Objective To investigate the use of hamstring muscle strengthening in female elite football training.

Design Descriptive, cross-sectional study.

Setting Online questionnaire.

Participants Overall, 338 Danish players were invited to answer the online questionnaire. 123 players from the best national league answered the questionnaire (≤ 18 yrs.: $N=70$) and (≥ 18 yrs.: $N=53$).

Assessment of Risk Factors The online questionnaire covered e.g. baseline information, years of football experience, previous injuries and amount of hours pr/week doing strength training. The following question was asked: 'Which of the following exercises are a part of your weekly training?' With the following options: Leg Curl, Deadlift, Nordic Hamstring and Kettlebell Swing.

Main Outcome Measurements Four hamstring strength exercises: Leg Curl, Deadlift, Nordic Hamstring and Kettlebell Swing.

Results 54,7% of the adult players reported that they did strength training 3–4 hours/week vs. 39,1% of the youth elite players. All four hamstrings exercises were reported to be a part of the weekly training in both groups: The Nordic Hamstring exercise was performed among 75% of the adult elite players vs 70% of the youth elite players. Deadlift 77% (adult) vs 53% (youth). Kettlebell swing 36% (adult) vs 44% (youth) and finally the Leg curl 40% (adult) vs. 14% (youth)

Conclusions The present results indicate that hamstrings exercises are implemented in the weekly training among the majority of Danish female elite football players. The Nordic Hamstring is overall the most performed hamstring exercise in both groups. However, it remains to be elucidated how the exercise is implemented in terms of frequency and load.

157 PREDICTORS OF TIME TO RETURN TO PLAY AND REINJURY FOLLOWING HAMSTRING STRAIN INJURIES WITH AND WITHOUT TENDON INVOLVEMENT IN PROFESSIONAL FOOTBALL

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Background Hamstring strain injury (HSI) account for ~12% of all injuries in professional football. It is suggested HSIs extending into the intramuscular tendon are more prone to reinjury, resulting in greater time-loss and delayed time to return to play (RTP). Currently, there is a lack of evidence regarding the effects of HSI with and without intramuscular tendon involvement as well as the impact of factors such as removal of a player and grade.

Objectives 1) Describe the number of HSIs using the British Athletics Muscle Injury Classification (BAMIC); 2) Determine if intramuscular tendon HSI results in extended RTP and higher reinjury risk; 3) Determine the predictors of RTP and reinjury.

Methods A retrospective study in one English Premier League football club over four seasons. Players included underwent an MRI within 7 days of injury and were graded by a

Radiologist using the BAMIC (0a-4). RTP and reinjury rates were recorded along with information on whether the players was removed from play. Data were analysed using a Kruskal-Wallis test and linear regression.

Results Twenty-nine HSI across 24 players (age = 26 ± 4 years) were recorded over 4 seasons. There was a significant difference in RTP between grades 1a and 2c ($P = 0.027$). No significant difference was observed in RTP between 2b and 2c and no greater risk of reinjury. Grade of HSI ($P = < 0.000$) and removal of the player ($P = 0.001$) were significant predictors of RTP. An increase in grade of HSI resulted in an additional 4 days RTP and removal from the field of play ($P = 0.001$) resulted in an additional 10 days.

Conclusion HSIs extending into the intramuscular tendon (2b cf. 2c) do not influence RTP or reinjury, however RTP is affected by the removal of a player and overall grade.

158 STRENGTH ENDURANCE AND FATIGABILITY: CANDIDATE RISK FACTORS FOR HAMSTRING RE-INJURY IN SPRINT SPORTS?

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Background Hamstring strain injuries (HSI) are characterized by a very high recurrence rate. Despite indications from the field that deficits in strength endurance and fatigability play a role in (re-)injury, screening for these in Return To Sport (RTS) decision making is still not common and requires further investigation.

Objective To justify hamstring strength endurance and fatigability at time of RTS as potential risk factors for re-injury.

Design Observational.

Setting Academic sports rehabilitation centre.

Patients (or Participants) 13 recently injured HSI athletes (M/F; 18–35yr) competitive in sprint sports, at time of RTS, and 17 healthy population-matched controls.

Interventions (or Assessment of Risk Factors) All participants underwent a RTS test battery including clinical and functional tests. For this study, single leg hamstring bridge endurance test (SLHB) and maximal isometric hamstring strength test (MIHS) in inner, mid and outer range, using hand-held dynamometry, were investigated. MIHS was retested after a shuttle-run until exhaustion fatigue protocol. Differences between injured (INJ) and uninjured (UNINJ) limb, and differences between injured and healthy athletes (CON) were tested using Students' t-tests and mixed model ANOVA.

