPPP since its inception in 2011.
- The EPPP **increased on-pitch accumulated coaching hours from 3,760 to 8,500** for academy clubs in the highest classification categories.
- Injury rates have increased alongside this change in training exposure, suggesting it is a contributing factor



Early Sport Specialisation

- The high levels of physical and psychological stress that specialised sport places on youth athletes can result in increased injury risk.
- A lack of variety in movement patterns inhibits the development of movement related skills**.
- The contact hours outlined in the EPPP refer only to on-pitch training and competition, excluding other aspects of complementary athletic development.
- During the ages of 12-16, an increase to 16 hours of football specific training is outlined in the EPPP. This is concerning for U15 players, as athletes who perform more weekly training hours than their age in years have increased risk of injury.

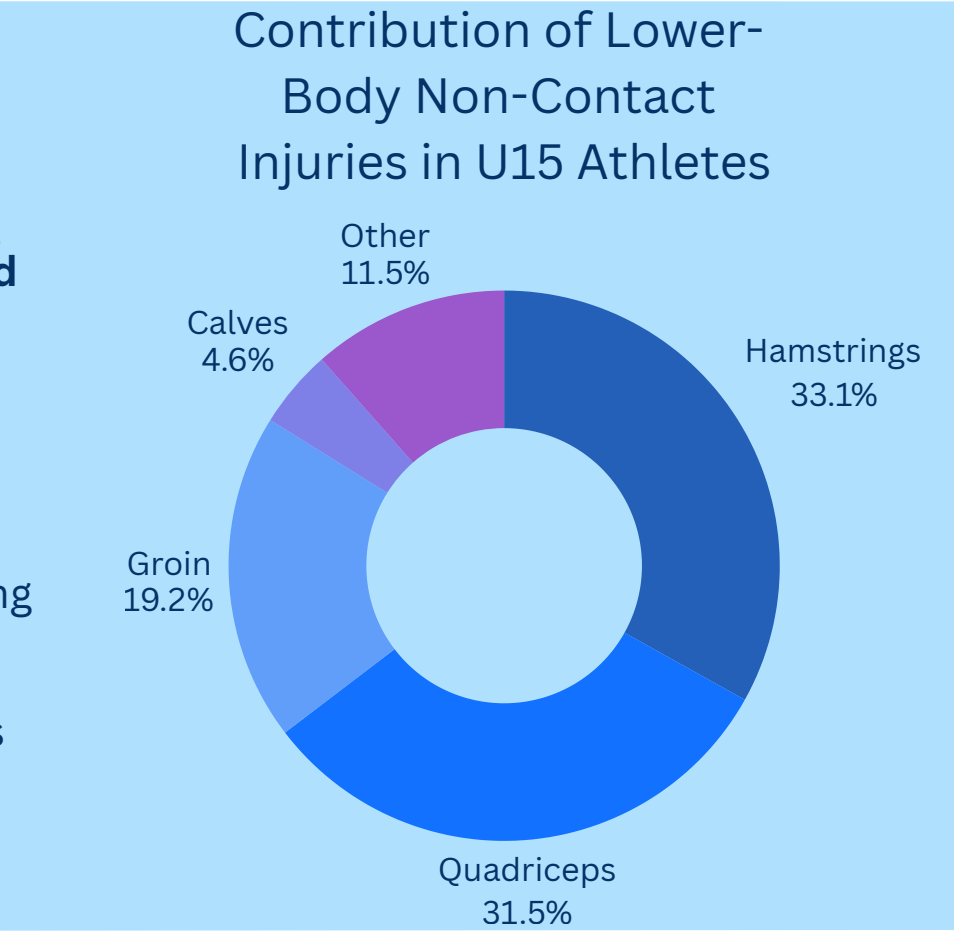
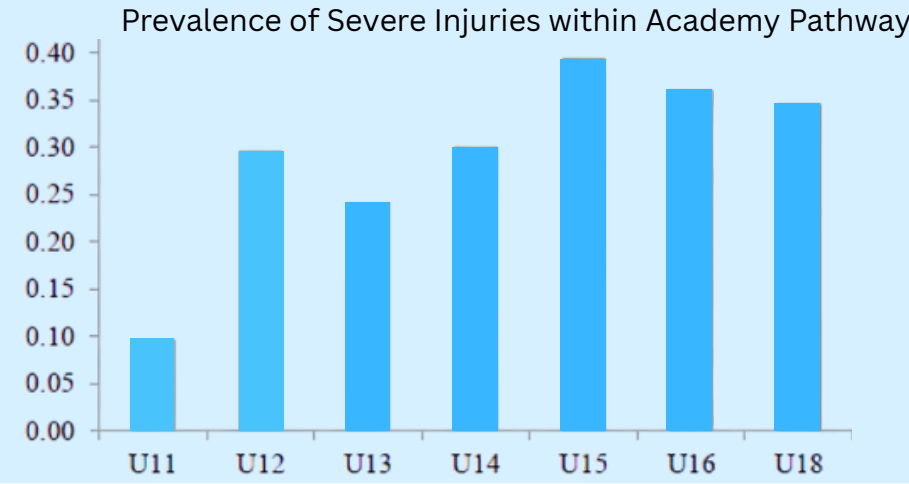
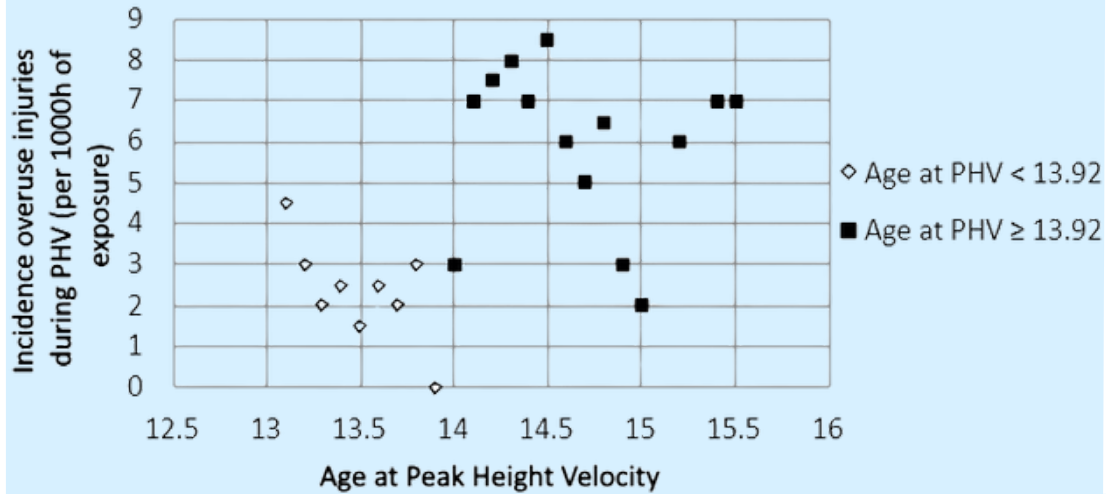
Workload Monitoring

