Μπορούμε να προλάβουμε την καταπόνηση και τους μυϊκούς τραυματισμούς των ποδοσφαιριστών;

Γιώργος Νάσσης

Λέκτορας Εφαρμοσμένης Αθλητικής Εργοφυσιολογίας
Τομέας Αθλητιατρικής & Βιολογίας της Άσκησης
Τμήμα Επιστήμης Φυσικής Αγωγής & Αθλητισμού
Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών

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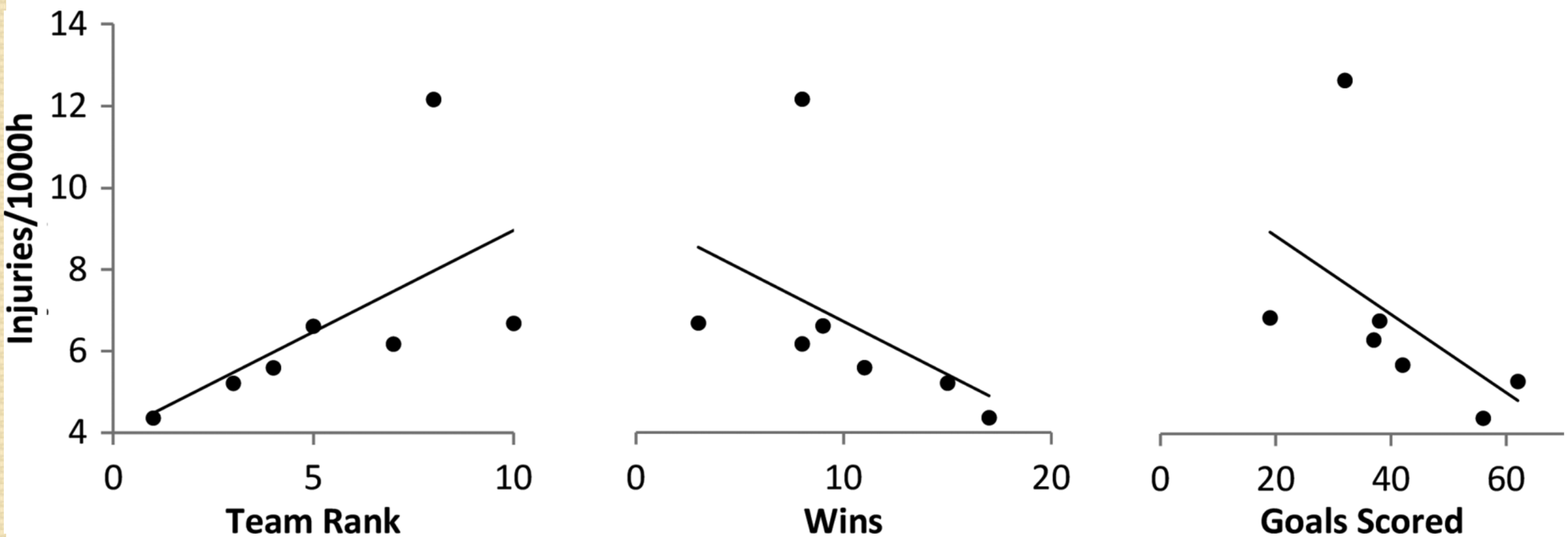
Γιατί είναι σημαντικό να προστατεύσουμε τους ποδοσφαιριστές μας από τραυματισμούς;

- Η συχνότητα των μυϊκών τραυματισμών σχετίζεται με την τελική κατάταξη (για περίπου ισοδύναμες ομάδες)



Eirale et al (2012). BJSM Online First, published on August 17, 2012 as 10.1136/bjsports-2012-091040

Στοιχεία από Premier League

<u>TOP EIGHT TEAMS – INJURIES</u>
SEASON 2011-12
SOURCE: PHYSIOROOM.COM

TEAM	POINTS	TOTAL DAYS LOST
MAN CITY	89	186
MAN UTD	89	1681
ARSENAL	70	1343
TOTTENHAM	69	1450
NEWCASTLE	65	1258
CHELSEA	64	356
EVERTON	56	716
LIVERPOOL	52	794

Peter Brukner, Head of Sports Medicine and Sports Science at *Liverpool Football Club*
Associate Professor in Sports Medicine, University of Melbourne

Ποιοι τραυματισμοί είναι πιο συχνοί;

Μερικά επιδημιολογικά στοιχεία

Origina

Injury incidence and injury patterns in professior
football: the UEFA injury study

J Ekstrand,[1,2] M Hägglund,[1] M Waldén[1]

- Η συχνότητα των τραυματισμών είναι ελαφρά υψηλότερη στους αγώνες σε σχέση με την προπόνηση
- Αναμένονται περίπου 2 τραυματισμοί ανά παίκτη την περίοδο
- Οι τραυματισμοί των οπίσθιων μηριαίων μυών παρουσιάζουν την υψηλότερη συχνότητα

Ekstrand et al (2011). Br J Sports Med 45:553-558

Original article

Injury incidence and injury patterns in professional football: the UEFA injury study

J Ekstrand,[1,2] M Hägglund,[1] M Waldén[1]

[1]Department of Medical and Health Sciences, Linköping University, Linköping, Sweden
[2]Medical Committee, UEFA, Nyon, Switzerland

Correspondence to Professor Jan Ekstrand, Department of Medical and Health Sciences, Linköping University, Solstigen 3, S-589 43 Linköping, Sweden; jan.ekstrand@telia.com

Accepted 8 June 2009
Published Online First 23 June 2009

ABSTRACT

Objective To study the injury characteristics in professional football and to follow the variation of injury incidence during a match, during a season and over consecutive seasons.

Design Prospective cohort study where teams were followed for seven consecutive seasons. Team medical staff recorded individual player exposure and time-loss injuries from 2001 to 2008.

Setting European professional men's football.

Participants The first team squads of 23 teams selected by the Union of European Football Associations as belonging to the 50 best European teams.

Main outcome measurement Injury incidence.

Results 4483 injuries occurred during 566 000 h of exposure, giving an injury incidence of 8.0 injuries/1000 h. The injury incidence during matches was higher than in training (27.5 vs 4.1, $p<0.0001$). A player sustained on average 2.0 injuries per season, and a team with typically 25 players can thus expect about 50 injuries each season. The single most common injury subtype was thigh strain, representing 17% of all injuries. Re-injuries constituted 12% of all injuries, and they caused longer absences than non re-injuries (24 vs 18 days, $p<0.0001$). The incidence of match injuries showed an increasing injury tendency over time in both the first and second halves ($p<0.0001$). Traumatic injuries and hamstring strains were more frequent during the competitive season, while overuse injuries were common during the preseason. Training and match injury incidences were stable over the period with no significant differences between seasons.

