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Noon, M, James, RS, Clarke, ND, Akubat, I & Thake, D

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Abstract:	The 2011 English Elite Player Performance Plan (EPPP) stipulates training volumes that could put elite youth players at high risk of non-functional overreaching. The aim of the study was to assess player perceptions of well-being and physical performance to these high training loads. Fourteen academy football players (mean ± SD: age 17 ± 1 yrs; stature 179 ± 6 cm; body mass 70.8 ± 8.6 kg, at pre-season) completed a perception of well-being questionnaire 1-4 times per week throughout each training block (pre-season, in-season 1, 2, 3). Physical performance tests were carried out at the end of each training block. Increases in training exposure ($P<0.05$; $=0.52$) and moderate / large deteriorations in perceptions of well-being (motivation, sleep quality, recovery, appetite, fatigue, stress, muscle soreness $P<0.05$; $=0.30$-0.53) were evident as the season progressed. A moderate decrease in 30m sprint performance ($P<0.05$; $= 0.48$), a large improvement in Yo-Yo intermittent recovery test performance ($P<0.05$; $=0.93$) and small decreases in countermovement jump ($P>0.05$; $=0.18$) and arrowhead agility ($P<0.05$; $=0.24$) performance were evident as the season progressed. The present findings show an imbalance between stress and recovery in English elite youth players even when players experience lower training exposure than stipulated by the EPPP.

Perceptions of well-being and physical performance in English elite youth footballers across a season.

Key words: Elite Player Performance Plan, recovery, training load.

Abstract

The 2011 English Elite Player Performance Plan (EPPP) stipulates training volumes that could put elite youth players at high risk of non-functional overreaching. The aim of the study was to assess player perceptions of well-being and physical performance to these high training loads. Fourteen academy football players (mean ± SD: age 17 ± 1 yrs; stature 179 ± 6 cm; body mass 70.8 ± 8.6 kg, at pre-season) completed a perception of well-being questionnaire 1-4 times per week throughout each training block (pre-season, in-season 1, 2, 3). Physical performance tests were carried out at the end of each training block. Increases in training exposure ($P<0.05$; $\eta_P^2=0.52$) and moderate / large deteriorations in perceptions of well-being (motivation, sleep quality, recovery, appetite, fatigue, stress, muscle soreness $P<0.05$; $\eta_P^2=0.30$-0.53) were evident as the season progressed. A moderate decrease in 30m sprint performance ($P<0.05$; $\eta_P^2 = 0.48$), a large improvement in Yo-Yo intermittent recovery test performance ($P<0.05$; $\eta_P^2=0.93$) and small decreases in countermovement jump ($P>0.05$; $\eta_P^2=0.18$) and arrowhead agility ($P<0.05$; $\eta_P^2=0.24$) performance were evident as the season progressed. The present findings show an imbalance between stress and recovery in English elite youth players even when players experience lower training exposure than stipulated by the EPPP.

Introduction

In the 2012-2013 season the Premier League's Elite Player Performance Plan (EPPP) was introduced to improve the long term development pathway for elite football players in England. Increased coach contact time and coaching quality were identified as critical aspects to enhance player development (The Premier League, 2011). Based on the 10,000 hour rule (Ericsson, 2013; Tucker and Collins, 2012), the aim was to achieve ~8500 hours over the development pathway, a ~2 fold increase in practice time. This was proposed to align the practice time of English football players with their European counterparts in football and elite development pathways in other sports (The Premier League, 2011).

Acute fatigue or functional overreaching (FOR) is required to maintain or improve physiological characteristics (Coutts et al. 2007a; Coutts et al. 2007b; Thomas and Busso, 2005). However, if recovery is inadequate non-functional overreaching (NFOR) manifests. NFOR is characterised by a maladaptive response resulting in decreased performance and increasing symptoms associated with fatigue which may be present for days or weeks (Meeusen et al. 2013; Nederhof et al. 2006; Nederhof et al. 2008). In professional elite senior players high training and competition loads have been linked to players underperforming both technically and tactically (Ekstrand et al. 2004; Verheijen, 2012), an increase in injury rate (Bengtssen et al. 2013; Owen et al. 2014) and impaired physical performance (Rollo et al. 2014). In elite youth players the incidence of NFOR in elite Dutch youth players was reported to be 7.4 % over 2 seasons.   Therefore, high training and competition demands stipulated by the EPPP and the associated physical and psychosocial responses are unknown and may put players at risk of NFOR.

Perception of well-being is considered a useful marker for identifying NFOR (Meeusen et al. 2013). Studies in youth football players have shown a link between declining perceptions of well-being and NFOR (Brink et al. 2012; Schmikli et al. 2011). These studies used psychometric questionnaire scales, the Recovery Stress Questionnaire for Athletes (RESTQ-Sport) and the Profile of Mood States (POMS), which potentially give a comprehensive assessment of the athletes stress/ recovery profile. However, these questionnaires are considered arduous and time consuming to complete and analyse, making player management more difficult on a daily basis (Gastin et al. 2013; Raines et al. 2012). Therefore, a simpler and less time consuming questionnaire that can be completed in <30 s on a daily basis, may be more practical in an applied team sport setting.