Main Outcome Measurements SLHB [number of repetitions]; MIHS [Newton].

Results Concerning SLHB, injured athletes showed a clinically relevant deficit in hamstring strength endurance compared to their healthy peers, both in their injured and un-injured leg (INJ=19.0±5.0; UNINJ=18.9±5.4; CON=24.5±5.3; $t=2.6$ & 2.7 ; $p=0.01$ & 0.01 respectively). For MIHS, a main group effect was found for outer range (INJ=347.5±67.3; CON=394.8±63.8; $F=6.1$; $p=0.02$), revealing that isometric strength was significantly worse in the injured leg compared to healthy controls. An overall fatigue effect was found ($F=7.8$; $p=0.01$), adding to the injured athletes' baseline deficit in MIHS performance.

Conclusions Hamstring strength endurance and fatigability were both justified as potential risk factors of re-injury and should be integral parts of future rehabilitation programmes and prognostic screening.

159 HAOS OR CHAOS? THE PROGNOSTIC VALUE OF THE HAMSTRING OUTCOME SCORE (HAOS) TO PREDICT THE RISK OF HAMSTRING INJURY

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Background Hamstring injury incidence remains high among male soccer players. One of the reasons is low adherence for effective hamstring injury prevention programs. Insight in injury risk can contribute to better adherence for injury prevention measures. The hamstring outcome score (HaOS) might provide an insight in injury risk.

Objective To determine the relation between the HaOS and both previous and new hamstring injuries in male amateur soccer players, and to determine the prognostic value of the HaOS to predict the risk of hamstring injuries.

Design Data was collected during a large cluster-RCT investigating a hamstring injury prevention program.

Setting This study was executed during one competition (2016–2017) in 32 first class amateur soccer teams.

Participants 400 adult male amateur soccer players started the study.

Assessment of risk factors The participants filled in a baseline-questionnaire consisting of injury history and the HaOS. During one full competition hamstring injuries were registered prospectively.

Main outcome measurements Previous hamstring injuries, new hamstring injuries and the HaOS (total score and subdomains) were considered in this study.

Results In 356 players, a significant relation was found between the HaOS (total score and all HaOS subdomain scores) and previous and new hamstring injury ($F=17.4$; $p<0.0001$ and $T=3.59$, $p=0.001$, respectively). This indicated that more hamstring injuries during the previous season was related to lower scores on the HaOS and lower HaOS scores correspond with more new hamstring injuries. With a cut-off score of 80% on the HaOS, logistic regression models showed a probability of 11%, 18% and 28% on a new hamstring injury in players with 0, 1 or 2 previous injuries, respectively.

Conclusion The HaOS is significantly associated with both previous and new hamstring injury and might be a useful tool to provide insight in players' hamstring injury risk when used in combination with injury history.

160 ECCENTRIC HAMSTRING STRENGTH AND SPRINTING PERFORMANCE CHANGES DURING THE OFF-SEASON IN SPANISH FOOTBALLERS

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Background Low eccentric hamstring strength and sprinting performance are associated with hamstring injury (HI) in football; however, the off-season effects on both qualities are unknown.

Objective The aim of the study was to investigate eccentric hamstring strength and sprinting performance changes during the off-season period in football players.

Design Prospective cohort study.

Setting Semi-professional (3rd-4th tier) and amateur (5th-8th tier) Spanish footballers.

Patients (or Participants) Male footballers ($n=107$) were contacted to participate. Seventy-four footballers (25 ± 4 years, 178.0 ± 6.6 cm, 74.9 ± 8.1 kg) were included in final analyses.

Interventions (or Assessment of Risk Factors) Eccentric hamstring strength (Nordbord) and sprint performance (30m sprint and V-Cut test) were assessed at the beginning (May-June 2017) and end of the off-season (July-August 2017). Previous HI, age and off-season length were considered the independent variables.

Main Outcome Measurements Eccentric hamstring strength ($N\cdot kg^{-1}$), 30m sprint (5–10m splits (s)) and change-of-direction performance (s). All outcomes were proposed before any data collection. Data was analysed using paired t-tests and linear mixed models.

Results No changes in eccentric hamstring strength were found at follow-up. Large (2%, $d=0.96$; $p<0.001$) and small (1%, $d=0.46$; $p<0.001$) decrements in performance were found for 30m sprint and 10m split time at follow-up, respectively. Previous HI, age or off-season length had no effect on any of the outcomes.

Conclusions Footballers showed no reduction in eccentric hamstring strength but impaired sprint performance after the off-season period, independent of age, previous HI and length of off-season. This may suggest the risk of sustaining a HI during the pre-season is lowered, as a result of decreased maximal