Conclusions The training and match injury incidences were stable over seven seasons. The risk of injury increased with time in each half of matches.

The Union of European Football Associations (UEFA) has expressed its concern over the physical and mental load on modern professional footballers and the possible risk of injury as a result of such loads. A research project, specifically aimed at evaluating the exposure to football and the risk of injury for top-level football players in Europe, was, therefore, initiated in 1999.[1]

Studies that describe injury risk and injury patterns in senior men's football are typically conducted over one season[2–12] or during tournaments,[13–15] and some include only part of a season.[16 17] Only few published studies have included data from two or more seasons,[18–21] and thus, little is known about the natural variations between seasons.

The aims of this study were to investigate the injury characteristics in professional men's football teams and to describe the variations of injury incidence during a match, during a season and over seven consecutive seasons.

MATERIAL AND METHODS

A prospective cohort study of European professional men's football was carried out during the years 2001–2008. The study covered seven consecutive seasons (July to May). In 2000, 14 of the top European men's clubs (clubs that had participated at the highest level in Europe over the last decade) were selected by UEFA and invited to take part in the study. Eleven teams agreed to participate and delivered complete data for the 2001/02 season.[11] Over subsequent seasons, 12 more teams were selected by UEFA and included in the study, the inclusion criteria being that they delivered complete material over full seasons (table 1). Seven teams participated through all seven seasons. The full methodology is reported elsewhere.[1] All contracted players in the first teams were invited to participate in the study.

Data collection

The study design followed the consensus on definitions and data collection procedures in studies of football injuries outlined by International Federation of Association Football (FIFA)[22] and UEFA.[1] Baseline data were collected once yearly, at the start of the season. Individual player exposure in training and matches was registered by the clubs on a standard exposure form. This included the first and second team, as well as national team exposure for all players, and was returned on a monthly basis. The team medical staffs were responsible for recording each injury immediately after the event on a standard injury form, and these were sent to the study group each month together with the exposure forms. The injury form provided information on the date of injury, scheduled activity, type and location of injury, re-injury, foul play and, from 2006/7, also the match minute when the injury occurred.

Definitions

The definitions applied in the study are shown in box 1. All injuries resulting in a player being unable to fully participate in training or match play (ie, time-loss injuries) were recorded, and the player was considered injured until the team medical staff allowed full participation in training and availability for match selection. Injuries were categorised under four degrees of severity based on the number of days' absence. All injuries were followed until the final day of rehabilitation.

Σχετίζονται οι τραυματισμοί με την καταπόνηση;

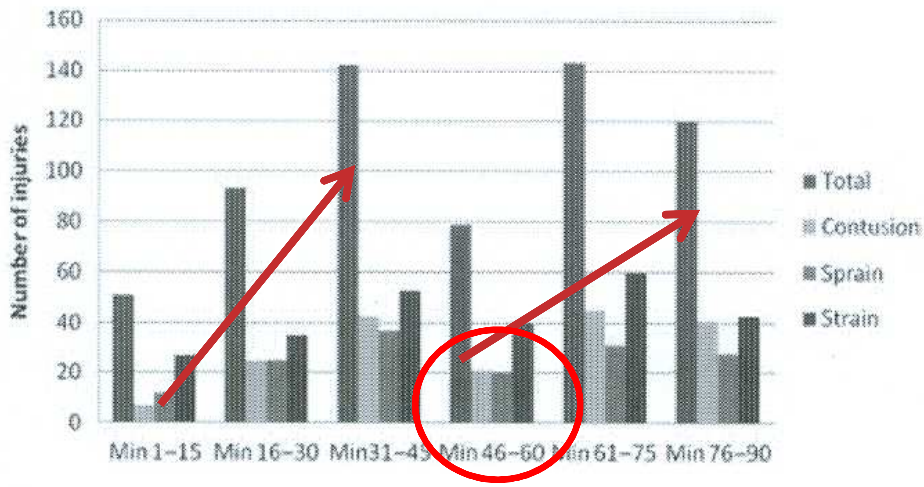


Figure 1 Distribution of traumatic injuries during a match (data from the 2006/07 and 2007/08 seasons).

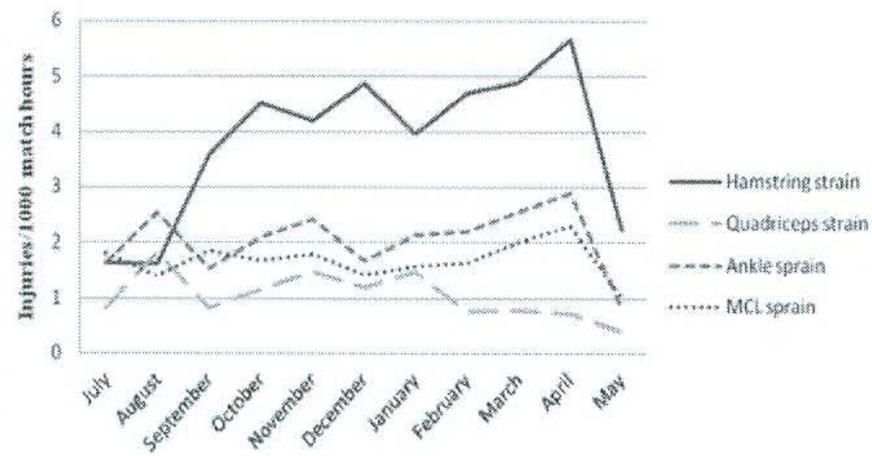


Figure 3 Distribution of the most common match play injuries over the football season.

Ekstrand et al (2011). Br J Sports Med45:553-558

Σχετίζονται οι τραυματισμοί με την καταπόνηση;

