Original Research

Including performance level lowers prevalence of non-timeloss groin injury. A cross-sectional study in 383 female amateur football players

Rob R.F.H. Langhout [a, b, c, *], Igor J.R. Tak [b, c, d]

[a] Physiotherapy Dukenburg Nijmegen, Department of Manual Therapy and Sports Rehabilitation, Nijmegen, the Netherlands
[b] Amsterdam Collaboration for Health & Safety in Sports (ACHSS), AMC-VUmc IOC Research Center, Amsterdam, the Netherlands
[c] Academic Center for Evidence-Based Sports Medicine (ACES), Amsterdam, the Netherlands
[d] Physiotherapy Utrecht Oost, Department of Manual Therapy and Sports Rehabilitation, Utrecht, the Netherlands

A B S T R A C T

Objective: To study the preseason prevalence of groin injury with normal and reduced performance.
Design: Cross-sectional cohort.
Settings: Online survey.
Participants: 383 Dutch female amateur football players (35 teams).
Main outcome measures: Prevalence of groin injury per injury group (timeloss or non-timeloss) using a general questionnaire and per performance group (groin pain with normal or reduced performance) using subscales Pain and Participation in Physical Activities of the Hip And Groin Outcome Score (HAGOS). Levels and between-group differences of groin-related symptoms and problems (HAGOS) for injury and performance groups. The injury groups from which players with groin pain and normal performance originate.
Results: Prevalence of non-timeloss groin injury was 22% (95% confidence interval (95%CI) = 18–26) (n = 84), 7% (95%CI = 5–10) (n = 26) for timeloss groin injury, 21% (95%CI = 17–25) (n = 80) for pain + normal performance and 16% (95%CI = 12–20) (n = 61) for pain + reduced performance. HAGOS-scores differed between injury (P < .022) and performance groups (p < .043). Twenty-three players (27%) with pain + normal performance originated from the non-timeloss groin injury group (100%).
Conclusion: As female amateur football players with groin pain and normal performance are considered non-injured, the prevalence of non-timeloss groin injury lowers by a quarter. These players have lower HAGOS scores than non-injured players without pain yet higher scores than those with non-timeloss groin injury.

© 2019 Elsevier Ltd. All rights reserved.

1. Introduction

Injuries are a matter of interest for athletes, coaches, clubs, federations, healthcare practitioners and researchers (Fuller et al., 2006; Waldén, Hägglund, & Ekstrand, 2015). For the latter it is common to study timeloss as a determinant of injury (Fuller et al., 2006). There is growing awareness that the simple dichotomous classification on "whether you can play or not" does not cover the whole injury spectrum (Tak et al., 2016). Severity of timeloss, expressed as the days lost to play, is considered important and as such is explicitly stated in the first step of the sequence of

prevention model (Mechelen, Hlobil, & Kemper, 1992). Over the past years there is growing awareness that male football players, while still being in play, have levels of pain and symptoms up to some degree (Haroy et al., 2017; Thorborg, Branci, Stensbirk, Jensen, & Hölmich, 2014). This situation is referred to as non-timeloss injury (Fuller et al., 2006) and its presence can be studied by using patient reported outcomes which are considered the gold standard to reflect the individual's health perception on more than one domain (Patrick et al., 2007).

Levels of groin-related symptoms and problems in the young and athletic population is usually assessed using the Hip And Groin Outcome Score (HAGOS), informing about symptoms, performance and quality of life (Thorborg et al., 2011). Recent studies using the HAGOS struggled to distinguish athletes who are not really bothered by their presented lower scores from those who do. As a

threshold determinant has not yet been described, percentile calculations and interquartile classifications were both used (Langhout et al., 2018; Thorborg et al., 2014; Thorborg & Holmich, 2014). In this approach researchers set the threshold based on statistics but this goes beyond the athlete's perception reflected in a patient reported outcome. This leaves a gap in the instrument's interpretation (Thorborg et al., 2011).