Several markers of physical performance may have the potential to identify NFOR in elite youth football players. Brink et al. (2012) and Schmikli et al. (2011) determined NFOR via a 2 month successive decrease in performance in a submaximal test in young elite football players. However, fluctuations in submaximal tests do not represent the range of physical capabilities required in football (Buchheit, et al. 2012). Therefore a more holistic battery of physical performance tests is required to identify NFOR in youth soccer players.

Limited data exists on periodic tracking of seasonal changes in perceptions of well - being and physical performance in youth football players. A season long study in elite German youth players reported that total recovery assessed using the REST-Q deteriorated towards the end of the season, however, no changes were noted in football specific physical performance tests (Faude, et al. 2011). Given the introduction of the EPPP, the aim of the present study was to assess seasonal changes in player's perceptions of well-being and physical performance via regular assessment of well-being and regular analysis of physical performance via a battery of tests.

Methods

Participants

Fourteen full-time U17-U21 academy football players from a club with category 2 status (academy category status is determined on a 1-4 scale based on several key performance indicators attributed to successful player development; The Premier League, 2011) volunteered and provided informed consent for the study (mean ± SD: age 17 ± 1 yrs; stature 179 ± 6 cm; body mass 70.8 ± 8.6 kg; sum of 8 skinfolds 56.1 ± 11.6 mm, at pre-season). A typical training week is presented in Table 1. All players and parents provided written informed consent. The study was approved by the Coventry University Ethics Committee and conformed to the declaration of Helsinki.

****Table 1 near here****

Exclusion criteria

Players injured for >75% of training days or players who did not participate in any training during a specified training block were excluded from the analysis. Three players were excluded based on this criteria (originally n=17).

Study design

The well-being questionnaire (WQ) was completed on 1-4 training days per week prior to squad pitch based sessions. Anthropometrics and performance tests were carried out at 4 time points during the season (Figure 1).

**** Figure 1 near here ****

Well-being questionnaire (WQ)

Players were asked to rate their perceptions of seven items each on a seven point scale [very good (+3), normal (0) to very poor (-3)] to monitor their perceptions of well-being related to: motivation to train, quality of previous night's sleep, quality of recovery from previous day, appetite, feeling of fatigue, level of stress and level of muscle soreness (Raines et al. 2012). The WQ has been used and developed by the club over the previous two seasons as a performance management tool to assess readiness to train. The questionnaire items were selected based on areas considered by the sport science staff to be necessary in player management and by items in the literature frequently associated with athlete monitoring and NFOR (Coutts et al. 2007a; Coutts et al. 2007b; Filaire et al. 2004; Gastin et al. 2013; Kellmann and Kallus, 2001; Morgan et al. 1987). At 9am prior to training, each player completed the WQ using a dry wipe marker pen on an A4 laminated white board located above their changing area (Raines et al. 2012). All players were given instructions on the use of the questionnaire by the sport science staff and familiarised with the process of completing the questionnaire throughout the previous 6 months. During the season the data were reviewed on a daily / weekly basis by sport science staff and coaches to assist decisions on individual player management and training periodisation. The data were collated post season and any player who did not train on a given day had that data point removed from the analysis.

Performance tests

Performance testing was carried out following a recovery day at the beginning of pre-season, the end of pre-season, the end of in-season 1 and the end of in-season 2 (Figure 1). The battery of performance tests consisted of a 30m sprint, a countermovement jump (CMJ), an arrowhead agility test (AAT) and a Yo-Yo intermittent recovery test level 1 (IRTL1). All players had several years of experience performing the tests and were therefore familiarised with the procedures. No testing took place following in-season 3 due to a number of players being released.

In addition IRTL1 was not collected following the end of pre-season due to players training with different squads, a high U18 and U21 fixture demand and time constraints. Players who did not complete the tests at all time points for any given performance test were removed from the analysis for that performance test only (CMJ n=8; 30m sprint n=12; IRTL1 n=12; AAT n= 12). Prior to all testing procedures players carried out a standardised 10 min warm-up consisting of jogging, running, sprinting and dynamic stretching. All testing was carried out on an indoor 3G pitch. Players wore football boots during all tests except for CMJ where trainers were worn. The order of the tests was identical on all four testing occasions: 1) CMJ; 2) 30m Sprint; 3) AAT; 4) IRTL1. There was a five minute intermission between each test.

Anthropometrics

Prior to the warm-up height, body mass and 7 skinfolds were assessed using the protocols set out by The International Society for the Advancement of Kinanthropometry (2001).

Countermovement Jumps (CMJ)

Following a set of three warm up jumps, players carried out a total of 3 unloaded CMJ (Taylor, 2012). Jump height was calculated using a contact mat (Fusion Sport, Canberra, Australia). There was a 3-5 second intermission between each of the three jumps. The participant was instructed to attempt to jump as high as possible.

The best jump was recorded. No information regarding jump technique was given. However jumps were disqualified if: either 1) a player pulled their thighs up to their chest to extend their flight time; or 2) both feet did not land back on the jump mat. If a jump was disqualified, corrective feedback was given and the player performed another jump. If corrective feedback was provided, a longer intermission of 15-20 seconds was required between jumps.