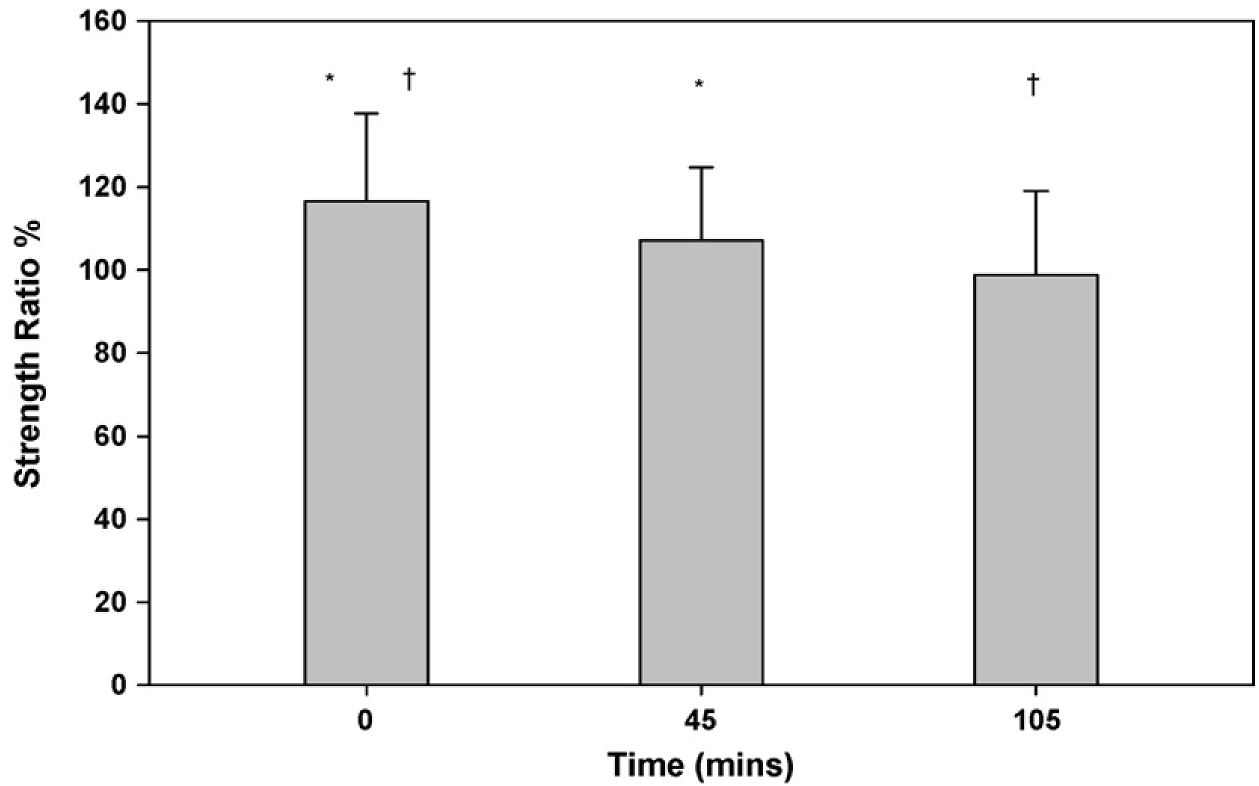


Fig. 3. Eccentric hamstring:concentric quadriceps strength ratio during SAFT90. *Significant difference between *t0 and t45; †significant difference between t0* and *t105.*

Small et al (2010). J Sci Med Sports 13:120-125

Σχετίζονται οι τραυματισμοί με την καταπόνηση;

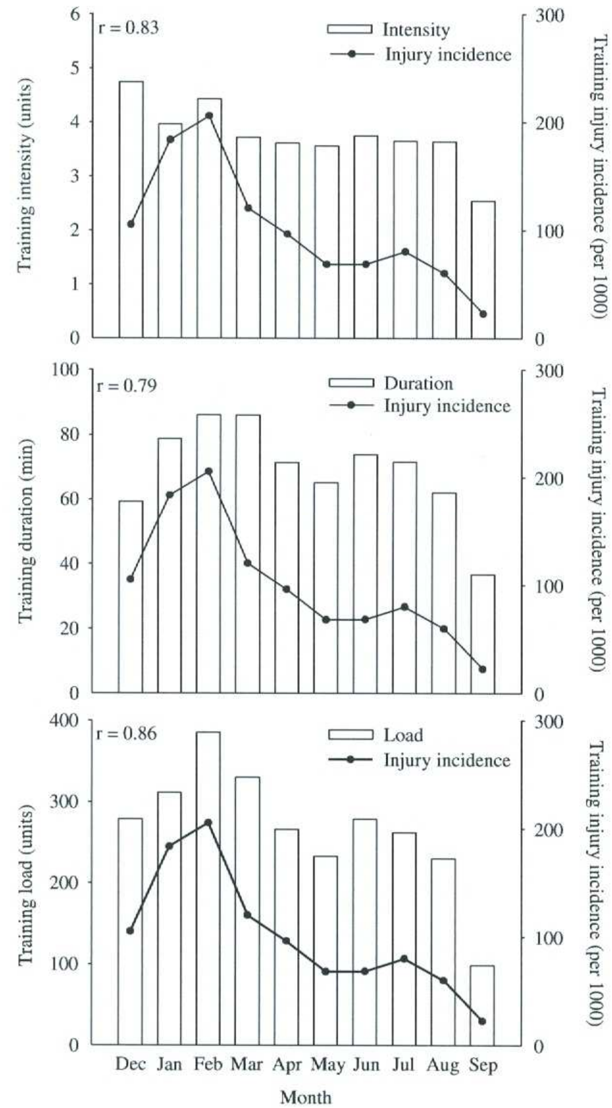
Celtic FC Lab

- Αναλύθηκαν η απόδοση και οι τραυματισμοί δε 2 συνεχόμενες αγωνιστικές περιόδους
- Σύνολο: 123 αγώνες (67 αγώνες με απόσταση 3-4 ημέρες μεταξύ τους)

- Η συχνότητα των τραυματισμών ήταν υψηλότερη με την αύξηση της συχνότητας των παιχνιδιών (25.6 versus 4.1 injuries per 1000 hours of exposure; P<0.001)