Previous studies discussed on the severity of injury defining this item as a functional level instead of timeloss only (Bahr, 2009; Clarsen & Bahr, 2012; Clarsen, Rønsen, Myklebust, Flørenes, & Bahr, 2014). In addition, a recent study on athlete health and injury perceptions implemented a socioecological context in step 1 of the injury sequence model and identified factors that athletes find important (Bolling, Barboza, Mechelen, & Pasman, 2018a). Perceived reduced performance and the inability to manage that situation were found important in the decision algorithm to consider oneself injured (Bolling et al., 2018b). This novel information has led us to re-study HAGOS data from a large cohort of female amateur football players (Langhout et al., 2018). The objective was to analyse the frequency of players with normal and reduced performance (data from HAGOS) in a cohort of players without groin injury and those sustaining groin injury (data from general questionnaire). The first aim was to study the preseason prevalence of groin injury per injury group (no injury, timeloss and non-timeloss injury) using a general questionnaire and per performance group (no groin pain/groin pain with normal/reduced/no performance) using subscales Pain and Participation in Physical Activities of the HAGOS. Secondly we examined the levels and between-group differences of groin-related symptoms and problems (HAGOS) for injury and performance groups. Thirdly we studied from which injury groups players with groin pain and normal performance originated.

2. Methods

2.1. Design and participants

This was a cross-sectional study for injury redetermination in addition to the consensus on injury reporting in football (Bahr, 2009). A large previous cohort study reported on the injury prevalence within this population of Dutch adult female amateur football players (Langhout et al., 2018). The Dutch Central Committee on Research Involving Human Subjects (CCMO) confirmed exemption from full ethical approval prior to the study as stated in the Dutch Medical Research Involving Human Subjects Act (https://wetten.overheid.nl/BWBR0036864/2018-08-01). The 'Strengthening the Reporting of Observational Studies in Epidemiology' (STROBE statement) was adhered to in reporting the findings of this study (Von Elm et al., 2014). All participants were registered by the Royal Dutch Football Association (KNVB).

2.2. Study procedure

Participants completed a standardized injury questionnaire and the HAGOS in the preseason of 2015−2016 (August to October 2015), which was sent to them via an online registration system (Google Forms, Google LLC, Mountain View, USA) (see Appendix of a previous study (Langhout et al., 2018)). All participants gave permission for the use of their anonymized data for research purposes. Questions and remarks concerning the study could be made via email and the questionnaire. When mail was not responded in 5 days, participants were sent a reminder. In the questionnaire timeloss and non-timeloss groin injuries were reported for the preseason of 2015−2016 season. Groin injury was clearly defined and the groin region was referred to as 'the region between the

front of the hip and the inner front of the thigh'. To minimize recall bias, figures with injury locations were used (see appendix). Also, dichotomous answer options were used (Patrick et al., 2007).

2.3. Hip And Groin Outcome Score (HAGOS)

The HAGOS is a questionnaire containing 37 items to assess the level of hip- and groin-related problems for all players on 6 subscales and covers the clinical situation of the past week prior to completion (Thorborg et al., 2011). The HAGOS is available in Dutch language and was found to be reliable (ICC's between 0.83 and 0.87), internally consistent (Cronbach's α between 0.81 and 0.92) and valid in young athletes (including football players) and comparable to the original Danish version (Tak, Tijssen, Schamp, Sierevelt, & Thorborg, 2018b). The HAGOS is freely available in several languages (http://www.koos.nu).

2.4. Definitions of groin injury and performance groups

Players were classified for groin injury and performance. Groin injury groups were derived from the questionnaire: non-injured (NI), non-timeloss groin injury (NTL-GI) and timeloss groin injury (TL-GI). Performance groups were defined using the HAGOS subscales Pain (P) and Participation in Physical Activities (PA). Subscale P contains 7 items asking for the frequency and amount of groin pain whereas the 2-item PA subscale asks for the ability to participate in sports in terms of performance level and duration. Performance groups were classified using combinations of both subscales: 'No groin pain' was indicated by a 100 score on the subscale P and lower scores defined any groin pain to be present. A 100 score on the PA subscale defined 'normal performance' where lower PA scores defined 'lower performance'. Performance group 1 (No pain) was defined as (P = 100 + PA ≤100); performance group 2 (Pain + normal performance) was defined as (P < 100 + PA = 100); performance group 3 (Pain + reduced performance) was defined as (P < 100 + PA<100 + playing) and group 4 (Pain + no performance) was defined as (P < 100 + PA<100 + not playing). Group 3 and 4 then represent non-timeloss and timeloss groin injuries, respectively. Information on playing ability was derived from the questionnaire. See Table 1.

