TITLE:

How do young soccer players train? A 5-year analysis of weekly training load and its variability between age groups in an elite youth academy

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ABSTRACT

The aim of this study was to quantify the session Rating of Perceived Exertion (sRPE), duration and training load accrued across typical training weeks undertaken by youth soccer players. Differences between starters, non-starters and variations in training load variables were also investigated. Data were collected from 230 elite youth players in four age groups (U15, U16, U17 and U19) during 5 competitive seasons. Mixed models were utilized to describe variation between age groups and compare starters to non-starters, with season as a fixed covariate effect. Week-to-week variation in training load was expressed as the percentage coefficient of variation (%CV). The main findings may be used to highlight a significant effect of age and playing status on training intensity, duration, and internal training load. Weekly training load increased progressively from the U15 to U17, with significant differences between each age group ($p < 0.03$). Lower mean weekly perceived intensity (sRPE) were noted in U15 when compared to the older age groups (4.2 vs 4.6–4.9 AU for U16 to U19, $p < 0.001$). Low weekly training load variation was observed across the different phases of the season in each age group, with the pre-season exhibiting the greatest variance (3.6–6.2%). Differences in the training load are likely more attributable to changes in training duration rather than sRPE. Control of session duration appears to play an important role when aiming to control load in the academy environment and practitioners should closely monitor the differences in duration and load being recorded between starters and non-starters.

Key words: Football, Athlete Monitoring, Training Distribution

INTRODUCTION

The quantification of individual athletes' training load and responses to that load is common practice in many elite level football clubs, including youth academies (44). Indeed, a high priority for sport scientists working in youth academies is to quantify and control the training dose prescribed to the players, with the aim of optimising player performance and health. The control of training load is achieved through careful manipulation of variables that should be accounted for in the training prescription process, such as frequency, intensity, duration and mode (3). The monitoring of training load variables and the integration of additional contextual factors (i.e., fitness, performance indicators, athlete perceptions etc.) can be utilized to assess the effectiveness of the periodized training strategies applied and inform decisions relating to the training program.

The training process framework, a conceptual model introduced to guide the development of athlete monitoring systems, describes the athlete's training load in two distinct categories: internal and external load (26). The external load relates to the quantity of training load performed by the athlete, which includes the volume and intensity of training that the athlete completes This is measured independently of the player's individual characteristics or fitness levels. The internal load refers to the athletes response to the external load and can be represented as the psycho-physiological stress experienced by the athlete. The session rating of perceived exertion method (sRPE) is a simple, inexpensive and non-invasive method for monitoring internal training load that has been validated for monitoring soccer players (24, 38). This method provides a measure of intensity that is influenced by a number of different factors, including cardiovascular load (9, 27) and mental and muscular fatigue (37, 39). Importantly for an applied setting sRPE allows for continuity of data collection (i.e., low risk of data loss) and can be applied across all training modes (e.g., technical-tactical training sessions, gym-based sessions and match play) and training locations.

Several recent studies have described the periodization strategies applied in elite level soccer (11, 28, 31, 32, 34, 40). Specifically, these case studies have described the periodized training strategies applied within a training micro-cycle structure, providing new insights into the quantity and distribution of training load in elite and sub-elite professional adult players (age range: 20–27 y). However, despite the widespread use of athlete monitoring in elite football academies, only a few studies have described the training characteristics of elite youth soccer players (13, 20, 45). These studies have been used to assess in-season weekly training load from one specific period of a season (e.g., start of the season (45), second half of the season (13) or across the entire season (20)), often with limited sample sizes per each age group. These studies also report different measures of load across different micro-cycle structures between the different age groups, making comparisons difficult. Consequently, the training characteristics of elite youth soccer players and the differences between age groups have yet to be fully established. Obtaining a better understanding of these characteristics, in particular the volume, intensity, and distribution of training load that elite youth players experience as they progress through football academies is particularly important as it can inform the development of appropriate training plans.