Dupont et al (2010). Am J Sports Med

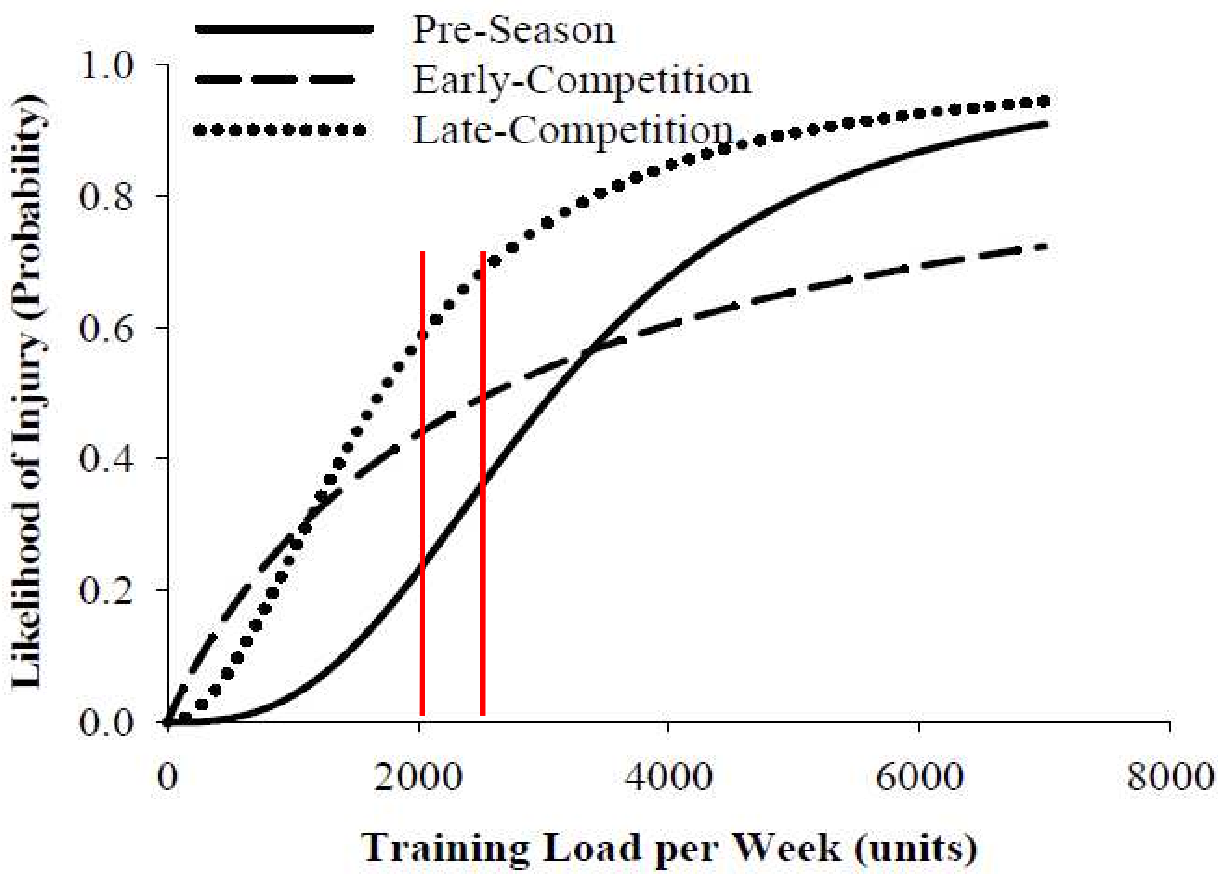
Πώς σχετίζονται οι τραυματισμοί με την καταπόνηση;



Gabbett (2004). J Sports Sci 22:409-417

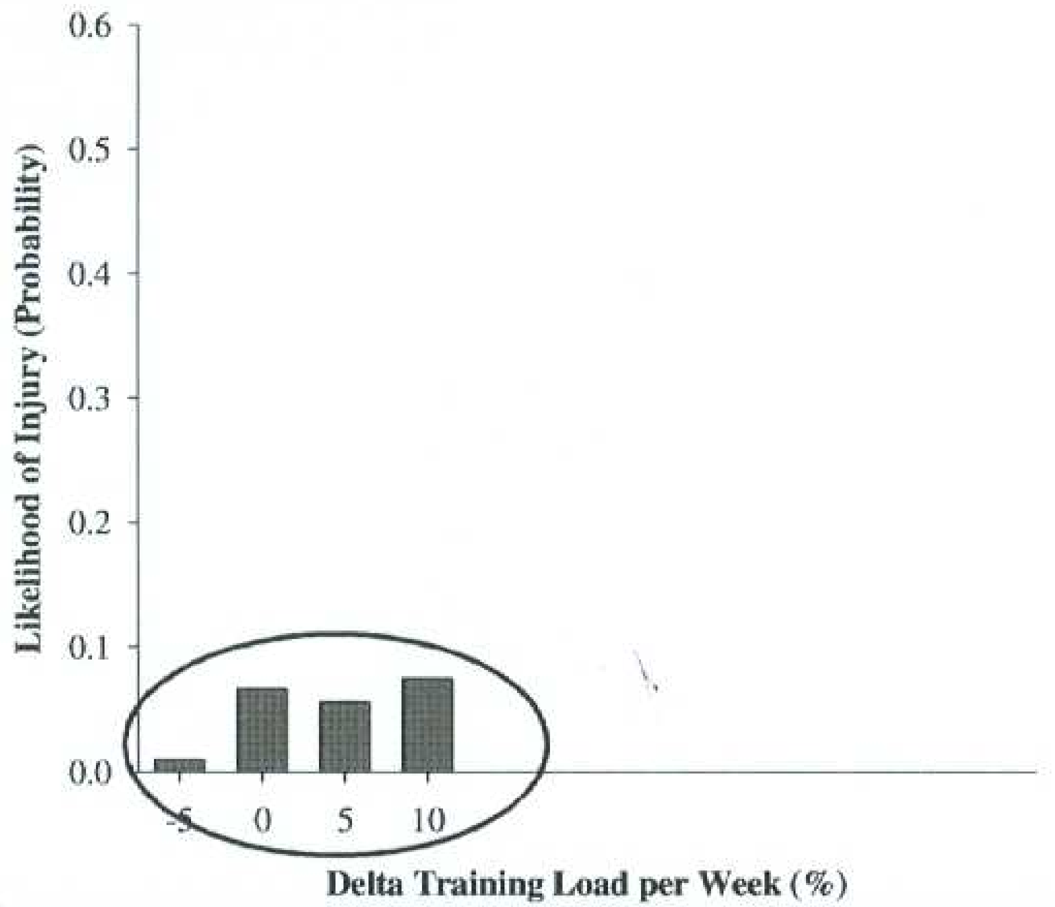
Πώς σχετίζονται οι τραυματισμοί με την καταπόνηση;