2.5. Statistical analysis

The data were tested for normality using a Kolmogorov-Smirnov procedure. Normally distributed data are presented as mean and standard deviation (SD). Non-normally distributed data are presented as a median and 25−75% interquartile range (IQR). A Mann-Whitney *U* test was used to examine differences in HAGOS scores between injury and performance groups. All performance groups were examined for the frequency (number and rate) of players being injured (NTL or TL) or not. Incorrect or missing data were reported and corrected by the means of the variables and frequencies. The level of significance was set at $\alpha < 0.05$. The data were analysed using SPSS 23 (IBM, Armonk, USA).

3. Results

3.1. Participants

From the 43 invited teams from all KNVB districts and amateur playing levels, 8 declined (120 players). From these, 35 teams (response rate 81%) were willing to participate. This resulted in 525 female players, from whom 91 (17%) failed to meet the inclusion criteria of being at least 18 years of age (n = 89) or participating in the included playing levels (n = 2 veterans league). There were no

Table 1
Injury groups (data from questionnaire) and classification of performance groups (HAGOS data) (N = 383). Performance groups 3 and 4 were further classified for playing ability (questionnaire).

Injury groups	Performance groups	HAGOS-subscale			Questionnaire
		P		PA	
No groin pain	1 No pain	=100	+	≤100	
Groin pain:	2 Pain + normal performance	<100	+	=100	
NTL-GI	3 Pain + reduced performance	<100	+	<100	+ Playing
TL-GI	4 Pain + no performance	<100	+	<100	+ Not playing

Abbreviations: P = Pain; PA = Participaption in Physical activities; NTL-GI = non-timeloss groin injury; TL-GI = timeloss groin injury.

dropouts, so data from 383 players were used for the analysis (Figure 1).

The players' characteristics are presented in Table 2.

3.2. Hip And Groin Outcome Score for injury groups

The prevalence of players per injury group (n, %) and their 95% confidence interval (95%CI) is depicted in Table 3. Players with timeloss and non-time loss groin injury had lower HAGOS subscale scores than non-injured players (all P < .001). The players with timeloss groin injury had lower HAGOS scores than those with non-timeloss groin injury except for subscales pain and ADL. See Table 3 and Figure 2A.

3.3. Hip and groin outcome score for performance groups

The prevalence of players for each performance group (N, %, 95% CI) is depicted in Table 4. For performance groups, players without groin pain (group 1) had higher HAGOS scores than those with groin pain and normal performance (group 2) but not for the PA subscale (due to cut-off point). Group 2 showed significantly higher scores than groups 3 and 4 for all subscales whereas group 3 had higher subscale scores for symptoms, SR, PA and QOL than group 4. (See Table 4 and Figure 2B).

Table 2
Player characteristics (n = 383) presented as mean (SD, range) or median (IQR 25–75). Exposure is presented for the previous season (2014–2015). Top Class playing level represents the highest amateur level without receiving payment.

Age (y)	24.1 (5.2; 18–52)
Height (cm)	170.7 (6.2; 155–190)
Weight (kg)	66.6 (8.9; 46–110)
Body mass index (kg/m^2)	22.6 (2.7; 17.1–40.0)
Match exposure (total matches per season)	20.9 (8.5; 0–46)
Training exposure (hours per week)	3.0 (1.5; 0–12)
Playing level, n (%)	
Top Class	19 (5)
Sub-top Class	41 (11)
1st Class	47 (12)
2nd Class	48 (13)
3rd Class	32 (8)
4th Class	86 (23)
5th Class	78 (20)
6th Class	30 (8)
Leg dominance, n (%)	
Left	41 (11)
Right	342 (89)
HAGOS subscales	
Pain (P)	100.0 (90.0–100.0)
Symptoms (S)	89.3 (78.6–100.0)
Function in daily living (ADL)	100.0 (95.0–100.0)
Function in sport and recreation (SR)	100.0 (84.4–100.0)
Participation in Physical Activities (PA)	100.0 (75.0–100.0)
Groin-related Quality of Life (QOL)	100.0 (85.0–100.0)