Information relating specifically to youth soccer players is critical as findings recorded by adult players (11, 28, 32, 34) may not be relevant to younger, less mature players (43). Gaining a greater understanding of the differences between youth and senior players may be used to inform training programming decisions with these specific age groups. Of the few studies that have investigated youth players, it was shown that older age groups (i.e., Under 18) are exposed to greater levels of load (volume, weekly sRPE and time >90% heart rate max) than younger age groups (45). These differences have been attributed, at least in part, to different technical-tactical requirements across the different age groups (1, 13) and different training styles used by coaches (41). A number of studies have reported the typical within-week micro-cycle distribution of training loads and across longer periods of the competitive season in elite adult players (28, 32, 34). Based upon these studies there appears to be a consistent pattern of distribution within weekly training micro-cycles but with little variation between weeks. This limited variation is likely a result of planning constraints that potentially limit player's adaptive responses. Other studies have highlighted that during the in-season starters experience greater training loads than non-starters in-season, particularly during congested periods (16, 19, 40). However, it is not currently known if non-starting players in elite youth academies record different training characteristics when compared to starters. As such, furthering our knowledge relating to these differences is important for the development of individual training plans that integrate the missing match load to ensure training adaptations and continue to promote the long-term development of all players within the squad.

Information regarding the nature, volume and intensity of the training performed can be used to facilitate the optimization of a training plan for individual players (15, 25) by helping to inform programmatic decisions. At present there are few reports regarding the training characteristics of elite youth soccer players, and many of the current studies have been limited by low sample sizes and the relatively short periods of a specific season. Therefore, the aim of this study was to quantify the perceived intensity (sRPE) and duration of the training and competition load performed by elite youth level soccer players (Under 15 to Under 19 age groups) from a top-level soccer academy over five consecutive seasons. Secondary aims were to quantify the differences between starters compared to non-starters in the different age groups and describe the variation of training load variables (sRPE, duration and training load) recorded across an entire competitive season.

METHODS

Experimental Approach to the Problem

This study was conducted utilizing mixed models to assess the levels of load accrued by elite youth soccer players across a whole training week, stratifying the data for age group and playing status. Each individual player's data was recorded during training and matches, as part of a systematic player monitoring programme, across all periods of 5 competitive seasons (from 2014-15 to 2018-19). For the purposes of this descriptive analysis player's mean weekly sRPE scores, total weekly training duration and total weekly sRPE-training load data (18) were assessed to ascertain the within (i.e., starter vs non-starter) and between group differences across 4 different age groups.

Subjects

Elite youth level soccer players from the Under 15 (U15), Under 16 (U16), Under 17 (U17) and Under 19 (U19) teams of the same elite level Italian soccer academy participated in this study. Over the multiple seasons a total of 230 unique players completed all training and matches (if scheduled), in at least one week. A written consent form was obtained from each subject and their legal guardian prior to the commencement of the study. The player's anthropometric measures are presented in Table 1. The study was approved by the University Research Ethics Committee (UTS HREC ETH19-4420).

INSERT TABLE 1 ABOUT HERE

Procedures

Individual player’s perceived exertion was recorded using the sRPE method, measured using Borg’s CR-10 scale (2, 18). All players were familiarized with the Borg Scale during a session dedicated to explaining this method and its correct use prior to commencing the study, this sensibilization process was repeated with all players at the beginning of each competitive season. The player’s sRPE value was collected by hand from each player independently (i.e., free from coaches and other player’s influence) ~30 min following each training session and match performed across all four age groups, prior to being recorded in the in-house training monitoring software. The internal load (sRPE-training load) of each session was subsequently calculated by multiplying the players’ sRPE by the duration of the session (18), which was determined as the time (minutes) elapsed from the initiation of warm-up to the end of the event (training or match).

The data from players who completed the whole in-season training week (typically four pitch-based technical-tactical training sessions, one gym-based session and a competitive match) was utilized for the analysis, calculating the mean sRPE value and sum of total weekly training duration and sRPE-training load. The players that took part in all of the team’s training sessions that specific week and at least 75% playing time of the competitive match were classified as starters. Non-starters were classified as players that performed all of the team’s training sessions but did not fulfil the match-related criteria. Each match is considered as a separate event, indicating that a player could be both a starter and a non-starter for any specific match across the duration of the competitive seasons. All training-related data were securely stored in an in-house software developed by the club.