- Workload can have both harmful or protective effects on injury risk. There is a delicate balance between implementing an appropriate stimulus to promote adaptation and exceeding tolerable training volumes.
- As **increased exposure is the primary injury risk factor in youth athletes**, determining this optimal balance is necessary.
- GPS technology is commonly used to quantify athlete workloads in a range of intensities, all of which increase injury risk within training sessions if exceeded.

Speed Threshold	Speed	Distance	Injury Risk
Very Low Intensity	0-1m/s	>542m	+60%
Low Intensity	1-3m/s	>2342m	+50%
Moderate Intensity	3-5m/s	>782m	+40%
High Intensity	5-7m/s	>175m	+80%
Very High Intensity	>7m/s	>9m	+270%

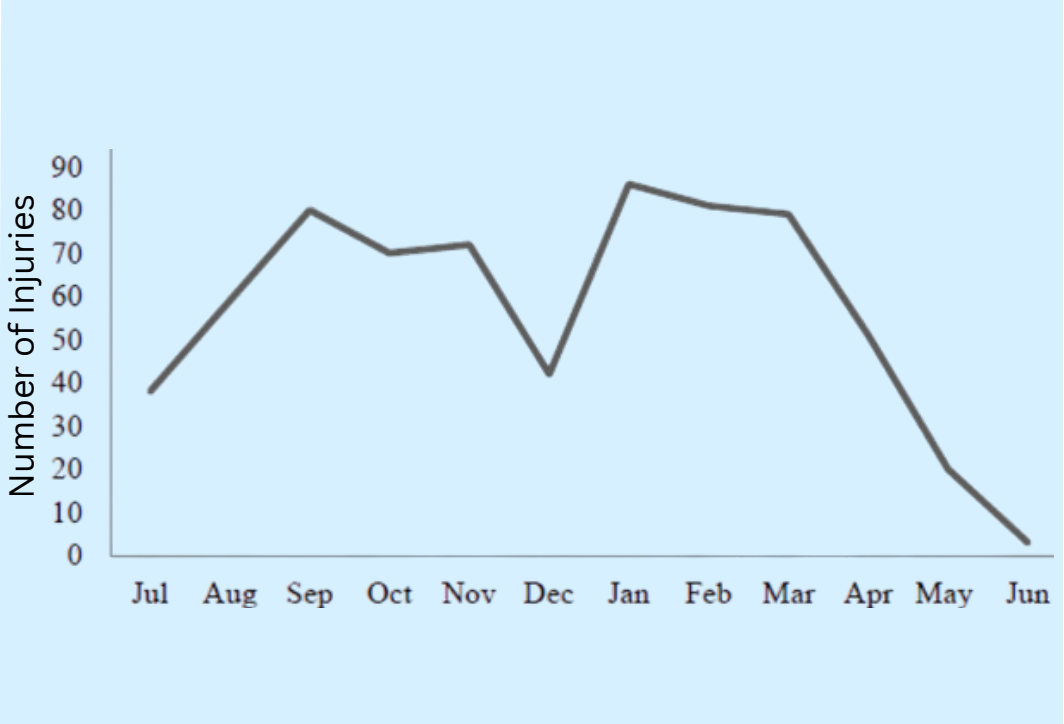
Peak-Height Velocity (PHV)