Abbreviations: n = number; SD = standard deviation; IQR = interquartile range; y = years; cm = centimetre; kg = kilogram; kg/m^2 = kilogram/square metre.
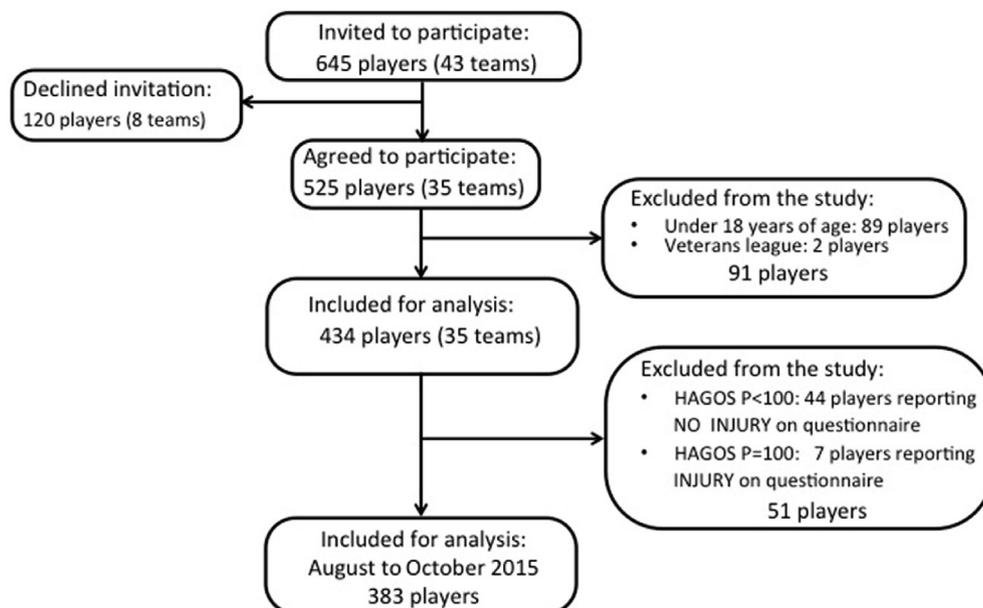

Fig. 1. Player's flow chart.

Table 3
Prevalences (n, %, 95%CI) and HAGOS-scores (median, IQR) for groin injury groups (n = 383).

Subscale	No GI n = 273 (71%; 95%CI 67–76)	P	NTL-GI n = 84 (22%; 95%CI 18–26)	P	TL-GI n = 26 (7%; 95%CI 5–10)
Pain	100 (100-100)	**<.001**	85 (80–93)	.079	81 (68–91)
SYMP	100 (89–100)	**<.001**	79 (69–82)	**.022**	71 (55–80)
ADL	100 (100-100)	**<.001**	90 (75–100)	.281	80 (74–96)
SR	100 (100-100)	**<.001**	80 (72–93)	**.002**	61 (40–85)
PA	100 (100-100)	**<.001**	75 (75–100)	**<.001**	69 (47–78)
QOL	100 (100-100)	**<.001**	85 (70–95)	**<.001**	65 (50–76)

Abbreviations: n = number; (CI = confidence interval; HAGOS = Hip And Groin Outcome Score; IQR = Inter Quartile Range; GI = groin injury; NTL = non-timeloss; TL = timeloss; SYMP = Symptoms; ADL = Physical function in daily living; SR = Physical function in sport and recreation; PA = Participation in physical activities; QOL = Groin-related quality of life.
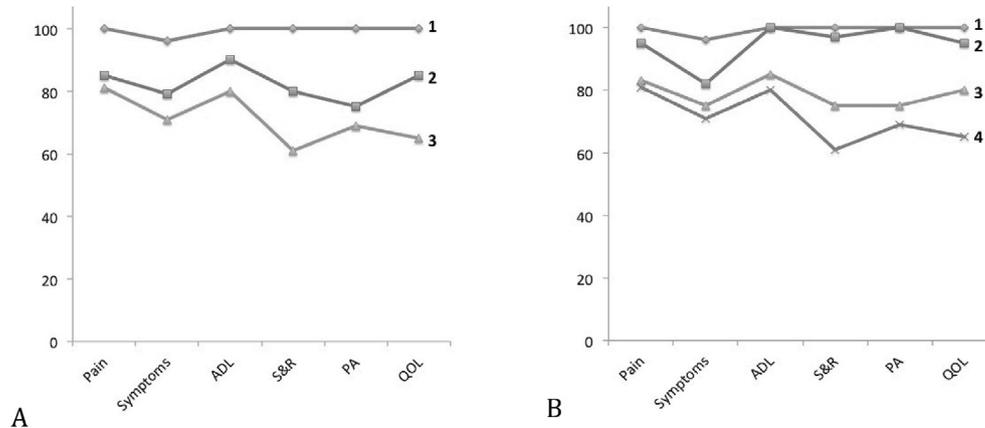

Fig. 2. A: Preseason HAGOS-scores (median) for injury groups: (1) non-injured, (2) non-timeloss and (3) timeloss groin injury B: Preseason HAGOS-scores (median) for performance groups: (1) No pain, (2) Pain + normal performance (3) Pain + reduced performance and (4) Pain + no performance

Table 4
Prevalences (n, %, 95%CI) and HAGOS-scores (median, IQR) for performance groups (n = 383).