Figure 1. Likelihood of injury with different training loads



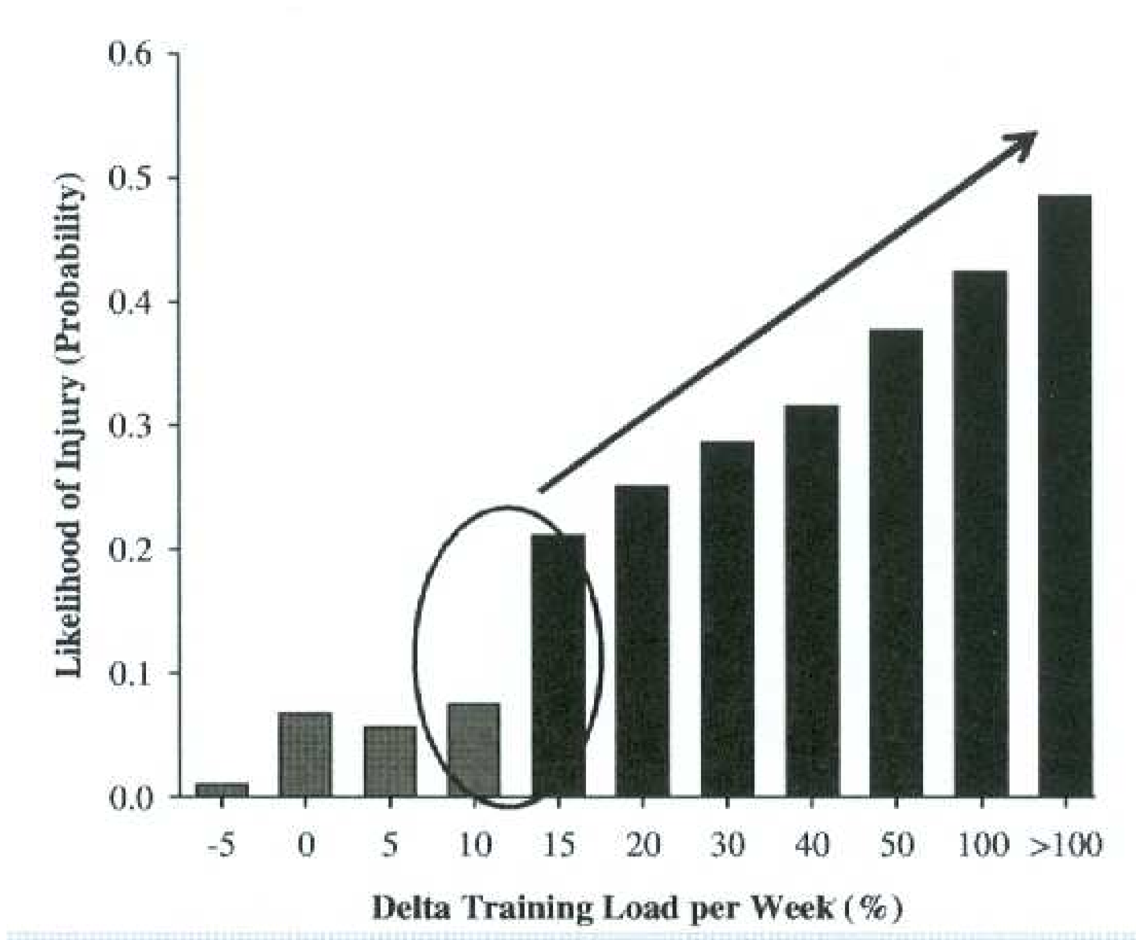
Gabett 2010, J Strength Cond Res 24: 2593-2603

Τι συμβαίνει με μικρές αλλαγές στο φορτίο της προπόνησης;



Gabett 2010. J Strength Cond Res 24: 2593-2603

Τι συμβαίνει με μεγάλες αλλαγές στο φορτίο της προπόνησης;



Gabett 2010, J Strength Cond Res 24: 2593-2603

Τι συμβαίνει με τους νεαρούς ποδοσφαιριστές;

Οι τραυματισμοί επηρεάζονται εκτός του προπονητικού φορτίο από το στάδιο της ανάπτυξης


BMJ

RESEARCH

Investigation of growth, development, and factors associated with injury in elite schoolboy footballers: prospective study

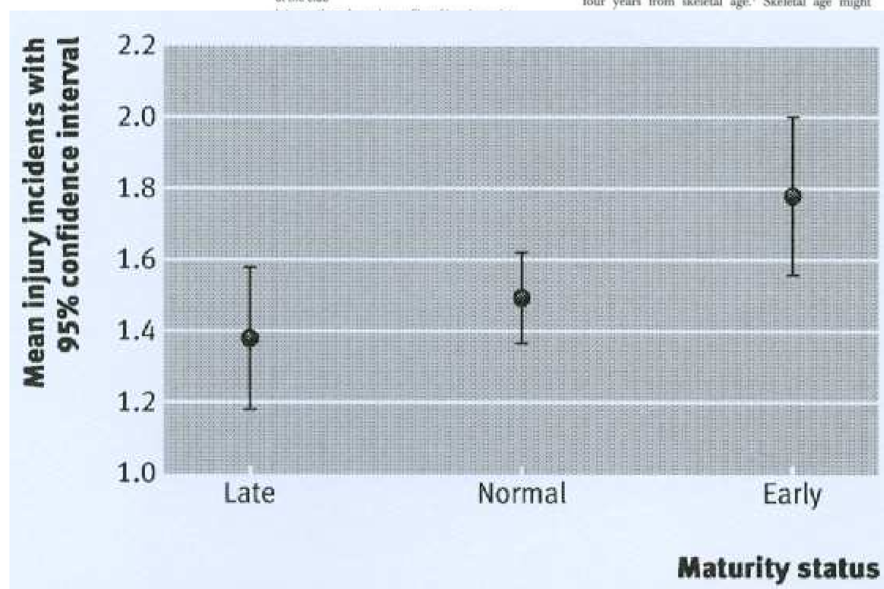
Amanda Johnson, senior academy physiotherapist,[1] Patrick Joseph Doherty, chair of rehabilitation,[2] Anthony Freemont, professor of osteoarticular pathology[3]

[1]Manchester United Football Club, Trafford Training Centre, Carrington, Manchester M31 4BH
[2]York St John University, York
[3]University of Manchester, Manchester
Correspondence to: A Johnson mandy.johnson@manutd.co.uk

Cite this as: BMJ 2009;338:b490
doi:10.1136/bmj.b490

ABSTRACT
Objective To investigate the differences between skeletal and chronological age and to assess the role of maturity status, anthropometric data, and football related variables in explaining injury statistics in elite schoolboy footballers.
Design Prospective study of injuries in schoolboy footballers according to skeletal age.
Setting Premier league football club in England.
Participants 292 schoolboy players (age 9-16) registered at the club

