Title: A multi-nation examination of the fatigue and recovery time course during the inaugural Under-18 Six Nations rugby union competition

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A multi-nation examination of the neuromuscular and perceptual fatigue responses during the inaugural Under-18 Six Nations rugby union competition

Abstract

The purpose of this study was to investigate the neuromuscular and perceptual fatigue responses of elite rugby players during the inaugural Under-18 (U18) Six Nations Festival. One hundred and thirty-three male players from five national squads (73 forwards, 60 backs) were examined during the competition. Each national squad was involved in three matches separated by 96 hours each. Over the competition, players completed a daily questionnaire to monitor perceived well-being (WB) and performed daily countermovement jumps (CMJ) to assess neuromuscular function (NMF). Reductions in WB were substantial 24 hours after the first and second match in forwards (d=0.77±0.21, p<0.0001; d=0.84±0.22, p<0.001) and backs (d=0.89±0.22, p<0.0001; d=0.58±0.23, p<0.0001) but reached complete recovery in time for the subsequent match. Reductions in CMJ height were substantial 24 hours after the first and second match for forwards (d=0.31±0.15, p=0.001; d=0.25±0.17, p=0.0205) and backs (d=0.40±0.17, p=0.0001; d=0.28±0.17, p=0.0062) and recovered at 48 hours after match-play. Average WB and CMJ height attained complete recovery within matchday cycles in the investigated international competition. The findings of this study can be useful for practitioners and governing bodies involved with fixture scheduling and training prescription during competitive periods.

Keywords: wellbeing, neuromuscular function, muscle damage, team sport

A multi-nation examination of the neuromuscular and perceptual fatigue responses during the inaugural Under-18 Six Nations rugby union competition

Introduction

Rugby union is an intermittent team sport, characterised by high-intensity periods of match play (e.g., high-intensity running, ball carrying, tackling), interspersed with low-intensity activity over 80 minutes in seniors and over 70 minutes at under-18 (U18) level[1]. These match demands result in increased markers of muscle damage alongside neuromuscular and perceptual fatigue post-match-play.[2,3] Typically, during a regular playing season, senior elite players play one match per week,[4] arguably allowing sufficient time to ensure complete recovery between matches.[5] In contrast, congested fixtures may occur within short tournaments, such as the Rugby World Cup. Thus, the accumulation and dissipation of fatigue might lead to players competing in a sub-optimal state, before fully recovering from the previous match.[6]

Congested competition schedules that involve multiple matches with shorter recovery times are commonplace in youth elite squads,[7] especially at the international level. For example, the inaugural U18 Six Nations Festival (the U18 equivalent to the highly recognised Six Nations Tournament) required national teams to play three matches over nine days. If the recovery time between matches is insufficient, fatigue accumulation could potentially have negative effects on players' welfare and performance,[8,9] and as such, have significant implications for competition organisers and national governing bodies.

Fatigue induced by rugby match-play and its succeeding recovery kinetics has been previously investigated.[10] For example, decreases in neuromuscular function (NMF) assessed by countermovement jumps (CMJ) can persist for up to 48 hours post-match.[3] Biochemical markers such as salivary cortisol and testosterone concentrations require up to 60 hours to return to baseline.[2] Similarly, elevations in concentration of plasma creatine kinase ([CK]) have been related to muscle damage[11] and can remain elevated for 72 hours after a match in elite academy players.[3] Perceptions of well-being (WB) have also been recommended for investigating players' response to match-play in both senior and youth elite populations.[3,9,12,13] Decreases in perception of WB can last for up to 72 hours after match-play.[3] Given the available evidence describing the time course of recovery following rugby matches, it would appear that a tournament with congested fixtures may provide players with insufficient time to recover.