- Athletes are especially susceptible to musculoskeletal injuries during periods of rapid growth, such as PHV, typically occurring within the U15-17 age categories.
- Adolescent male footballers display a **heightened prevalence of injury in the year of PHV** than the previous year.
- This increased risk results from dysfunctional movement patterns and heightened levels of joint stiffness.
- The EPPP's increase of workload in a linear fashion between the ages of 12 to 16 is of concern, as it coincides with this period of rapid growth.



Acute to Chronic Workload Ratio

- Workload prescription may be more indicative of injury risk than workload itself.
- Although **40% of injuries are linked to acute spikes in workload**, high chronic workloads can have a protective effect. Therefore, assessing the acute to chronic workload ratio may result in a more accurate prediction of injury risk.
- Seasonal variation of injury shows two peaks, in September and December, corresponding to the beginning of pre-season and return to play after the winter break, a result of high acute workloads following periods of decreased activity.



Low Energy Availability

- To support their high energy expenditure through physical activity, as well as the energy required for growth and maturation, nutrition must be a key consideration within academy development protocols.
- Despite high energy demands, **academy players are often reported to under-fuel**.
- An athlete's capacity to withstand physical stress can be negatively affected by insufficient nutrient intake, especially in periods of growth and development.
- Meeting the nutritional requirements for physical activity, growth and development builds strong tissues that are resistant to the demands of football, reducing risk of injury.

4 INJURY PREVENTION PROGRAMME

Structured Warm-Up

- High compliance with warm-up protocols **decreases acute injury risk by 39%** in youth footballers. Therefore, common barriers to their compliance must be addressed.
- The Raise, Activate & Mobilise, Potentiate (RAMP) style warm-up is built around efficiency within the overall training session, achieving athlete preparedness and decreasing risk of injury while reducing time and energy demands.
- Balance training, with an emphasis on football specific actions, has also been included for its association with injury reduction, specifically of the hamstring and calf muscles.

Structured Warm-Up (~15 minutes)		
Phase of Warm-Up	Exercise	Duration (s) / Distance (m)
Raise	Straight Line Jog	30s
	Side Shuffle	30s
	A-Skip	30s
	High Knees	30s
	Flick Heels into Jog	30s
Activate	Heel Toe Walk	30s
	Walking Lunges	30s
	Monster Walk	30s
	Inch Worm	30s
	Bear Crawl	30s
Balance	Single Leg: Balance	30s x6 (3x Each Leg)
	Single Leg: Serve	30s x6 (3x Each Leg)
Mobilize	Walking Leg Swings	30s
	Open Gates While Walking	30s
	Close Gates While Walking	30s
	Walking Knee Hug	30s
	Swings Arms While Walking	30s
Potentiate	Stride @70% Intensity	25m
	Forward-Backwards-Forward Jog	25m
	Forward Bounds	25m
	Acceleration @80%	25m
	Acceleration @90%	25m
	Acceleration @100%	25m

Athlete Monitoring Processes

- Comparing athlete GPS data to **intensity-specific workload parameters** can determine if athletes should partake in training and competition at given intensities.
- Special consideration must be given to acute and chronic workload monitoring during the **seasonal injury peaks** in September and January.
- Early sport specialisation should be discouraged, with an **emphasis given to diverse movement skills**.
- Athletes **should not exceed 16 hours** of organised football and supplemental physical activity with ratios of 2:1 for organised vs free play.
- Growth rates should be closely monitored to identify periods of rapid growth. It is recommended that **anthropometric measurements are recorded every 3 months**, with workloads adapted accordingly in high-risk periods.
- A combination of a 24-hour dietary recall and self-reported weighed food diary, with an adjustment to rectify under-reporting, was deemed a valid method of energy-intake collection to **identify low energy availability** in elite adolescent male footballers.

5 DISCUSSION

- It has been reported that improving a greater amount of modifiable risk factors will optimise the preventive effects of IPPs. **This proposed IPP provides a holistic approach to injury prevention**, including a structured warm-up, strength and flexibility training, creating a greater preventive effect than implementing these factors in isolation.
- The addition of **athlete monitoring processes provides greater injury risk** in relation to workload, growth, maturation and nutritional intake.
- To support the compliance of IPPs within academy football, an **emphasis should be placed on coach education**, focusing on the efficacy and key barriers of IPPs, while providing coaches with intervention resources.

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