Statistical Analysis

Hierarchical Linear mixed models were used to detect variation in mean weekly sRPE, total weekly duration and total weekly sRPE-training load between age groups with season as a fixed covariate effect. The differences between starters and non-starters were also investigated as a fixed effect, while individual players' were considered a random effect with a diagonal covariance matrix. Each model's residuals were visually inspected for normality and estimated marginal means and 95% confidence intervals (CI) were calculated for each age group across all three dependent variables. Significant differences were further investigated by multiple pairwise comparisons using the models estimated marginal means, with Bonferroni correction applied. Cohen's *d* effect size was computed from the mixed model to assess the magnitude of differences between age groups. The thresholds utilized for the interpretation were: <0.20, *trivial*; 0.20–0.59, *small*; 0.60–1.19, *moderate*; 1.20–1.99, *large*; and ≥2.00, *very large* (22).

Week-to-week variation in sRPE-training load throughout the entire competitive season (i.e., including preseason and post-season phases) was also calculated. Coefficient of variation (%CV) was calculated (i.e., the typical error expressed as a percentage of the mean score) and smallest worthwhile change (SWC) was obtained by multiplying the between subject standard deviation by 0.2 (21). For this analysis, the %CV and SWC data were grouped into four distinct periods of the season: Preseason (the training period prior to the first match of the competitive season), 1st half of the season (period from the first competitive match of the season to the winter break), 2nd half of the season (period from the restart following the ~10 day winter break to the end of the competitive league season) and post-season (the period comprising play-offs following the league season). Analyses were conducted using SPSS version 22 (SPSS Inc, Chicago, IL, USA). All data presented are calculated as mean and standard deviation, or 95% confidence interval where shown. Statistical significance was set at $p < 0.05$.

RESULTS

Across the five competitive seasons a total of 33,435 individual training observations were collected during the in-season period, with a range of 7,612 to 9,037 observations across the 4 age groups. significant effects on playing status (i.e., starter vs. non-starter), age group and season average weekly sRPE, total weekly duration and total weekly sRPE-training load were determined with the mixed model analysis. Models presented normally distributed residuals, estimated marginal means and 95% CI are presented in Table 2. Total weekly duration pairwise comparisons between the different age groups were all significant (all $p < 0.034$). Average weekly sRPE comparisons between age groups were all significant at $p < 0.001$ except for comparisons between the U17 and U16 age groups ($p = 1.00$). Total weekly sRPE-training load comparisons were all significantly different between age groups ($p < 0.001$), except between the U16 and U19 age groups ($p = 1.00$). Within age group differences recorded between starters and non-starters were significant for all three dependent variables. The differences within and between the different age groups weekly training load values are shown in Figure 1. The magnitude of differences between the different age groups are presented alongside the estimated marginal means and 95% CI in Table 3. The week-to-week variation in training load and SWC across the different periods of the competitive season and four different age groups are summarized in Table 4.

INSERT TABLE 2 ABOUT HERE

INSERT FIGURE 1 ABOUT HERE

INSERT TABLE 3 ABOUT HERE

INSERT TABLE 4 ABOUT HERE

DISCUSSION

Differences between age groups, season period and different seasons

The present study is the first known study to provide a detailed description of the seasonal training load characteristics of elite youth soccer players across different age groups. The quantity of data assessed, and different levels of analysis provide important insights into the training load characteristics and periodization models applied within an elite Italian youth soccer academy. Significant effects of age and playing status on sRPE, training duration and total weekly sRPE-training load were the main findings of the current study. Similar to previous studies (12, 36), we observed low levels of variation of load between the different phases of the season, with pre-season exhibiting the greatest changes in load between different training weeks.