To date, most of the research investigating post-match fatigue in rugby union has focused upon single-match observations.[3,12,14] However, these 'one-off' observations might not account for the large match-to-match variations in physical demands[15] or neglect potential residual fatigue resulting from previous match-play.[9] Johnston et al.,[9] previously observed the presence of residual fatigue in school rugby league players aged 16.6 ± 0.2 years when five matches were played over a five-day period. However, these findings may not be reflective of rugby union international-level competitions, where differences between rugby codes,[16] scheduling and player's characteristics, such as lower body strength, exist.[17] Within rugby union, Lacome et al.,[7] monitored the NMF, WB and [CK] of players from a single national team during an under-20 (U20) Rugby Union World Cup. Matches were separated by 94 to 120 hours, and no tendency for progressive deterioration of the assessed variables was reported. Nevertheless, the inclusion of a single team was a self-acknowledged limitation of their research, and the scheduling of fixtures is different during the U20 competition, in comparison to the U18 Six Nations competition.

To our knowledge, no study has evaluated the fatigue and recovery kinetics of youth elite rugby players from multiple squads during a period of intensified international competition. Therefore, the purpose of this study was to evaluate the effects of playing multiple matches during the inaugural U18 Six Nations competition on lower body NMF and perceptual WB using an enhanced multi-nation sample.

Methods

Participants

One-hundred and thirty-three international-level male U18 rugby union players (age 17.7 ± 0.3 years; stature 186.9 ± 7.4 cm; body mass 92.5 ± 13.3 kg) from five different European national squads participated in this study. Participants were divided into positional groups as forwards (n = 73, stature = 190.5 ± 6.3 cm, body mass = 108.9 ± 11.3 kg) and backs (n = 60, stature = 182.4 ± 6.3 cm; body mass = 84.4 ± 8.9 kg). Participants were selected to represent their country during the inaugural edition of the Six Nations Festival. The competition was held in Cardiff, Wales, during March and April 2018 and no participant travelled more than a single time zone to the tournament site. Before data collection, participants received verbal and written explanations of the study in their home language and signed informed consent to provide daily WB information and undertake daily NMF tests throughout the competition. If required, forms were translated by a certified translator and later verified by a staff member of the respective nation. Ethics approval was obtained from the university local research ethics committee.

Study design

A prospective, observational, longitudinal design was used to assess the post-match recovery profiles of forwards and backs during a period of congested fixtures of an international competition (2018 U18s Six Nations Festival). Each national squad played three matches against three different opposing teams over a nine-day period. Matches were separated by an average of 94.5 ± 2.6 hours, and the starting time varied between 12:00 and 15:00. The five nations involved in this study followed similar schedules through matchday cycles, as determined by their respective staff, consisting of: *Matchday -1 (Team run), Matchday, Matchday + 1 (Recovery session), Matchday + 2 (On-field rugby session), Matchday -1 (Team run), etc.* Testing was conducted on each camp day before undertaking any physical exertion and before breakfast within a two-hour window (07:30 – 09:30) to avoid diurnal effects on performance. Participants followed at least three consecutive days of familiarisation trials before the first match (MD1) with the testing protocol to minimise systematic error.[18] Playing time was recorded by each nation's coaching staff, and participants played an average of 53 ± 19 minutes per match. One hundred and fourteen players played three matches, 14 players played two matches, and 5 players played a single match. Only data from participants who played 20 minutes or more were analysed within the subsequent matchday cycle (MD1 n = 116; MD2 n = 119) for consistency with literature in fatigue and recovery[19] and in youth rugby union.[20] Playing times were obtained from official team reports.

Experimental procedures

Lower-body NMF

Lower-body NMF was assessed using jump height calculated from a CMJ. CMJ height is a commonly used metric for assessing lower-body NMF,[10] and has a typical error less than its smallest worthwhile change (SWC).[18] The CMJs were performed on a portable force platform (Pasport Force Platform, PASCO Scientific, California, USA), attached to a laptop with software (PASCO Capstone, PASCO Scientific, California, USA) and measured ground reaction forces at 500 Hz. Concurrent validity has been reported elsewhere.[21] A standardised two-minute warm-up consisting of dynamic stretching was performed before the performance tests (walking lunges, squats, heel flicks, high knees, skipping, leg swings and three practice submaximal CMJs). Following the warm-up, players performed two maximum CMJs.[3] Participants began standing on the force platform with knees extended and feet in a position of their choice. Players were instructed to keep their hands on their hips and jump as high as possible. The depth of the countermovement was at the discretion of the participant as its effect on CMJ height has shown to be only marginal and, therefore, does not need to be stabilised.[22] The average CMJ height was recorded for analysis as recommended by a recent meta-analysis (CV = 14%).[23]

Perception of well-being

An electronic questionnaire was built in Google Forms (Google, CA, USA) and used to daily assess overall perception of WB by summing the scores from the following subscales; sleep, fatigue, muscle soreness, stress and mood. Each item was rated on a five-point Likert scale with one score increments as described in previous research.[12] The lowest possible score was five points and the highest 25 points. Reliability of this method has been reported (CV=7.1%).[24] Participants completed the questionnaire on their mobile phone on their own to prevent any influence from other players.

