The Functional Movement Screen for Injury Prediction in Male Amateur Football

Despite various research approaches, there is still conflicting evidence as to the worthiness of injury prediction tools in football. This study was aimed at investigating correlations between injuries of amateur male football players and the results of a Functional Movement Screen (FMS). Using an observational design, ten amateur teams of the fifth and sixth division (Deutscher Fußball-Bund) were examined by means of FMS scores prior to a tenweek off- and main-season observation period (July to September 2013).

The assessment included injuries and football exposure times during training and competition. Injury was defined as concerning the lower limb, and as non-contact with time loss of at least three days. After a drop-out of 56% (125 out of 221) 96 players could be analysed. We calculated a total exposure time of 1,770 hours (competition 289 h, training 1,481 h). We observed 10 injury incidents concerning 8 players, occurring exclusively during training. The according incidence was 6.8 injuries per 1,000 training hours.

There were no significant differences between injured and uninjured players neither for any FMS item nor for the total score except for the hurdle step (Z=-2.059; p=0.040). Only the ratings of the hurdle step task and the injury state were correlated significantly (rpbis=0.209; p=0.041). Even if taking into account the hurdle step task and the injury state were correlated significantly (rpbis=0.209; p=0.041). Even if taking into account the hurdle step task and the injury state were correlated significantly (rpbis=0.209; p=0.041).

Evidence for injury prediction by means of football specific c parameters, screening tools or questionnaires is not yet sufficiently established. A systematic review from 2012 (3) reported football associated injury risk factors identified ed earlier, e.g. anthropometrics, team-specific items like changes of coaches or clubs, and athletic performance or pre-injury (5, 7, 10-12). Another systematic review focussing on football specific demands extracted key risk factors (previous injury, fatigue, muscle imbalance) and widely used screening tests (Functional Movement Screen, questionnaires, isokinetic muscle testing) (16).

The Functional Movement Screen (FMS) is a test battery consisting of seven items (Fig. 1), examining coordination, flexibility, and trunk stabilisation.
capacities by means of expert ratings. Although the FMS was developed in the field of physiotherapists aiming at identifying disturbed coordination patterns based on single items execution deficits, it was evaluated in the field of North American College Football intending to use the composite score as injury risk prediction tool. Composite test scores of 14 points or less out of maximally 21 points were identified to be associated with an increased injury risk (14). For maximal predictive power, an FMS score equal or less than 14 points combined with a history of previous injury provided the greatest indicator of future injury risk in several sports, e.g. female football, male or female rugby, and swimming/diving (9). But – providing conflicting evidence – these positive experiences could not be confirmed in all fields of sports, e.g. (ice) hockey (4).

For the European professional football, first experiences were published in 2012 as a conference paper, only (19). Seeking for high-level papers, McCall and collaborators (16) found no articles providing the FMS to be able to identify professional male football players at injury risk. For amateur male football players, findings are still lacking. Apart from the composite score, recently published findings revealed injury specific differences in single FMS items in Hungarian elite male football players (22).

This paper aimed at assessing FMS composite and single item scores to analyse correlations with injury incidences in amateur male football players.

Methods

Study Design

The investigation was conducted as an observational study in the football season 2013/14. Prior to the monitoring of exposure and occurring injuries, a functional diagnosis tool (FMS) was used to assess probably disturbed coordination patterns.

Subjects

As inclusion criterion, all observed teams should belong to the fifth and sixth division organised in the Deutscher Fußball-Bund (DFB), which included the amateur state of all participating male football players. Teams had to have 2-3 training units per week. Managers and players were informed about study goals, diagnostic tools, and monitoring details and agreed to participate.

The investigation started with 10 teams including 221 players. Due to a drop-out of 56% (n=125), only 96 male players (age: 23.7 ±3.5 years; height: 1.82 ±0.07 m; weight: 79.9 ±7.7 kg) could be included and monitored completely (Fig. 2).

FMS-Screening Tool

The FMS (Functional Movement Systems Inc., Chatham, VA, USA) was created as a field test tool with minimal needs of equipment to test coordination, trunk stability and flexibility in seven tasks related to frequently observed neuromuscular problems associated with the risk of injury (14): Deep Squat, Hurdle Step, Inline Lunge, Active Straight Leg Raise (ASLR), Shoulder Mobility, Trunk Stability Push-Up (TSP), and Rotary Stability (Fig. 1).

Every task could achieve maximally 3 points in case of an excellent execution, 2 points showing minor deficits, 1 point for a poor execution, and no point, if pain was reported. Reliability for the total score (ICC=0.92) was evaluated earlier (17). In early studies, Kiesel and colleagues (14) reported sensitivity (54%) and specificity (91%) coefficients promoting validity for injury risk prediction abilities for a cut-off FMS composite score of 14 points in the field of College Football players; more than 14 points were called a ‘good pattern’, 14 points or less a ‘poor pattern’, respectively. However, later investigations could not confirm validity of this cut-off point (1, 4). Furthermore, internal consistency for the seven tasks was found to be poor (Cronbach’s alpha=0.58), and the seven items loaded on more than one factor explaining only 47.3% of the total variance (15).

Examiners in the present study were skilled, well experienced and certified to distinguish correct from poor executions (16). Pre-injury clearing and the FMS testing took place directly before the observation period.