Based upon the current results there was a progressive increase in weekly training load from U15 to U17, with significant differences recorded between each age group. The increase observed in sRPE-training load was mirrored by the increase in weekly training duration (training + match) across the three age groups. Notably, however, the increase in total weekly sRPE-training load and duration was not linear across the age groups, as the values for U19s were lower when compared to the U17s (*d* = -0.28, small). The differences noted in U19 was likely a result of lower levels of both sRPE and training duration, likely due to greater care in load management and preparation for the next competitive match, often characterized by shorter micro-cycles, more similar to an adult approach than the youth academy up to U17 (28). The weekly sRPE-training load values reported in the present study are slightly lower than those previously reported in an Italian youth soccer population (2798 ± 322 AU in U17) (23), but greater than a number of English youth academies (U17 = 2091 AU (17) and U18 = 1041 AU (excluding a match) (33)), while markedly lower than those reported from an elite U16 team (2919 AU) (45). These differences may be partially explained by different coaching philosophies or different training monitoring structures. While descriptive in nature, the present results provide reference values from the largest cohort to date (across 5 competitive seasons) and clearly identifies the importance for practitioners to prepare youth players for the increase in sRPE load from U15 to U17.

We observed a moderate increase (*d* = 0.78) in mean perceived training intensity (sRPE) from U15 to U16 age groups (+0.7 AU), with this variable subsequently remaining similar between the 3 older age groups of the academy (trivial to small effect sizes). The in-season sRPE ratings observed in the current study are lower than those reported from a Brazilian youth academy (U15: 4.90 ± 0.30 and U19: 6.85 ± 0.34) (10). The increase in perceived intensity between

U15 and the older age groups is supported by previous from a Portuguese youth academy (1). In that study, the authors suggested that U15 training was less physiologically demanding than the older age groups due to a greater emphasis being placed on technical aspects of the game (1). Collectively, based upon the current data, the training load that the U15 age group are exposed to elicits lower levels of perceived exertion. This suggests that practitioners can assist coaches with the planning and implementation of training interventions that can help prepare U15 players for the increased intensity they will experience in the older age groups of the academy. This planning phase is essential as it has previously been observed youth soccer that coaches and players' perception of effort may be weakly correlated (5). While the small differences recorded in sRPE between U16 and U19 age groups appears to indicate changes in player's perception of effort between age groups, it cannot be fully established in the present study due to differences in the levels of external load performed by players as they progress though the academy system (3, 8, 13, 20).

The limited differences observed in sRPE values between the three older age groups (d = 0.01 – 0.33) highlight that the variations observed in sRPE-training load between these groups are likely attributable to changes in training duration. This finding is in agreement with a previous study on youth soccer (45), that also reported increases in sRPE-training load between age groups to be largely due to greater training duration. Similarly, a recent study assessing both professional rugby codes (union and league) also reported a large amount of the variability in sRPE-training load was explained by session duration (57-73%), with the intensity of a session (internal and external) explaining only 24-34% of the variance in sRPE-training load (42). When interpreted collectively, these findings support practitioners evaluating and controlling for training duration and intensity separately. This finding has simple but important implications for practitioners who aim to control training load in youth football, as it highlights that control of training session duration is an important driver.

Overall, the duration of training performed during an in-season training week is similar to previous studies from across different countries (e.g., Spain (30, 31) and the Netherlands (6)). The training duration recorded in the present study appears to be at the upper limit of the range performed by an English Premier League youth academy, who record ~400-420 min per week from the U15 to U18 age groups (20). In addition, the stability reported in weekly training and match duration from U15 to U18 (7, 20) is similar to the small to moderate differences recorded between age groups in the present study (<36 min, $d < 0.51$). However, these findings are in contrast to a previous study that reported a progressive increase in weekly training duration from U14 to U18 (45). Collectively, these findings show that differences in weekly duration may be determined by the clubs training schedule and diverse styles of training periodization adopted across clubs and countries.

The mixed-effects models also revealed a significant effect of competitive season on sRPE values, training duration and sRPE-training load, indicating an important coach or group effect. This is particularly evident in the U15 and U16 age groups, where distinct differences in the distribution of sRPE-training load being recorded by both starters and non-starters can clearly be observed in the violin plots. Changes in the weekly training plan within a season and between seasons may also influence the sRPE-training load recorded within a club. Similar variations have been observed in professional soccer, with head coaches influencing not only the proportion of training drills but also the physical load induced (41). The importance of coaches input into the levels of training load and duration of individual sessions is supported by a survey of Premier League coaches and practitioners which highlighted that the content of training sessions was mostly determined by coaches (44). However, it has been found that coaches' perceptions of the load being prescribed to their athletes and evaluation of the players' recovery status may not always be aligned (29). Differences between players developmental age (13) and the physical capacity of the specific group of players (4) may also account for differences in weekly loading strategies.