Subscale	1 No pain n = 216 (56%; 95%CI 51–61)	P	2 Pain + NORM P n = 80 (21%; 95%CI 17–25)	P	3 Pain + RED P n = 61 (16%; 95%CI 12–20)	P	4 Pain + NO P n = 26 (7%; 95%CI 5–10)
Pain	100 (100–100)	**<.001**	95 (85–98)	**<.001**	83 (76–82)	.355	81 (68–91)
SYMP	96 (93–100)	**<.001**	82 (79–89)	**<.001**	75 (68–82)	.123	71 (55–80)
ADL	100 (100–100)	**<.001**	100 (90–100)	**<.001**	85 (75–98)	.491	80 (74–96)
SR	100 (100–100)	**<.001**	97 (88–100)	**<.001**	75 (69–84)	**.016**	61 (40–85)
PA	100 (100–100)	.784	100 (100–100)	**<.001**	75 (75–75)	**.043**	69 (47–78)
QOL	100 (100–100)	**<.001**	95 (85–100)	**<.001**	80 (60–90)	**.006**	65 (50–76)

Abbreviations: n = number; CI = confidence interval; HAGOS = Hip And Groin Outcome Score; IQR = Inter Quartile Range; NORM P = normal performance; RED P = reduced performance; No P = no performance; SYMP = Symptoms; ADL = Physical function in daily living; SR = Physical function in sport and recreation; PA = Participation in Physical activities; QOL = Groin-related quality of life.

3.4. Performance groups and player profile

Table 5 shows the injury profile for all players per performance group. It shows that the No injury group contained 57 players (21%) who had reported pain (P < 100) and normal performance (PA = 100) according the HAGOS. The non-timeloss group contained 23 players (27%) who had reported normal performance (PA = 100).

4. Discussion

This study showed that when performance levels are accounted for in the injury definition the prevalence of non-timeloss groin injury lowers a quarter.

The consensus statement on injury reporting in football (Fuller et al., 2006) suggests studying complaints with and without medical care, referred to as timeloss injury and non-timeloss injuries.

Table 5
Injury profile for all players per performance group (HAGOS), expressed as the injury status reported by questionnaire (n = 383) (n, %).

Performance groups Injury groups	No Pain n = 216 (56%)	Pain + Norm P n = 80 (21%)	Pain + Red P n = 61 (16%)	Pain + No P n = 26 (7%)
No injury n = 273 (71%)	216	57	0	0
NTL-GI n = 84 (22%)	0	23	61	0
TL-GI n = 26 (7%)	0	0	0	26

Abbreviations: HAGOS = Hip And Groin Outcome Score; n = number; GI = groin injury; NTL = non-timeloss injury; TL = timeloss injury; NORM P = normal performance; RED P = reduced performance; No P = no performance.

Previous injury studies focussing on timeloss injury have as such underestimated the true burden of sports injury as many players with groin-related complaints continue to play and train (Langhout et al., 2018; Tak et al., 2018a). On the other hand including all players with some pain and symptoms do likely overestimate the injury burden.

4.1. Performance and prevalence

Prevalence rates of non-timeloss injuries were found 3—5 times higher than those with timeloss (Haroy et al., 2017; Langhout et al., 2018; Powell & Dompier, 2004). Groin injury prevalence rates were twice as high for male (4—19%) compared to female football professionals (2—9%) (Thorborg et al., 2014; Waldén et al., 2015). Prevalence rates in Dutch female amateur football players (NTL-GI 36%, TL-GI 11%) were comparable to those in Norwegian female professionals (NTL-GI 36%, TL-GI 9%) (Haroy et al., 2017; Langhout et al., 2018).