Statistical Analyses

Data were analysed using SAS University Edition (SAS Institute, Cary, NC). Daily CMJ measures were log-transformed to reduce bias as a result of non-uniformity error, and perceptual WB data were analysed as a percentage of the highest possible score. Data were all analysed using linear mixed modelling (Proc Mixed). Linear mixed modelling has been deemed more appropriate than parametric statistics for accommodating nested data and when sphericity cannot be assumed on repeated measures designs.[25] Individual athletes were specified as random effects to allow for different within-subject standard deviations by the use of random intercepts. Playing position (forward or back) and day (referring to the day of the competition) were added as fixed factors and provided estimated means for the WB and CMJ scores for each day. Pairwise differences between competition days relative to baseline (pre-MD1) were further inspected for practical significance using magnitude-based inferences.[26] The threshold for a change to be considered practically important (SWC) was set at 0.2 x between-subject standard deviation (SD), based on Cohen's *d* effect size (ES) principle. Thresholds ES were set as: <0.2 *trivial;* 0.2 *small*; 0.6 *moderate*; 1.2 *large*, and 2.0 *very large*. The probability that the magnitude of change was greater than the SWC was rated as <0.5%, *almost certainly not*; 0.5-5%, *very unlikely*; 5-25%, *unlikely*; 25-75%, *possibly*; 75-95%, *likely*; 95-99.5%, *very likely*; >99.5%, *almost certainly*. Where the 90% confidence interval (CI) crossed both the upper and lower boundaries of the SWC (ES±0.2), the magnitude of change was described as *unclear*.[26] Statistical significance is also reported, and significance was set at an alpha level of $P < 0.05$.

Results

Lower-body NMF

Figure 1 presents the changes in CMJ height in forwards and backs during the competition. In forwards, changes in CMJ returned to baseline by 48 hours after MD1 and MD2. In backs, CMJ performance returned to baseline 48 hours following MD1 and MD2. There was a *small* increase in CMJ performance in backs at 72 hours after MD2. Daily mean and SD values for CMJ height are presented in Table 1.

Insert figure 1 near here please

Well-being

Figure 2 presents the changes in perceptions of WB in forwards and backs during the competition. In forwards, changes in perceptions of WB returned to baseline by 72 hours after MD1 and MD2. In backs, changes in perception of WB returned to baseline at 48 hours after MD1, dropped again at 72 hours and recovered at 96 hours. Perception of WB in the same positional group recovered by 72 hours after MD2 and substantially increased at the 96-hour mark. Daily mean and SD values for WB are presented in Table 1. Table 2 shows daily values for the WB subscales in forwards and backs. In forwards, self-reported fatigue and muscle soreness returned to baseline at 72 hours after MD1 and MD2. Stress, sleep quality and mood showed no changes on this positional group. In backs, self-reported fatigue returned to baseline 48 hours after MD1 and 72 hours after MD2. Muscle soreness returned to baseline at 48 hours after MD1, increased again at 72 hours and recovered at 96 hours. When examining the second matchday cycle, muscle soreness recovered at 48 hours from match play. Self-reported mood in backs was lower at 24 hours after MD1 and MD2 but recovered at 48 hours after each match. No practically important differences were identified in backs' self-reported sleep quality and stress.