<u>30m Sprint test</u>

Players performed three maximal 30 m sprints (Shalfawi, et al. 2011). The sprint time was recorded using electronic timing gates (Smartspeed, Fusion Sport, Canberra, Australia). The start line was set up 0.5 m behind the first set of timing gates. Each sprint was inter-dispersed with a four minute passive recovery period. The fastest time achieved of the three sprints was used for analysis.

<u>Arrowhead Agility Test (AAT)</u>

Players completed the AAT (Chan and Chan, 2010, Figure 2) as quickly as possible in the sequence ABCEA on two occasions and the sequence ABDEA on two occasions. Each run was inter-dispersed with a four minute standing passive recovery period. Electronic timing gates were used to record the time taken to run the agility course (Smartspeed, Fusion Sport, Canberra, Australia). The start line was set up 0.5 m behind the electronic timing gates. The run was disqualified if the player: 1) touched any of the cones; or 2) stepped over or failed to go around any of the cones; or 3) completed the course in a different order to that which was instructed. If a player was disqualified, corrective feedback was given and they performed the test again following adequate recovery. The fastest time achieved from four runs was used for analysis.

**** Figure 2 near here ****

Yo-Yo intermittent recovery test level 1 (IRTL1)

The IRTL1 was set up as described by Krustrup et al. (2003). To prevent players running prior to the audio beep, players were informed that the consequence of false starting on 3 occasions was withdrawal from the test. No player was removed for false starts.

Statistical analysis

Descriptive data, including squad total training time, actual training exposure, total match time, training availability and match availability, are expressed as mean ± SD for each training block.

Training exposure and questionnaire data were analysed on a per training block basis (Figure 1). All training sessions were ~2 hours in duration. Any session that a player participated in was recorded as a 2 hour session for that individual. Training exposure per week was summated and a mean training exposure for each individual in a given block was calculated. The group mean of each individual's mean training exposure was used in subsequent analysis to assess any difference between the training blocks. For the purpose of analysis, the questionnaire items fatigue, stress and muscle soreness were reverse scored. Therefore a higher score reflected greater fatigue, stress or muscle soreness. A seasonal norm for each individual was determined as the mean score for each item throughout the season. The mean for each individual's responses in a given block of training was also calculated. The difference between the mean score in each block and the seasonal norm for each individual was calculated. The group mean of the difference between the individuals' seasonal norm and the individual's mean score in each block was used in subsequent group analysis to assess differences between training blocks. The questionnaire data and training exposure data were typically not normally distributed. Analysis of variance (ANOVA) with a bootstrapping procedure (used where data are not normally distributed; Kruizenga et al. 2005) of 1000 replications was used to assess any differences between the training blocks. Confidence intervals were set at 95% (95 % CI) and were calculated using Tukey pairwise comparisons. The 95 % CI of differences between means that failed to overlap zero were considered statistically significant.

General linear model analysis of variance (ANOVA) with repeated measures was used to assess for changes in performance tests during the season. If Mauchley's test of sphericity was violated the degrees of freedom were adjusted using the

Greenhouse-Geiser correction (Field, 2000). Where differences were evident post-hoc pairwise comparisons (Bonferonni adjusted) were used to identify where the differences occurred. Results are reported as mean ± SD and 95% CI.

Significance for all analysis was set at $P<0.05$. Effect sizes (ES) were calculated using partial eta squared (η_p^2), which were defined as trivial (<0.1), small (0.1-0.3), moderate (0.3-0.5) and large (>0.5) (Hopkins et al. 2009). All analysis was performed using Statistical Package for Social Science (SPSS) for Windows (version 20; SPSS inc, Chicago, USA).

Results

Over a period of 283 days there were 194 squad training sessions within 144 days. Table 2 summarises the descriptive data for training and match play within each training block throughout the season. A large increase in training exposure was evident as the season progressed (Table 2). Post-hoc tests revealed lower training exposure in pre-season compared with all other training blocks (-3.2 h, CI -4.5 to -2.0 h, $P<0.05$; -2.1 h, CI -3.3 to -0.8 h, $P<0.05$; -2.7 h, CI: -3.9 to -1.4 h, $P<0.05$; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Table 2).

****Table 2 near here****

A total of 1362 questionnaire responses were collected throughout the season with each player completing 97 ± 8 (range: 83-109) across all training blocks (pre-season, 14 ± 3; in-season 1, 31 ± 4; in-season 2, 34 ± 4 and in-season 3, 20 ± 2). A moderate decrease in perception of motivation to train was observed as the season progressed (Figure 3a). Pairwise comparisons revealed moderately lower perception of motivation to train during in-season 3 in comparison with pre-season (-0.66 AU, CI -1.03 to -0.35 AU, P<0.05, Figure 3a).