In their work of studying the magnitude and severity of overuse injuries, Clarsen and Bahr et al. studied the functional level of injured athletes by use of the Oslo Trauma Research Center Questionnaire (OSTRCQ) (Bahr, 2009; Clarsen & Bahr, 2012; Clarsen et al., 2014). Recently Bolling et al. studied the decision algorithm of when athletes consider themselves injured. The discriminant factor of these studies was that players with pain and symptoms were considered injured in case of a loss of their required performance level (Bolling et al., 2018b; Clarsen & Bahr, 2012). As a result of implementing performance level in this study the injury prevalence rate of non-timeloss groin injury drops by a quarter from 22% to 16%. As a consequence, the group of players with groin pain and normal performance increases to 21%. The prevalence of timeloss groin injuries did not alter. These results are in line with previous studies of taking hampered performance levels into account to prevent from overestimation of non-timeloss injury and from underestimating timeloss injury (Bahr, 2009; Bolling et al., 2018b; Clarsen & Bahr, 2012).

4.2. Cut-off point for performance

In our current study we examined the players' perception using a patient reported outcome measure (HAGOS). We used the subscales Pain (P) and Participation in Physical activities (PA) for this purpose. The PA subscale has been referred to as a subscale of which the true meaning needs further study as it does not seem to be strongly related to other groin outcome scores or generic measures of physical functioning (Thorborg & Holmich, 2014). The 2 items measuring the patients' ability to perform preferred physical activities for as long as they want (item 1) and at their normal performance level (item 2) do vividly represent the athlete's perception of any hampered performance level being present or not.

Critical comments have been made on ceiling effects of the HAGOS PA subscale being present as when a 100 score is obtained no further improvements can then be observed (Kemp, Collins, Roos, & Crossley, 2013). As a 100 score indicates no restrictions what so ever in perceived and required performance levels this truly represents the above mentioned athletes perception of injury (Bolling et al., 2018a). Therefor ceiling effects of this subscale may not be considered a negative issue.

4.3. HAGOS-scores and injury profile

In the sequence of injury prevention, injury severity was defined as the duration of timeloss (Mechelen et al., 1992). Previous studies also described severity by using the HAGOS, measuring the level of

groin-related problems (Langhout et al., 2018; Tak et al., 2018b; Thorborg & Holmich, 2014). Other studies defined severity by identifying functional levels using the OSTRCQ (Bahr, 2009; Clarsen & Bahr, 2012; Clarsen et al., 2014). This questionnaire prevents from underestimation as it not only measures the magnitude and functional level of timeloss injury yet also of pain and symptoms (non-timeloss injury) (Clarsen & Bahr, 2012). Recent studies also suggested taking performance level into account thereby having the athlete decide him/herself on being injured or not (Bolling et al., 2018a, 2018b).

Including performance level into injury decision-making of those with groin pain adds a new subgroup to the existing classification (timeloss, non-timeloss, medical attention) being the players with pain with normal performance. This defines non-timeloss injury as pain with reduced performance. The players from the new group (pain with normal performance) consider themselves non-injured, thereby increasing the non-injured group. In this study these players originated from the group of players who already considered themselves non-injured (n = 57) and from those with non-timeloss injury (n = 23). Thus including performance in defining injury reduces the non-timeloss groin injury group by a quarter. Compared to non-timeloss injury those with pain with normal performance had higher (better) scores for all HAGOS subscales (P < .001) and the players with timeloss groin injury (no performance) had the worst scores on performance level (Function in sports and recreation and Physical activity) and Quality of life (QOL). These results agree with a previous study for timeloss and non-timeloss groin injury (Langhout et al., 2018).

To underline the relevance of performance levels as suggested by previous studies (Bahr, 2009; Bolling et al., 2018a, 2018b; Clarsen & Bahr, 2012; Clarsen et al., 2014) this study quantified prevalence rates of groin injury form a previous study after correcting for performance level. Thereby we avoided underestimation of the actual injury burden of (overuse) injuries, as both NTL-GI and TL-GI were assessed. Players self-reported their injuries instead of medical staff, as many amateur clubs have no structured medical care. There were no missing data as the electronic system did not allow for incomplete surveys.

This study has its limitations. This was a cross-sectional study on historical data in which potential confounders were not assessed. There was no physical examination by the medical staff and therefore groin injury could not be diagnosed according the entity classification (Weir et al., 2015; Serner et al., 2015). Players were not directly asked for perceived performance yet this was derived from HAGOS-scores leading to exclusion of 51 players (7 players reporting P = 100 score on HAGOS and 'injured' on the injury questionnaire and 44 with P < 100 reporting 'no injury'). A cut-off point of 100 median score for subscale pain and PA should be further evaluated and validated. Players who responded at the beginning of the surveillance period had less time to become injured or to recover than players who responded at the end.