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Discussion

The present study utilised an enhanced multi-nation sample to analyse the time course of recovery of lower-body NMF and perceptual WB during the inaugural U18 Six Nations rugby union competition. The main findings showed that it takes about 48 and 72 hours for NMF and perception of WB respectively to recover following a match. Of note, there was no clear tendency for progressive deteriorations of NMF or WB throughout the investigated tournament, following similar recovery kinetics than what has been observed in single match designs.[3]

Reductions in lower-body NMF were *small* 24 hours after MD1 and MD2, but only *trivial* 48 hours after MD1 and MD2. These findings are consistent with those reported in rugby union and rugby league literature.[3,27] Decreased lower-body NMF might be caused by reductions in contraction velocity associated with increased muscle damage from eccentric exercise.[28] Also, reductions in voluntary muscle activation as a result of central fatigue may also have contributed to reductions in NMF.[29] A *small* increase in lower-body NMF compared to baseline was found in backs at 72 hours after MD2. It has been seen that measurements demanding cooperation from the subject often show improvements in the results when repeated at short intervals, resulting in a ‘learning effect’ which might explain this finding.[30] A potential alleviation of muscle damage after a previous bout of a similar exercise known as the ‘repeated bout effect’[31] might also offer an explanation for this finding.

Decreases in WB were *moderate* 24 hours after MD1 and MD2 but returned to baseline within 72 to 96 hours after each match. The time course of recovery of perceptual WB after match-play in this study is consistent with earlier reports[3,14] and supports findings that identify psychometric questionnaires as sensitive tools to detect reductions in WB for up to 72 hours after match-play and its gradual return to baseline thereafter. It has been suggested that alterations in perceptual WB are more sensitive to tournament competition than jump-derived measures of NMF.[32] The findings of this study support the utility of simple, cost-effective questionnaires for monitoring a player's perceived recovery status during periods of congested fixtures.

The results of the present study are in line with those of Lacome et al.,[7] who indicated that changes in perceptual WB and NMF do not accumulate during a period of congested fixtures in U20 elite rugby players (94 – 120 hours between matches). In this study, and despite allowing for an even shorter turnaround (90 – 98 hours between matches), decreases in NMF and perceptual WB after match-play recovered before the succeeding match within the explored matchday cycles. However, the fact that the average time of match play in this study (53 ± 19 min) was less than the lower boundary of match play time used by Lacome et al.[7] in their analyses (60 min) must be considered.

Successful player management strategies (e.g., adequate load prescription, rotation for match-play and the use of recovery strategies) could explain the ability of players to recover throughout the investigated competition, although this is unknown. The five national teams involved coincided in using the day following match-play for implementing recovery protocols of their choice such as nutrition strategies, hydration, cold baths and massages. The reported findings should be interpreted carefully and in the context of this research, as players were in a controlled environment away from academic and social commitments. As such, support staff had control of their daily load and recovery. The case might be different during school or club competitions, where academic requirements and scheduling may disrupt recovery kinetics.[33,34] Another potential explanation for the lack of an identifiable progressive deterioration in NMF and WB is that subjective responses might be influenced by a player's willingness to provide favourable answers in proximity to match-play.[27]

The findings of this study show that despite following a similar pattern, NMF and perceptual WB can differ between positional groups and within matchday cycles. For instance, decreases in WB were *small* for forwards and *trivial* for backs at 48 hours after the first match, potentially suggesting a faster recovery in backs. However, perception of WB in backs dropped again at 72 hours after MD1 to return to baseline at 96 hours. This may be explained by training loads within the matchday cycle,[35] which were not controlled for in this study. Similarly, decreases in perceptual WB were *moderate* for forwards but only *small* for backs at 24 hours after the second match. Differences between positional groups in responses to match play can be evident when looking at specific WB subscales. Increases in perception of fatigue and muscle soreness were present after MD1 and MD2 in both positional groups, which is consistent with previous research.[12,14] However, muscle soreness remained increased in forwards at 48 hours after MD1 and MD2, whereas in backs it recovered by the 48-hour mark after match play. This observation might be influenced by the greater number of contacts that forwards normally experience during matches,[36] as muscle damage resulting from blunt trauma may prolong recovery.[37] Conversely, mood disturbances were identified only in backs at 24 hours after MD1 and MD2. Mood disturbances can arise because of stress derived from a competition[38] and from increased fatigue.[2] Locomotive demands are higher in backs than in forwards,[36] resulting in greater eccentric damage associated with high-speed running.[39] It may seem that the sources of match-related fatigue might be distinct between positional groups, and therefore, its manifestations might differ, although this remains to be investigated. Furthermore, and in line with previous research, individual player's responses were highly variable.[3,14] This emphasises on the importance for practitioners to assess individual player's recovery kinetics during periods of congested fixtures and to be aware of the potential risk of cumulative fatigue which might have a negative effect on performance[40] and incidence of injury.[41]