A moderate decline in perceptions of sleep quality was evident as the season progressed (Figure 3b). Post-hoc tests revealed moderately lower perceptions of sleep quality during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (-0.30 AU, CI -0.66 to -0.01 AU, P<0.05; -0.44 AU, CI -0.73 to -0.15 AU, P<0.05; -0.54 AU, CI: -0.84 to -0.23 AU, P<0.05; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Figure 3b). Perceptions of sleep quality were also moderately lower during in-season 2 and in-season 3 in comparison with in-season 1 (-0.14 AU, CI -0.25 to -0.02 AU, P<0.05; -0.24 AU, CI -0.39 to -0.11 AU, P<0.05, for in-season 2, for in-season 3 vs. in-season 1 respectively, Figure 3b).

A moderate decrease in perceptions of recovery was evident as the season progressed (Figure 3c). Pairwise comparisons revealed moderately lower perceptions of recovery during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (-0.41 AU, CI -0.62 to -0.22 AU, P<0.05; -0.51 AU, CI -0.72 to -0.32 AU, P<0.05; -0.45 AU, CI -0.66 to -0.25 AU, P<0.05; for in-season 1, in-season 2, and in-season 3 vs. pre-season respectively, Figure 3c). Perceptions of recovery were also moderately lower during in-season 2 in comparison with in-season 1 (-0.10 AU, CI -0.19 to -0.01 AU, P<0.05; Figure 3c).

A large decrease in perceptions of appetite was observed as the season progressed (Figure 3d). Post-hoc tests revealed a large decrease in perceptions of appetite during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (-0.56 AU, CI -0.87 to -0.27 AU, P<0.05; -0.67 AU, CI -0.98 to -0.37 AU, P<0.05; -0.71 AU, CI -1.01 to -0.43 AU, P<0.05; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Figure 3d). In addition during in-season 2 and in-season 3 a large decrease in perceptions of appetite was evident in comparison with in-season 1 (-0.11 AU, CI -0.18 to -0.04 AU, P<0.05; -0.15 AU, CI -0.24 to -0.07 AU, P<0.05, for in-season 2 and in-season 3 vs. in-season 1 respectively, Figure 3d).

A moderate increase in perceptions of fatigue was evident as the season progressed (Figure 3e). Pairwise comparisons revealed moderately higher perceptions of fatigue during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (0.30 AU, CI 0.12 to 0.51 AU, P<0.05; 0.33 AU, CI 0.15 to 0.54 AU, P<0.05; 0.39 AU, CI 0.21 to 0.59 AU, P<0.05; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Figure 3e).

A moderate increase in perceptions of stress was observed as the season progressed (Figure 3f). Pairwise comparisons revealed moderately higher perceptions of stress during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (0.54 AU, CI 0.25 to 0.86 AU, P<0.05; 0.78 AU, CI 0.48 to 1.12 AU, P<0.05; 0.85 AU, CI 0.55 to 1.21 AU, P<0.05; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Figure 3f). In addition moderately higher perceptions of stress were observed during in-season 2 and in-season 3 in comparison with in-season 1 (0.24 AU, CI 0.10 to 0.39 AU, P<0.05; 0.31 AU, CI 0.15 to 0.48 AU, P<0.05, for in-season 2 and for in-season 3 vs. in-season 1 respectively, Figure 3f).

A large increase in perceptions of muscle soreness was evident as the season progressed (Figure 3g). Pairwise comparisons revealed a large increase in perceptions of muscle soreness during in-season 1, in-season 2 and in-season 3, in comparison with pre-season (0.40 AU, CI 0.10 to 0.70 AU, P<0.05; 0.66 AU, CI 0.36 to 0.95 AU, P<0.05; 0.79 AU, CI 0.49 to 1.09 AU, P<0.05; for in-season 1, in-season 2 and in-season 3 vs. pre-season respectively, Figure 3g). In addition a large increase in perceptions of muscle soreness was observed during in-season 3 in comparison with in-season 1 (0.39 AU, CI 0.09 to 0.69 AU, P<0.05; Figure 3g).

**** Figures 3a to 3g near here****

Small to large fluctuations in fitness throughout the season are presented in table 3. Moderate changes in 30m sprint speed were evident during the season. Pairwise comparisons revealed that players were moderately slower at the end of pre-season (0.17 s, CI 0.05 to 0.28 s) and at the end of in-season 2 (0.19 s, CI 0.13 to 0.25 s) in comparison with the beginning of pre-season. A large increase in distance covered in the IRTL1 was evident as the season progressed. Pairwise comparisons revealed a large increase in distance covered in the IRTL1 at the end of in-season 1 (334m, CI 160m to 506m) and at the end of in-season 2 (947m, CI 761 to 1132m) compared to the beginning of pre-season. In addition a large increase in distance covered at the end of in-season 2 in comparison with in-season 1 was observed (613m, CI 505 to 721). Through the season changes in AAT performance and CMJ performance were small.

****Table 3 near here****

Discussion

The main finding of the study was that moderate and large decreases in perceptions of well-being were evident as the season progressed. In addition a moderate decline in sprint performance was observed at later testing points in the season. The planned training hours in the present study (9.6 ± 2.9 h per week) and training exposure (8.0 ± 0.7 h) were still below the 12-14 h per week stipulated by the EPPP for this age group. In addition training exposure was lower in pre-season in comparison with the other training blocks.