4.4. Future perspectives

Including performance level from an athlete's perspective in injury reporting seems promising and consensus is needed on this item. The use of PROM's provide new insight and their cut-off points should be developed for measuring performance level and to compare between studies. Perceived performance levels should specifically be adressed in these PROM's like in the HAGOS.

5. Conclusion

When players with groin pain and normal performance are considered non-injured the prevalence of non-timeloss groin injury

lowers by a quarter in female amateur football. These players sustain more groin-related problems (HAGOS) than non-injured players without pain and less problems than those with non-timeloss groin injury.
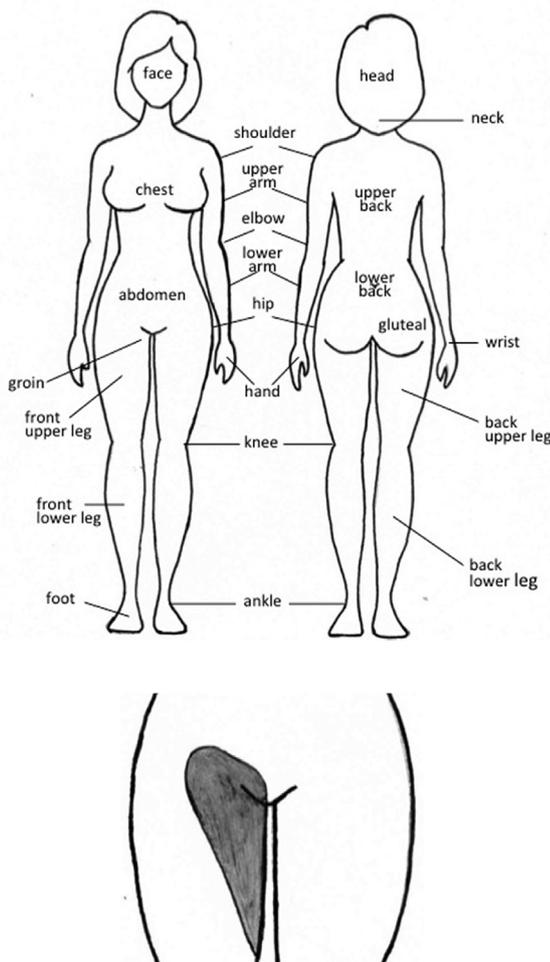
Funding

None.

Declaration of competing interest

None.

Appendix

References

Bahr, R. (2009). No injuries, but plenty of pain? On the methodology for recording overuse symptoms in sports. *British Journal of Sports Medicine, 43*, 966—972. https://doi.org/10.1136/bjsm.2009.066936.

Bolling, C., Barboza, S. D., Mechelen, W Van, & Pasman, H. R. (2018). How elite athletes, coaches, and physiotherapists perceive a sports injury. *Translational Sports Medicine, 48*, 2233—2240. https://doi.org/10.1002/tsm2.53.

Bolling, C., Mechelen, W Van, Pasman, H. R., & Verhagen, E. (2018). Context matters: Revisiting the first step of the 'sequence of prevention' of sports injuries. *Translational Sports Medicine, 48*, 2233—2240. https://doi.org/10.1002/tsm2.53.

Clarsen, B., & Bahr, R. (2012). Matching the choice of injury/illness definition to study setting, purpose and design: One size does not fit all! *British Journal of Sports Medicine, 48*, 510—512. https://doi.org/10.1136/bjsports-2013-093297.

Clarsen, B., Rønsen, O., Myklebust, G., Flørenes, T. W., & Bahr, R. (2014). The Oslo sports Trauma research center questionnaire on health problems: A new approach to prospective monitoring of illness and injury in elite athletes. *British Journal of Sports Medicine, 48*, 754—760. https://doi.org/10.1136/bjsports-2012-092087.

Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Dvorak, J., et al. (2006). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Scandinavian Journal of Medicine & Science in Sports, 16*, 83—92. https://doi.org/10.1111/j.1600-0838.2006.00528.x.

Haroy, J., Clarsen, B., Thorborg, K., Holmich, P., Bahr, R., & Andersen, T. E. (2017). Groin problems in male soccer players are more common than previously reported. *The American Journal of Sports Medicine, 45*, 1304—1308. https://doi.org/10.1177/0363546516687539.