This study examined the recovery kinetics of five international teams during the inaugural U18 Six Nations competition to highlight the fatigue-recovery profiles of U18 international rugby union. To the authors' knowledge, this study comprises the largest sample size available to date in post-match fatigue literature (n = 133), which allowed to address common sample size limitations in elite sports research.[42] The study design called for cooperation between the involved nations, which in turn allowed to standardise data collection and merge results from multiple teams. However, the study has limitations related to the monitoring protocol and the environment where data was collected. No biochemical markers were measured to complement the daily assessment of NMF and WB. Measures such as [CK] and cortisol can provide valuable insight into post-match fatigue,[2] but their daily collection across five different squads during an official international competition lacks practicality. Similarly, no measures of internal and external load were included, making it impossible to link recovery kinetics to physical exertions. Force-time characteristics of CMJs such as peak power and peak force[23] were not evaluated, and NMF and WB were not assessed following the final match as players were immediately required to leave camp and return to their daily routines. However, given the novelty of the cohort and the ecological validity of the testing protocol, we are confident that it provides valuable information related to the time course of recovery in youth elite rugby players during an official international competition.

Practical applications

A 4-day turnaround seems to be sufficient time to allow for complete recovery in a sequence of three consecutive matches when elite youth rugby union players are in a fully controlled environment. Substantial decreases in lower-body NMF and perceptual WB can be expected the day following match-play, and as such, heavy training of the lower body should be avoided to allow NMF to restore. Perceptual response to matchplay might differ across positional groups, and analysis of WB subscales is recommended. Practitioners should consider utilising the first 24 hours after a match as an excellent opportunity for implementing recovery strategies. Lower-body NMF seems to recover 48 hours after a match, so return to field training can be considered on an individual basis at this point. On average, perception of WB seems to outlast assessment of lower-body NMF for monitoring post-match fatigue and be able to detect incomplete recovery for up to 72 hours after a match. As such, a combination of objective and subjective assessments of recovery status can provide valuable guidance for prescribing training loads during periods of intensified fixtures.

Conclusion

The present study showed that, on average, international-level youth rugby union players attained complete recovery of lower-body NMF and perceptual WB within matchday cycles during the U18 Six Nations competition. The results of this research can be useful for coaches and practitioners for monitoring fatigue and prescribing training during periods of intensified fixtures.

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Tables

	Forwards (n = 73)								
	Pre MD1	**24 h post MD1**	**48 h post MD1**	**72 h post MD1**	**Pre MD2**	**24 h post MD1**	**48 h post MD1**	**72 h post MD1**	**Pre MD3**
CMJ height (cm)	33.43 ± 4.72	32.00 ± 5.25	32.63 ± 4.42	33.57 ± 4.83	33.27 ± 3.96	32.32 ± 4.24	32.67 ± 4.87	33.45 ± 4.17	33.53 ± 4.39
WB (5-25 scale)	16.74 ± 3.96	14.31 ± 3.79	15.48 ± 3.78	16.12 ± 3.76	16.76 ± 3.96	14.09 ± 3.86	15.40 ± 4.10	16.34 ± 4.06	16.65 ± 4.16

	Backs (n = 60)								
	Pre MD1	**24 h post MD1**	**48 h post MD1**	**72 h post MD1**	**Pre MD2**	**24 h post MD2**	**48 h post MD2**	**72 h post MD2**	**Pre MD3**
CMJ height (cm)	38.59 ± 5.85	36.53 ± 5.59	37.68 ± 5.36	39.19 ± 5.51	39.07 ± 4.16	37.13 ± 5.47	39.07 ± 5.43	39.87 ± 4.67	39.52 ± 4.85
WB (5-25 scale)	16.51 ± 4.18	13.71 ± 4.11	16.00. ± 4.07	15.56 ± 4.07	16.52 ± 4.31	14.66 ± 4.13	15.14 ± 4.39	16.31 ± 4.39	17.25 ± 4.56

Table 1. Daily values for countermovement jump height (CMJ) and perception of well-being in forwards and backs. Data are presented as mean ± SD.