The present study provides evidence of reduced perceptions of well-being, in English elite youth soccer players, as the football season progresses from pre- through in-season. Factors influencing stress in elite youth players include the training /competition load, pressure to earn a contract and relationships with peers, coaches, friends and family (Weedon, 2011). Furthermore neglecting recovery strategies, for example inadequate nutrition and sleep, will further exacerbate the impact of the stress (Reilly and Ekblom, 2005; Barnett, 2006). It is evident that an imbalance between high physical / psychosocial stress and adequate subsequent recovery exists in elite youth football indicating that player education and player management strategies are required. Faude et al. (2011) reported similar decreases in perceptions of well-being in elite German youth football players, with reduced perceptions of recovery and higher perceptions of stress as the season progressed. In comparison, the present study uses fewer items (7 vs 65) to identify seasonal fluctuation in well-being. This gives practicality and allows player well-being to be assessed on a daily basis (Gastin et al. 2013; Raines et al. 2012).

In the present study the compliance of completing the questionnaires on a daily basis was a limitation which was influenced by dual site training venues. Electronic devices may have improved compliance, however, are more expensive to implement. It has been suggested short self-report questionnaires have ecological validity in a practical setting (Gastin et al. 2013). A potential limitation to the questionnaires is the potential bias introduced by how players feel their peers or coaches will perceive them. Further to this players may attempt to manipulate training frequency and intensity if they perceive the questionnaires influence training prescription. Hence, educating the players on the purpose of the questionnaires and the relationship built between player and the coach is an important aspect to attaining valid information from self-report questionnaires (Gastin et al.2013). Further to this, the inclusion range of monitoring strategies in addition to well-being questionnaires may give a comprehensive assessment of player readiness.

Previous studies have linked reductions in submaximal endurance performance to NFOR and reduced perceptions of recovery (Brink et al. 2012; Schmikli et al. 2011). The present study uses a more holistic battery of football specific performance tests in comparison with tests previously used to identify NFOR (Buchheit et al. 2012). In previous studies perceptions of well-being have not necessarily translated into decreases in physical performance. Faude et al. (2011) reported no difference in aerobic or neuromuscular performance throughout the season when perceptions of well-being declined. In comparison with the present study, the squad training time was lower (~6 Vs ~10 h per week) potentially reducing the overall training stimulus and preventing attenuation of physical performance measures.

The accumulation of fatigue throughout the season could be influencing physical performance in the present study. Kraemer et al. (2004) reported reduced sprint performance following 11 weeks intensified training and competition in collegiate football players. In addition, Rollo et al. (2014) reported an 11% decrement in IRTL1 performance, an 18.7% decrement in CMJ performance and a 4.4% and 4.7% decrement in 10m and 20m sprints respectively following a congested fixture period in trained senior football players. However, in the present study not all aspects of physical performance declined. A potential rationale for the improvement in endurance and decrement in neuromuscular performance could be a high training/competition volume resulting in a shift towards greater endurance characteristics and a diminished explosive ability. Several researchers have reported a muted explosive neuromuscular response to concurrent training (Dudley and Djamil, 1985; Häkkinen et al. 2003; Hunter et al. 1987; Jones et al. 2013). Concurrent speed and high-intensity training (HIT) in addition to high volume football specific training (~10 h) similar to that of the present study elicited improvements in both endurance and explosive performance (Dupont et al. 2004; Wong et al. 2010). In contrast similar training modalities with a lower training volume (~6 h) have reported improvements in endurance but no changes in explosive performance (Helgured et al. 2001). It is important to consider the aforementioned studies that reported a negative effect of concurrent strength and endurance training showed a blunted response, not a decrement as seen in the present study. In the present study strength and speed training was not quantified.

Therefore, potentially the intensity of the strength and speed training may not have been sufficient to maintain or improve speed. Differences in specificity of training and accumulation of fatigue are potential factors influencing seasonal changes in physical performance. Furthermore differences in training history, age, genetics, training exposure, period of training exposure, fixture congestion and scheduling of testing could explain these differences between studies.

Assessing well-being on a daily basis could identify daily fluctuations in well-being and evaluate readiness to train. A limitation to the present study is the physical performance testing only gives a snap shot of the players' physical performance on that given day. It is unclear whether each physical performance result represents the effect of an acute training bout (FOR) or an accumulated fatigue (NFOR) (Nederhof et al. 2006; Nederhof et al. 2008; Meeuson et al. 2013). Additionally the analysis conducted in the present study identifies a global group response. Given the nature of team training this analysis might be useful with regard to the periodisation of team sessions, however individual responses to training are likely to be markedly different (Akubat et al. 2012). Therefore it is critical that practical strategies to identify individual fluctuations in the fitness / fatigue dichotomy are carried out on a daily/weekly basis (Borresen and Lambert, 2009; Gastin et al. 2013; Hill-Haas et al. 2009; Lambert and Borresen, 2006).