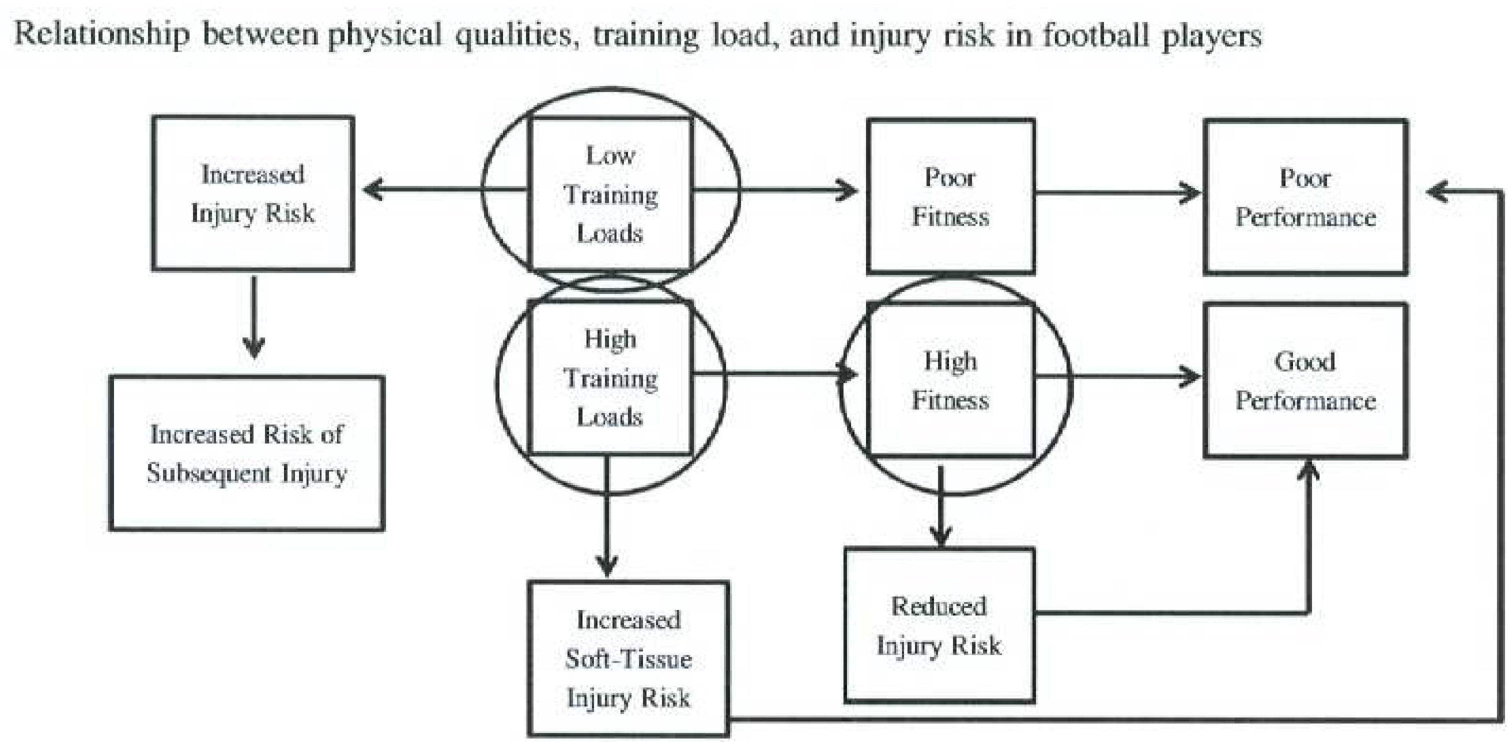
INTRODUCTION
As financial rewards and obligations grow there is growing pressure to produce elite athletes in professional sport. Club coaching and medical staff are continually looking for the safest and most successful methods to develop talented young players to compete at the highest level. In youth sport, chronological age is the usual method of dividing children into age related training and competitive groups, but between individuals in the same age group this can differ by as much as four years from skeletal age.[1] Skeletal age might