Forwards (n = 73)

	Pre MD1	24 post MD1	48 h post MD1	72 h post MD1	Pre MD 2	24 h post MD2	48 h post MD2	72 h post MD2	Pre MD3
Fatigue	3.57 ± 0.62	2.85 ± 0.82** *Likely small*	3.29 ± 0.73* *Possibly small*	3.37 ± 0.68 *Very likely trivial*	3.68 ± 0.71 *Almost certainly trivial*	2.77 ± 0.87** *Likely small*	3.26 ± 0.74* *Possibly small*	3.35 ± 0.73 *Very likely trivial*	3.49 ± 0.67 *Almost certainly trivial*
Muscle soreness	3.43 ± 0.65	2.49 ± 0.86** *Almost certainly moderate*	3.09 ± 0.85* *Possibly small*	3.28 ± 0.78 *Likely trivial*	3.61 ± 0.77 *Very likely trivial*	2.47 ± 0.85** *Almost certainly moderate*	3.21 ± 0.82* *Possibly small*	3.51 ± 0.66 *Very likely trivial*	3.53 ± 0.73 *Very likely trivial*
Stress	3.53 ± 0.63	3.41 ± 0.72 *Very likely trivial*	3.48 ± 0.61 *Almost certainly trivial*	3.43 ± 0.70 *Almost certainly trivial*	3.46 ± 0.70 *Almost certainly trivial*	3.44 ±0.77 *Almost certainly trivial*	3.47 ± 0.80 *Almost certainly trivial*	3.53 ± 0.69 *Almost certainly trivial*	3.49 ± 0.73 *Very likely trivial*
Sleep quality	3.80 ± 0.64	3.85 ± 0.80 *Almost certainly trivial*	3.62 ± 0.84 *Likely trivial*	3.80 ± 0.70 *Almost certainly trivial*	3.73 ± 0.78 *Almost certainly trivial*	3.67 ± 0.86 *Almost certainly trivial*	3.58 ± 0.91 *Likely trivial*	3.80 ± 0.76 *Almost certainly trivial*	3.86 ± 0.83 *Almost certainly trivial*
Mood	4.00 ± 0.65	3.81 ± 0.87 *Very likely trivial*	3.90 ± 0.57 *Almost certainly trivial*	4.03 ± 0.62 *Almost certainly trivial*	3.98 ± 0.68 *Almost certainly trivial*	3.81 ± 0.79 *Very likely trivial*	3.87 ± 0.73 *Almost certainly trivial*	3.91 ± 0.62 *Almost certainly trivial*	4.02 ± 0.62 *Almost certainly trivial*

Backs (n = 60)

	Pre MD1	24 post MD1	48 h post MD1	72 h post MD1	Pre MD 2	24 h post MD2	48 h post MD2	72 h post MD2	Pre MD3
Fatigue	3.44 ± 0.62	2.78 ± 0.94** *Almost certainly small*	3.25 ± 0.84 *Likely trivial*	3.23 ± 0.81 *Likely trivial*	3.56 ± 0.70 *Likely trivial*	2.98 ± 0.86** *Almost certainly small*	3.11 ± 0.81* *Very likely small*	3.40 ± 0.83 *Almost certainly trivial*	3.57 ± 0.83 *Likely trivial*
Muscle soreness	3.35 ± 0.69	2.60 ± 0.95** *Very likely small*	3.20 ± 0.86 *Likely trivial*	3.02 ± 0.87* *Possibly small*	3.52 ± 0.76 *Likely trivial*	2.72 ± 0.90** *Very likely small*	3.15 ± 0.83 *Likely trivial*	3.49 ± 0.75 *Likely trivial*	3.81 ± 0.67* *Possibly small*
Stress	3.58 ± 0.66	3.34 ± 0.91 *Likely trivial*	3.60 ± 0.67 *Very likely trivial*	3.52 ± 0.70 *Very likely trivial*	3.40 ± 0.64 *Likely trivial*	3.58 ± 0.60 *Almost certainly trivial*	3.38 ± 0.68 *Likely trivial*	3.60 ± 0.74 *Very likely trivial*	3.69 ± 0.64 *Very likely trivial*
Sleep quality	3.92 ± 0.53	3.72 ± 0.79 *Likely trivial*	3.82 ± 0.70 *Very likely trivial*	3.83 ± 0.74 *Very likely trivial*	3.80 ± 0.64 *Very likely trivial*	3.81 ± 0.80 *Very likely trivial*	3.60 ± 0.71* *Possibly trivial*	3.70 ± 0.83 *Likely trivial*	3.90 ± 0.66 *Almost certainly trivial*
Mood	4.00 ± 0.38	3.52 ± 0.92** *Likely small*	3.93 ± 0.48 *Very likely trivial*	3.85 ± 0.58 *Very likely trivial*	3.92 ± 0.60 *Very likely trivial*	3.68 ± 0.78* *Possibly small*	3.77 ± 0.76 *Very likely trivial*	3.83 ± 0.70 *Very likely trivial*	3.98 ± 0.47 *Very likely trivial*