The influence of the training hours experienced in the present study on perceptions of well-being and performance needs careful consideration. It seems unlikely that both optimal physical performance and skill acquisition can be prioritised. In the context of developing elite football players simply counting 10000 hours is not the right approach to long term player development, although the amount of deliberate practice is important (Ericsson, 2013; Tucker and Collins, 2012). Therefore, it is important that coaches consider the trade-off between higher training volumes and well-being and physical performance. Further research is needed to identify methods to monitor daily / weekly fluctuations in physical performance and track individual player trends to reduce the risk of NFOR in elite youth football players. In addition the sensitivity of wellness questionnaires to training load may be of interest to help inform player management strategies.

In summary, the present data gives the first insight into the potential impact of the new EPPP in England on physical performance and perceptions of well-being. Results suggest that elite youth football players in England have deteriorating perceptions of well-being, decrements in selected neuromuscular performance, but an improvement in endurance performance as the season progresses. This imbalance between high physical / psychosocial stress and subsequent inadequate recovery potentially exists as a result of high training / competition and psychosocial pressures of English elite youth football. Given that players did not actually achieve the hours stipulated by the EPPP it would be expected that a greater training exposure would further exacerbate the imbalance between stress and recovery. Effective player management strategies need to be established to allow coaches to make informed decisions and optimise player performance.

Disclosures

No conflict of interest

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Table 1. Typical weekly training schedule.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	S & C	Prehab PBS Power	S & C	Prehab PBS Speed	PBS	Match	Recovery
PM	PBS	PBS		PBS			

S & C, strength and conditioning gym based session; Prehab, prehabilitation session; PBS, squad pitch based session (includes technical, tactical, physical training). Pre-season only one PBS was carried out on Tuesdays and Thursdays. U21 games were carried out on any midweek day altering players training schedule. Players involved in U21 fixtures midweek each missed 5 ± 4 training sessions per season and 2 ± 2 training sessions per season the day following match day.

Table 2. Descriptive data for training and matches throughout the season and within each block of training for elite category 2 English academy football players.

	Season	Pre-Season	In- Season 1	In-Season 2	In-Season 3
Training time (h per week)	9.6 ± 2.9	6.8 ± 2.5	10.8 ± 3.1	9.4 ± 2.7	9.8 ± 2.9
Training Exposure (h per week)	8.0 ± 0.7	5.7 ± 1.3	9.0 ± 1.3*	7.8 ± 1.2*	8.4 ± 1.1*
Match time (min)	2017 ± 486	343 ± 124	767 ± 226	491 ± 126	415 ± 234
Training availability (%)	89 ± 6	86 ± 20	87 ± 12	90 ± 11	91 ± 9
Match Availability (%)	93 ± 8	88 ± 27	91 ± 13	95 ± 10	96 ± 8

Training time, total number of hours per week that squad pitch base sessions were carried out; Training exposure, players actual training exposure to squad pitch based sessions taking into account injury, illness, loans, compassionate leave and international duty; Match time, total number of match minutes played; Training availability, percentage of training days player was without injury or illness; Match availability, percentage of match days player was without injury or illness (includes U18 and U21 games). Note that loans, compassionate leave and international duty were classified as available to train / play competitive matches. Data are expressed as mean ± SD, n=14. * denotes significantly different from pre-season ($F_{(3,52)}$=18.06, P<0.05; η_p^2 =0.52).

Table 3. Performance tests at four testing points during a season for elite category 2 English academy football players.

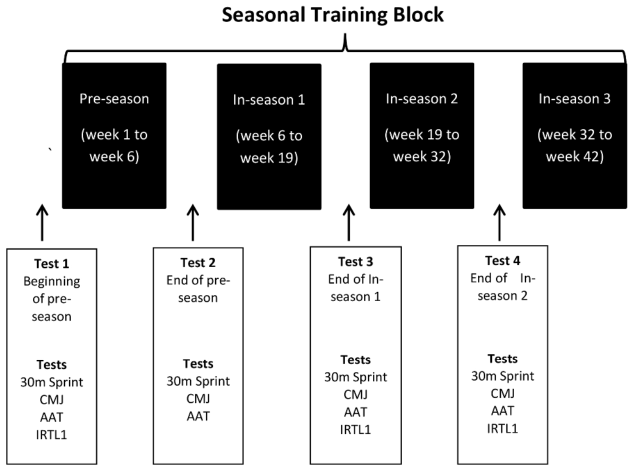
	n	Beginning of Pre-season	End of pre-season	End of in –season 1	End of in –season 2
30m Sprint (s)	12	4.14 ± 0.19	4.31 ± 0.18*	4.24 ± 0.22	4.34 ± 0.20*
Agility (s)	12	8.17 ± 0.26	8.27 ± 0.26	8.29 ± 0.26	8.33 ± 0.29
CMJ (cm)	8	44 ± 6	42 ± 6	44 ± 7	43 ± 6
IRTL1 (m)	12	2203 ± 334	N/A	2537 ± 235*	3150 ± 269*^

Data are expressed as mean ± SD for 30m Sprint ($F_{(3,33)}$=10.12, P<0.01; η_P^2=0.48), IRTL1 ($F_{(2,22)}$=144.84, P<0.05; η_P^2=0.93) AAT ($F_{(3,33)}$=3.44, P=0.03; η_P^2=0.24) CMJ ($F_{(1.39,9.37)}$=1.55, P=0.23; η_P^2=0.18). * denotes different from beginning of pre-season; ^ denotes different from end of in-season 1.