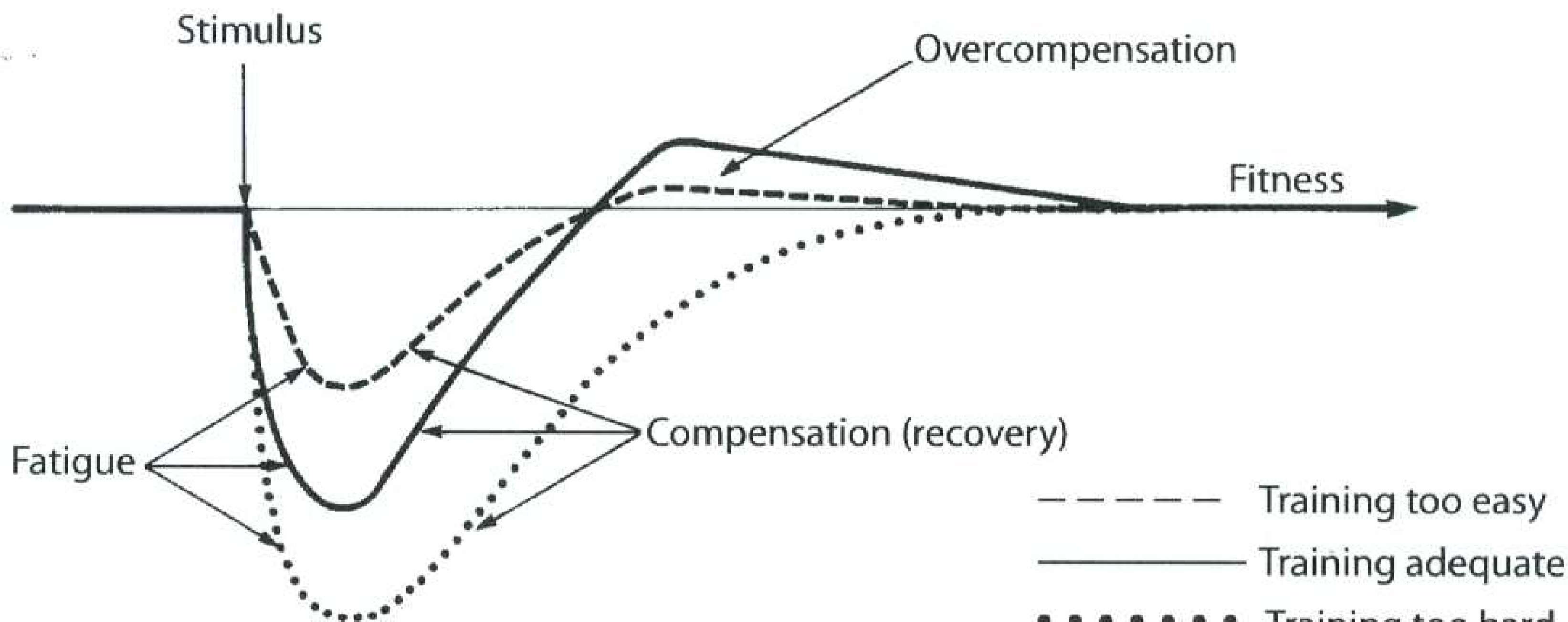


Johnson et al. (2009). BMJ 338:b490

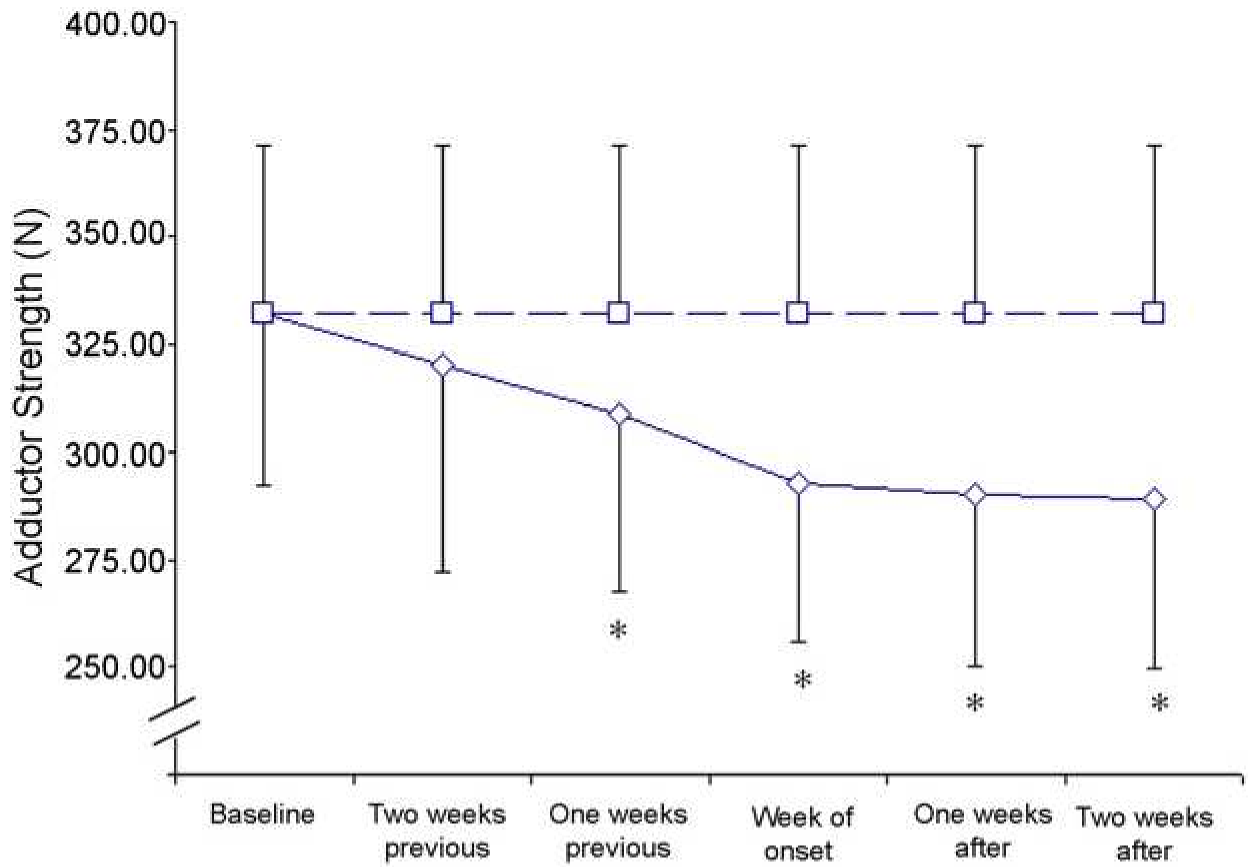
Η κότα έκανε το αυγό ή το αυγό την κότα;

- Εάν η προπόνηση οδηγεί σε τραυματισμούς μήπως ΔΕΝ πρέπει να προπονούμαστε;




Stimulus
Overcompensation
Fitness
Fatigue
Compensation (recovery)
Training too easy
Training adequate
Training too hard

Μπορούμε να προλάβουμε τους τραυματισμούς; Ένα απλό παράδειγμα



Crow et al. (2010). J Sci Med Sport 13(2):202-204.

BJSM Online First, published on September 28, 2012 as 10.1136/bjsports-2011-090803

Statistical modelling for recurrent events: an application to sports injuries

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[2]School of Exercise Science, Australian Catholic University, Brisbane, Queensland, Australia
[3]School of Human Movement Studies, The University of Queensland, Brisbane, Queensland, Australia
[4]Australian Centre for Research into Injury in Sport and its Prevention (ACRISP), Monash Injury Research Institute (MIRI), Monash University, Melbourne, Victoria, Australia

Correspondence to Professor Caroline F Finch, Australian Centre for Research into Sports Injury and its Prevention (ACRISP), Monash Injury Research Institute (MIRI), Building 70, Monash University Clayton Campus, Melbourne, VIC 3800, Australia; caroline.finch@monash.edu

Accepted 21 June 2012

ABSTRACT

Background Injuries are often recurrent, with subsequent injuries influenced by previous occurrences and hence correlation between events needs to be taken into account when analysing such data.

Objective This paper compares five different survival models (Cox proportional hazards (CoxPH) model and the following generalisations to recurrent event data: Andersen-Gill (A-G), frailty, Wei-Lin-Weissfeld total time (WLW-TT) marginal, Prentice-Williams-Peterson gap time (PWP-GT) conditional models) for the analysis of recurrent injury data.

Methods Empirical evaluation and comparison of different models were performed using model selection criteria and goodness-of-fit statistics. Simulation studies assessed the size and power of each model fit.

Results The modelling approach is demonstrated through direct application to Australian National Rugby League recurrent injury data collected over the 2008 playing season. Of the 35 players analysed, 14 (40%) players had more than 1 injury and 47 contact injuries were sustained over 29 matches. The CoxPH model provided the poorest fit to the recurrent sports injury data. The fit was improved with the A-G and frailty models, compared to WLW-TT and PWP-GT models.

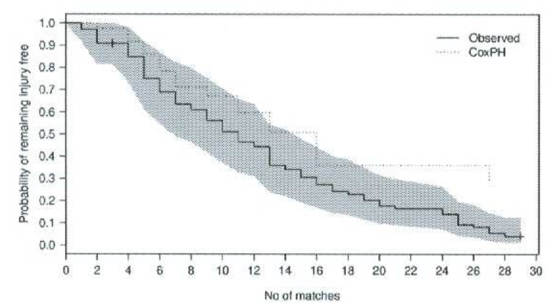
Conclusions Despite little difference in model fit between the A-G and frailty models, in the interest of fewer statistical assumptions it is recommended that, where relevant, future studies involving modelling of recurrent sports injury data use the frailty model in preference to the CoxPH model or its other generalisations. The paper provides a rationale for future statistical modelling approaches for recurrent sports injury.