Table 2. Daily values for well-being subscales in forwards and backs (1 to 5 Likert scale). Data are presented as mean ± SD. Magnitude-based inferences indicate practical significance of the differences between daily scores and the baseline (pre-MD1). *Significant at $p < 0.05$. **Significant at $p < 0.0001$

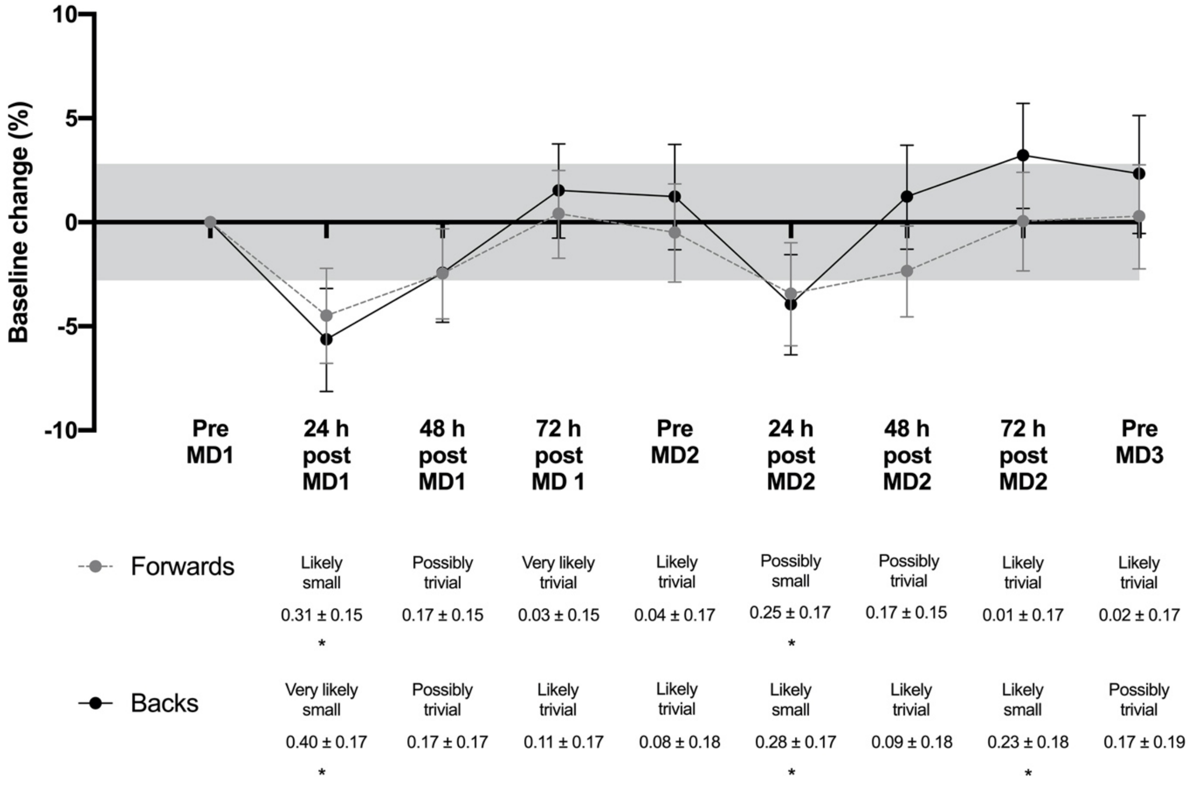

Figure 1. Changes from baseline in NMF in forwards and backs during the investigated competition. Effect