Figure 1. Schedule of performance tests across the season.

Figure 2. The arrowhead agility test (AAT) course.

Figure 3. Perceptions of a) motivation to train ($F_{(3,52)}$=8.65, P<0.05; η_P^2=0.33), b) sleep quality ($F_{(3,52)}$=7.55, P<0.05; η_P^2=0.30), c) recovery ($F_{(3,52)}$=15.38, P<0.05; η_P^2=0.47), d) appetite ($F_{(3,52)}$=18.52, P<0.05; η_P^2=0.52), e) fatigue ($F_{(3,52)}$=9.63, P<0.05; η_P^2=0.36), f) stress ($F_{(3,52)}$=15.19, P<0.05; η_P^2=0.47), g) muscle soreness ($F_{(3,52)}$=19.28, P<0.05; η_P^2=0.53) in each of the 4 training blocks for elite category 2 English academy football players. Data presented as the group mean ± SD of the difference between the individual's seasonal norm and the individual's mean score in each training block, n=14. * denotes significantly different from pre-season; + denotes significantly different from in-season 1.



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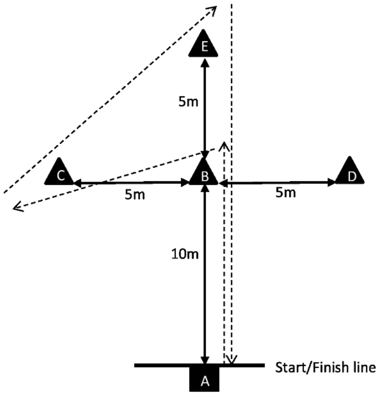

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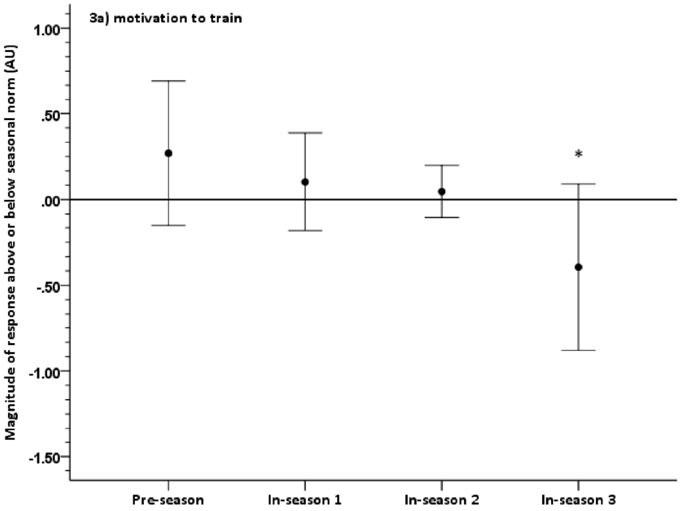

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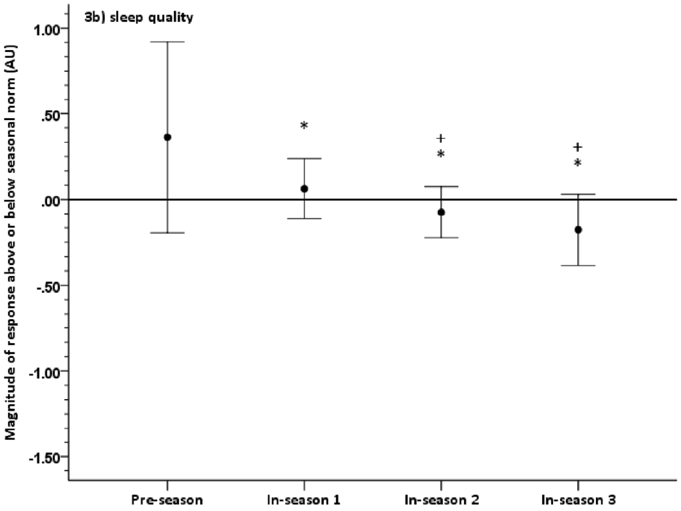

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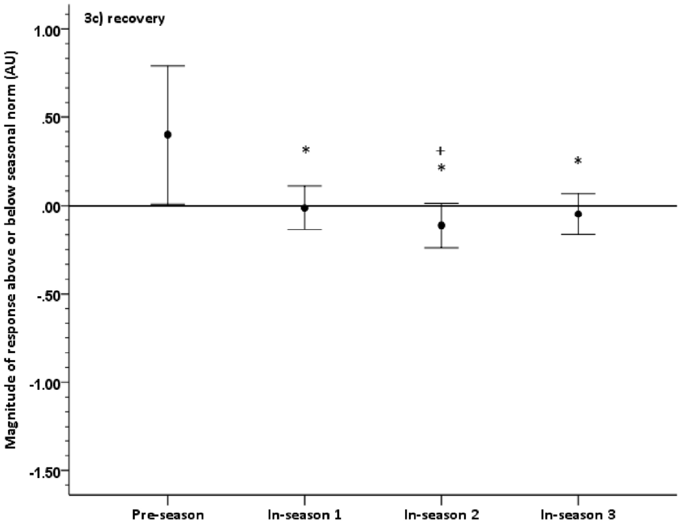