Kemp, J. L., Collins, N. J., Roos, E. M., & Crossley, K. M. (2013). Psychometric properties of patient-reported outcome measures for hip arthroscopic surgery. *The American Journal of Sports Medicine, 41*, 2065—2073. https://doi.org/10.1177/0363546513494173.

Langhout, R., Weir, A., Litjes, W., Gozeling, M., Stubbe, J. H., & Kerkhoffs, G. (2018). Hip and groin injury is the most common non-time-loss injury in female amateur football. *Knee Surgery, Sports Traumatology, Arthroscopy, 27*, 3133—3141. https://doi.org/10.1007/s00167-018-4996-1.

Mechelen, W Van, Hlobil, H., & Kemper, H. C. G. (1992). Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. *Sports Medicine, 14*, 82—99.

Patrick, D. L., Burke, L. B., Powers, J. H., Scott, J. A., Rock, E. P., Dawisha, S., et al. (2007). Patient-reported outcomes to support medical product labeling claims: FDA perspective. *Value in Health, 10*(SUPPL 2), S125—S137. https://doi.org/10.1111/j.1524-4733.2007.00275.x.

Powell, J. W., & Dompier, T. P. (2004). Analysis of injury rates and treatment patterns for time-loss and non—time-loss injuries among collegiate student-athletes. *Journal of Athletic Training, 39*, 56—70.

Serner, A., Tol, J. L., Jomaah, N., Weir, A., Whiteley, R., Thorborg, K., et al. (2015). Diagnosis of acute groin injuries. A prospective study of 110 athletes. *The American Journal of Sports Medicine, 43*, 1857—1864. https://doi.org/10.1177/0363546515585123.

Tak, I., Glasgow, P., Langhout, R., Weir, A., Kerkhoffs, G., & Agricola, R. (2016). Hip range of motion is lower in professional soccer players with hip and groin symptoms or previous injuries, independent of cam deformities. *The American Journal of Sports Medicine, 44*, 682—688. https://doi.org/10.1177/0363546515617747.

Tak, I., Langhout, R., Bertrand, B., Barendrecht, M., Stubbe, J., Kerkhoffs, G., et al. (2018). Manual therapy and early return to sport in football players with adductor-related groin pain: A prospective case series. *Physiotherapy Theory and Practice, 11*, 1—10. https://doi.org/10.1080/09593985.2018.1531096 [Epub ahead of print].

Tak, I., Tijssen, M., Schamp, T., Sierevelt, I., & Thorborg, K. (2018). The Dutch hip and groin outcome score: Cross-cultural adaptation and validation according to the COSMIN checklist. *Journal of Orthopaedic & Sports Physical Therapy, 48*, 299—306. https://doi.org/10.2519/jospt.2018.7883.

Thorborg, K., Branci, S., Stensbirk, F., Jensen, J., & Hölmich, P. (2014). Copenhagen hip and groin outcome score (HAGOS) in male soccer: Reference values for hip and groin injury-free players. *British Journal of Sports Medicine, 48*, 557—559. https://doi.org/10.1136/bjsports-2013-092607.

Thorborg, K., & Holmich, P. (2014). Measurement qualities of hip and groin outcome scores: Letter to the editor. *The American Journal of Sports Medicine, 42*, NP7—NP10. https://doi.org/10.1177/0363546513514718.

Thorborg, K., Holmich, P., Christensen, R., Petersen, J., Roos, E. M., & Hölmich, P. (2011). The copenhagen hip and groin outcome score (HAGOS): Development and validation according to the COSMIN checklist. *British Journal of Sports Medicine, 45*, 478—491. https://doi.org/10.1136/bjsm.2010.080937.

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2014). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. *International Journal of Surgery, 12*, 1495—1499. https://doi.org/10.1016/j.ijsu.2014.07.013.

Waldén, M., Hägglund, M., & Ekstrand, J. (2015). The epidemiology of groin injury in senior football: A systematic review of prospective studies. *British Journal of Sports Medicine, 49*, 792—797. https://doi.org/10.1136/bjsports-2015-094705.

Weir, A., Brukner, P., Delahunt, E., Ekstrand, J., Griffin, D., Khan, K., et al. (2015). Doha agreement meeting on terminology and definitions in groin pain in athletes. *British Journal of Sports Medicine, 49*, 768—774. https://doi.org/10.1136/bjsports-2015-094869.