sizes and 90% CI are reported. Magnitude-based inferences show practical importance of differences. Grey area represents SWC. *p<0.05 **p<0.0001.

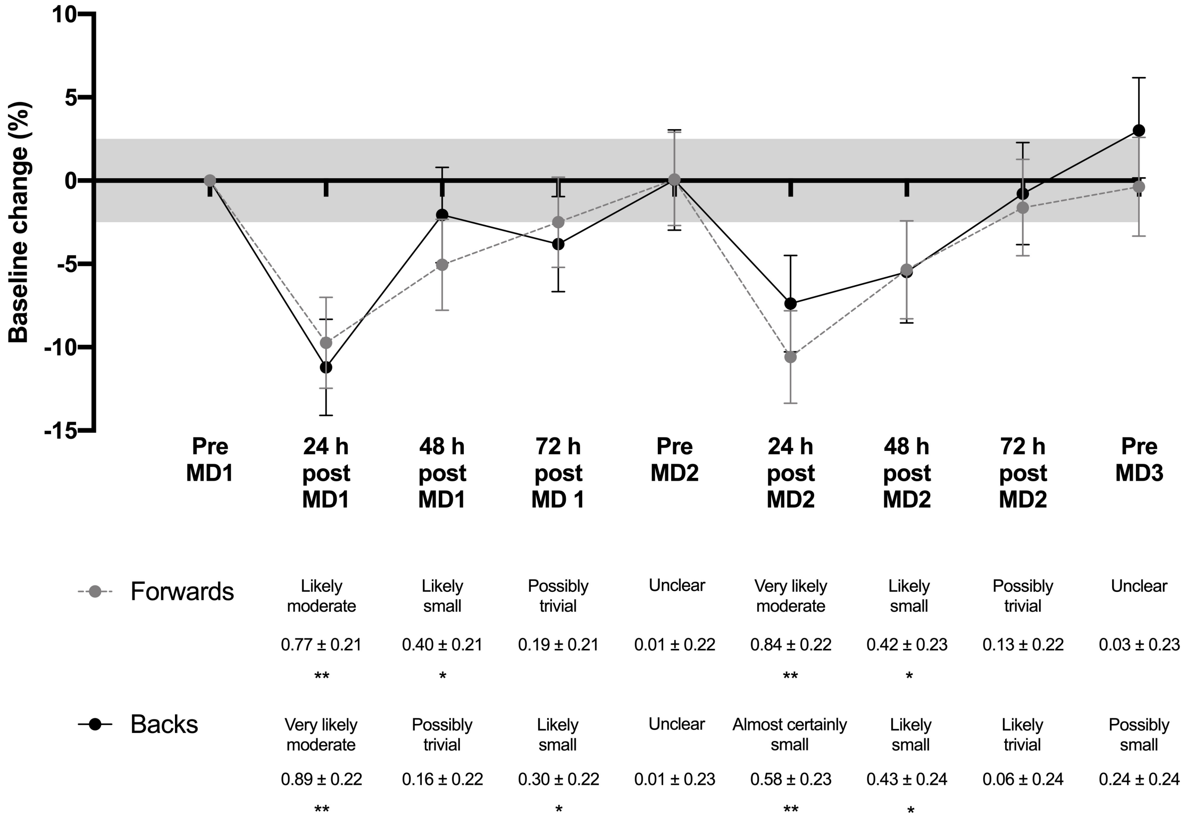

Figure 2. Changes from baseline in perceptual WB in forwards and backs during the investigated competition. Effect sizes and 90% CI are reported. Magnitude-based inferences show practical importance of differences. Grey area represents SWC. *$p<0.05$ **$p<0.0001$.