INTRODUCTION

Sports injuries are often recurrent in that some people experience more than one sports injury over time. There is wide recognition that subsequent injury (of either the same or a different type) can be strongly influenced by previous injury occurrences.[1–4] Such recurrent injuries are unlikely to be statistically independent, and appropriate statistical methods need to be used to analyse such data accurately.[5–8] While different modelling approaches have been used to report recurrent event data, such as modelling the within-person total number of events or time to the first event, they have often been naïve in the statistical sense in that they do not take correlation between events into account or have excluded important detailed information about the subsequent events.[9] Over the last decade, there have been some significant statistical advances in the modelling of recurrent event data.[7 10–12] While there has been some application to health data,[9 13] these methods are yet to be reported in sports medicine applications. This means that many models of the likelihood of recurrence of sports injury, or for understanding causal relationships when conditions can be recurrent, could be flawed, leading to incorrect information being used to inform prevention priorities and programmes.

A key statistical challenge inherent in analysing recurrent injury data is that the probability of injury occurrence is likely to be influenced by earlier injuries, even when they are not of exactly the same type; this can be manifest as an injury either raising or lowering the rate of further injury. This is important because analyses that incorrectly treat different within-person injuries as statistically independent run the risk of generating misleading results. Ignoring potential within-person event dependency leads to reported greater precision than is warranted and possible biasing of results away from the null. A second statistical issue is that many naïve statistical approaches implicitly restrict the baseline probability of injury, and the influence of covariates on this, to be the same across all injuries when, in fact, they vary across people and different injury types. Across people, this variability implies that some will have inherently higher or lower rates of different subsequent injuries. Together, these statistical issues mean that in any recurrent injury dataset there will be different within-person correlations across people and that the within-person injury times will be dependent. Any correlation among injuries (whether produced by event dependence or variability) will violate assumptions that the timing of injuries is independent, and result in problems of estimation and incorrect inference if not properly taken into account.

Despite many studies documenting the incidence of sports injuries, and recognition of the recurrent nature of many injuries,[14] appropriate statistical modelling for recurrent sports injuries has largely been absent from published studies. In general, subsequent sports injury has been handled statistically in one of three ways. The majority of cohort studies have reported Poisson counts and calculated injury rates as the total number of injuries per unit time, even when many players contribute more than one injury occurrence to the numerator. Inherently, such calculations treat all injuries within given players as independent. When these studies have recognised that injury history can predict injury risk, they have adjusted for it in regression models by including a dichotomous predictor representing 'previous injury history? (yes/no)'. On the rare occasion when researchers have recognised within-player injury dependency, they have only modelled the time to



3(a)

Μπορούμε να προλάβουμε τους τραυματισμούς; Τι μπορούμε να κάνουμε;

Πρόληψη

Αξιολόγηση των παραγόντων κινδύνου

Παρακολούθηση του φορτίου της προπόνησης

Παρακολούθηση των παραγόντων κόπωσης

Υιοθέτηση μίας πιο ολιστικής προσέγγισης

Αξιολόγηση ορισμένων δεικτών κόπωσης

Δείκτης	Πλεονεκτήματα	Μειονεκτήματα	Σχόλιο
Μείωση της απόδοσης	Σχετικά υψηλή ακρίβεια	Χρόνος, ευαισθησία μεθόδου, αξιοπιστία	Ο καλύτερος δείκτης
Διαταραχή λειτουργίας συμπαθητικού & παρασυμπαθητικού νευρικού συστήματος	Μη παρεμβατική μέθοδος	Χρόνος, κόστος, δυσκολία στην ερμηνεία	Αρκετά υποσχόμενη μέθοδος
Αύξηση καρδιακής συχνότητας ηρεμίας	Ευκολόχρηστη	Προυποθέτει τυποποίηση συθηκών καταγραφής	
Αύξηση καρδιακής συχνότητας σε υπο-μέγιστο έργο	Ευκολόχρηστη	Έλλειψη πειστικών στοιχείων στη βιβλιογραφία	
Καθυστερημένη πτώση της καρδιακής συχνότητας μετά από άσκηση	Ευκολόχρηστη	Έλλειψη πειστικών στοιχείων στη βιβλιογραφία	

Bosquet et al. (2008). Br J Sports Med 42:709-714; Borresen & Lambert (2008). Sports Med 38:633-646; Meeusen et al (2006). Eur J Sport Sci 6:1-14

Αξιολόγηση ορισμένων δεικτών κόπωσης

Δείκτης	Πλεονεκτήματα	Μειονεκτήματα	Σχόλιο
Διαταραχές ορμονικού προφίλ (ελεύθερη τεστοστερόνη/κορτιζόλη, αυξητική ορμόνη)	Μη παρεμβατική (στο σάλιο)	Κόστος	Τα επίπεδα ορμονών επηρεάζονται από πολλούς παράγοντες (στρες δειγματοληψίας, χειρισμός δειγμάτων, δίαιτα, περί24ωρη & εποχική διακύμανση
Διαταραχές της διάθεσης (mood profile)	Απλή, μη παρεμβατική μέθοδος	Σχετικά χαμηλή αξιοπιστία	Πρέπει να τυποποιηθούν οι συνθήκες συμπλήρωσης του ερωτηματολογίου (ίδια ώρα & μέρα)
Βιοχημικοί δείκτες στο αίμα (CK, CRP, ουρία)		Μη ισχυρές ενδείξεις στη βιβλιογραφία	Δε σχετίζονται πάντα με κόπωση
Λειτουργίας ανοσοποιητικού συστήματος (IgA)		Μη ισχυρές ενδείξεις	

Bosquet et al. (2008). Br J Sports Med 42:709-714; Borresen & Lambert (2008). Sports Med 38:633-646; Meeusen et al (2006). Eur J Sport Sci 6:1-14

Μπορούμε να προλάβουμε τους τραυματισμούς; Τι μπορούμε να κάνουμε;

Ανάγκη για πολύπλευρη αξιολόγηση

Συμπερασματικά

- Η επιτυχία της ομάδας φαίνεται ότι εξαρτάται, εκτός των άλλων, από τον αριθμό των τραυματισμών.
- Η πρόληψη των τραυματισμών θα πρέπει να περιλαμβάνει μία πιο ολιστική προσέγγιση και τη συνεργασία πολλών ειδικοτήτων (ιατρών, φυσιοθεραπευτών, προπονητών, φυσιολόγων, ψυχολόγων κλπ).
- Τα προγράμματ εκγύμνασης σε σκοπό την πρόληψη των μυϊκών τραυματισμών θα πρέπει να αποτελούν βασικά δομικά στοιχεία της προπόνησης.

gnassis@phed.uoa.gr