Monitoring

The observation interval was covering ten weeks – two weeks of off-season just before the start of season (July 2013) and eight weeks from season start to the end of September.
The assessment protocol collected injuries (counts) and times of presence and absence of all players during the observation period separately for training (rounded for 30 minutes' increments) and competition (rounded for 5 minutes' increments). Injury incidence was calculated as the ratio of the exposure time divided by the number of injuries, and then transformed into counts per 1,000 hours.

An injury was counted, if training or competition had to be quit for the actual day and a following time-loss of at least three days. Due to the regular training frequency of two or three units per week, a shorter time-loss was not noted. Injury was defined as non-contact injuries of the lower limb (muscles, tendons, bones, and joints) including the hip and the groin without superficial skin lesions. ‘Paper and pencil’ documentation was executed by assistant coaches. Collected data were transferred monthly to the study conductors.

Statistics
Cases of injury were assessed as frequencies. The FMS score values were treated as scaled data (mean ±SD). The point biserial correlation (rpbis) was calculated to analyse associations between injury and FMS scores. Differences between samples – injured vs. uninjured players and dropped-out vs. remaining players – were tested by means of the non-parametric Mann/Whitney U-test. Significance was accepted at a level of p≤0.05.

Results
Starting with 221 players, there was a drop-out of 56% in total (Fig. 2). 63 players dropped out, partly explained by the general pre-season situation, where players change to other teams or clubs. 158 persons participated at the start-up FMS-screening. 34 players dropped-out due to communication problems between coaches, teams, assistant coaches and study conductors. Additionally, the documentation of exposure time and injuries was incomplete for some players (n=28).

With respect to following analyses, we analysed FMS scores of the dropped-out (total score 13.7±2.3pts., n=63) and the remaining players (total score 13.6±2.1pts., n=96), but did not find any significant differences (p>.05) (Tab. 1).

Within the remaining sample, distribution of execution quality most frequently showed the 2-point execution rating for almost all items except for the ‘Trunk Stability Push-Up’ (TSP) and the ‘Shoulder Mobility’ test (Fig. 3).

A frequency analysis revealed a ‘good pattern’ FMS result for 36% (35 out of 96 players), while 64% (61 out of 96) showed a ‘poor pattern’ total score relative to a cut-off value of ≤14 points.

The documentation revealed a total exposure time of 1,770 hours covering 289 competition hours and 1,481 training hours. Accordingly, we noted 10 injuries (4x groin, 4x adductor muscles, 1x calf muscles, and 1x ankle sprain), but none of them happening during competition. Injury incidence was
Injury incidence is known to be higher during competition (27.5 to 44.6 injuries per 1,000 h) compared to training hours (6, 18). As one player suffered from three injuries (groin and adductor muscles), there were only eight injured persons being compared to 88 uninjured players. Uninjured players were better in the ‘Hurdle Step’ task than injured players (uninjured 1.0±0.5 points vs. injured 1.6±0.5 points; Z=2.059, p=0.041). Apart from this, there were neither significant differences nor correlations in any other FMS result (Tab.1).

Discussion

We found no association between the FMS composite score and the injury state (rpbis=0.093, p=0.367), but a significant correlation for the ‘Hurdle Step’ task (rpbis=0.209; p=0.041), although uninjured and injured players differed merely (0.4 points) (Tab. 1). What was in line with recently published studies concluding that single FMS items could be helpful for injury prediction rather than the composite score (2, 15).

The ‘Hurdle Step’ task was found to be associated specifically with ankle injuries in elite-level male professional football players (22). An association, we cannot confirm in our study, where only one out of ten injuries concerned the ankle joint.

Previous studies in the field of amateur and professional football players covering one or more complete football seasons reported injury incidents during training varying from 4.1 to 11.2 injuries per 1,000 hours (6, 18). As all ten counts of injuries in the present study were noted exclusively for the training exposure time, the resulting injury incidence of 6.8 injuries per 1,000 training hours appeared to be comparable, although we observed ten weeks only and used a different definition of an injury and documentation protocol. We cannot explain why there was no injury noted for competition hours in our study. In general, injury incidence is known to be higher during competition (27.5 to 44.6 injuries per 1,000 h) compared to training hours (6, 18).

In fact, our results are limited due to the drop-out rate of more than fifty percent leading to a remaining sample size of 96 players and the uncertainty about probable injuries within the group of the dropped-out players. Obviously, the motivation was high in the beginning, but comparable to earlier investigations, compliance and adherence were fading away in the time course of monitoring (20, 21). Furthermore, the chosen definition of injury, the according time loss and the documentation setting affected our results for injury incidences providing problems for comparisons with other investigations (13). Probably, ceiling effects also affected our FMS results, when all players of a complete team had to be judged one after the other, although testers were certified and experienced.
Conclusion

Even if taking into account some experimental limitations, we conclude that the FMS does not allow a valid injury prediction in the field of amateur male football players.

With respect to experiences with different kinds of sports and confounding pre-injury effects, a fixed cut-off criterion of 14 points or less indicating increased injury risk is problematic. “More attention should be paid to the score of each task rather than the sum score when we interpret the functional movement screen scores” (15).

Conflict of Interest

The authors have no conflict of interest.

Remark

FMS is a registered trademark of Gray Cook (FunctionalMovement.com).

References

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