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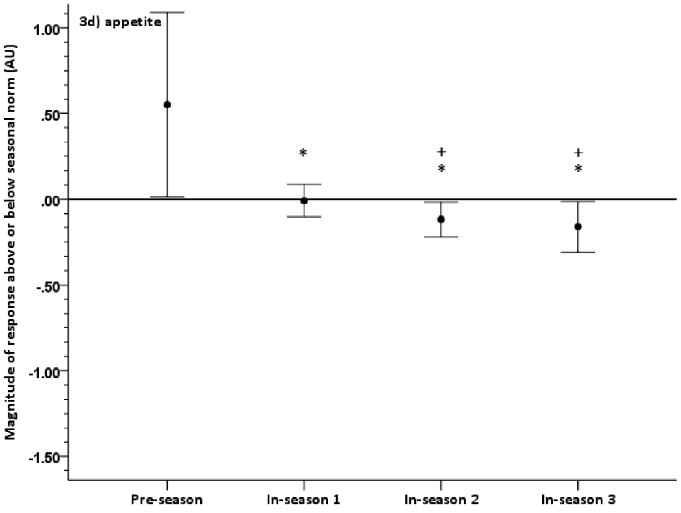

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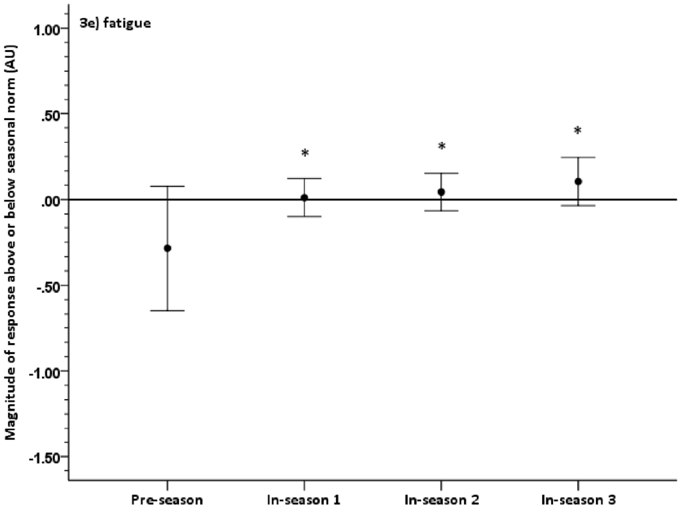

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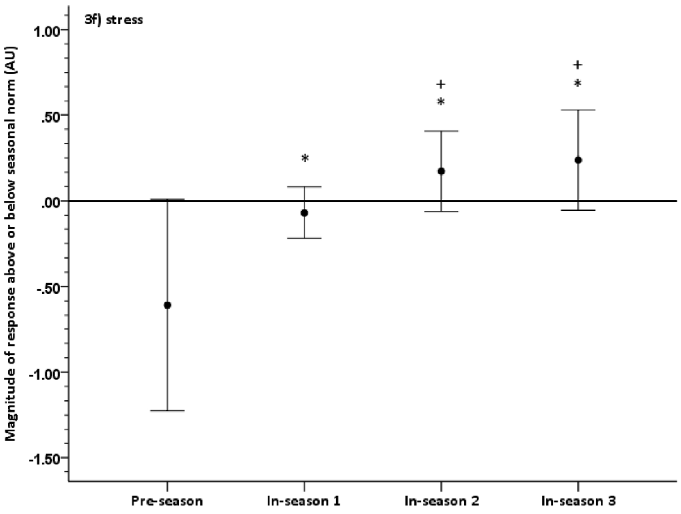

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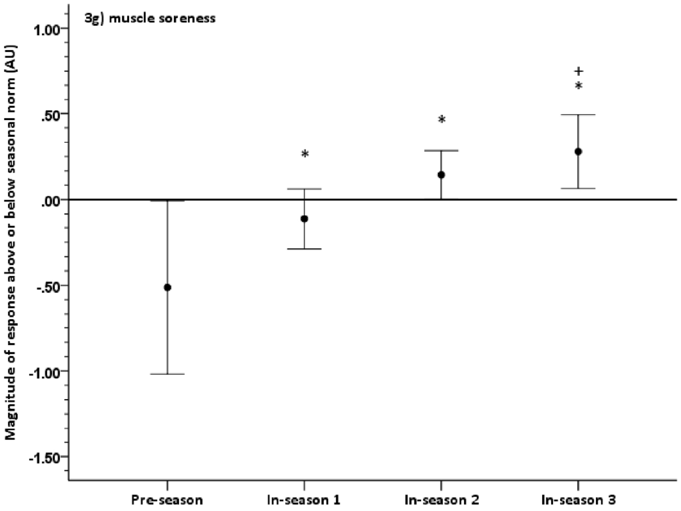

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