Difference between Starters vs. Non-Starters

The assessment of differences in training load characteristics between starters and non-starters is of particular interest to a youth academy in order to ascertain whether the players are receiving a sufficient physical stimulus to promote their physical development and maintain fitness in-season. Indeed, players who do not participate in an official match may also be exposed to lower training loads, which places them at risk of losing match-specific fitness (16, 35). We observed differences between starters and non-starters across all three variables, with non-starters reporting lower sRPE, duration and sRPE-training load. From these results the mean difference observed between starters and non-starters was 9-10% for duration and 6-10% for sRPE, respectively. These differences contribute towards considerable differences in total weekly sRPE-training load between starters and non-starters, ranging from 16–21% across the four age groups. This confirms previous observations of non-starters performing lower weekly loads across a range of different internal and external parameters (31, 34, 40).

The differences between starters and non-starters remained as the players' progress through the youth academy (+400 AU, +40 min and +0.35 AU respectively, for sRPE-training load, duration and sRPE). However, the differences in weekly duration recorded between the two groups was less than the duration of a competitive match (i.e., a match duration of 70 min in U15, 80 min in U16 and 90 min in U17 and U19 age groups), indicating that some compensatory training was performed during the training week. It has previously been recommended that non-starters complete an additional training session to replicate at least part of the physical demands of a match and reduce the difference in load (34, 40). Indeed, the dose of compensatory work performed by non-starters in this study increased with age, likely as an attempt to offset the differences in match exposure. These differences are similar to those observed in young professional non-starter players from a Spanish reserve team utilizing differential RPE scores (~ -500 AU for both respiratory and muscular RPE scores) (31). However, different methods in identifying starters and non-starters make comparisons between studies difficult (16, 19). Additional compensatory training completed by non-starters may play an important role in player preparation by protecting from reductions in chronic load, potentially protecting against increased injury risk and loss of fitness (43). Indeed, any small deficits in training load between matches may accumulate into large differences when considered across an entire competitive season (16).

Variance in training load variables

Given that changes in the levels of physical stimuli are considered important for promoting physical adaptations to training (14), it is important to assess the within-week variability of the loads prescribed to athletes, particularly in the youth academy setting. The present findings showed that all age groups (U15 – U19) had greatest variability in training during the preseason period, with the U17 age group exposed to the largest variances in load (6.2%). These observations are similar to reports on elite level adult players (36), where there was little variability during in-season weekly training loads and minor decrements in variability as the season progressed. However, the week to week training variability observed in this study is lower than previously reported in elite adult Portuguese players (i.e., ~12-21% during a 10-week period including pre-season) (12). Differences in the variability reported between these studies may be due to changes in training structure (i.e., the number of weekly sessions) or the specific training philosophy applied within each organization. Since there are many sources of variability in total weekly training load (including the training density, frequency and volume), future studies might examine the contextual factors that influence the variability in training load applied in youth academies. In elite level adult players, the training schedule (and load) during in-season has been related to the preparation for the next competitive fixture (32, 35). This often includes modifying training and recovery activities to control players' fatigue across the weekly micro-cycle, as opposed to focusing on players' achieving their individual peak levels of physical performance (32, 35). From a practical point of view, it is presently unknown if this loading pattern, characterized by limited variation in training loads, is best suited to youth athletes and their physical development.

Whilst the present study is the largest known report of training characteristics of youth soccer player's, we acknowledge that all data were collected in one elite level Italian academy and that the present observations may be influenced by cultural training differences specific to that organization. The differences recorded between age groups in this study indicate that this aspect merits further investigation, ideally using a multicentre approach including data from many elite youth soccer academies. A limitation of the present study was that no external load measures were assessed. The inclusion of the external load demands performed by the different age groups would help to further the evaluation of internal loads recorded and help to ascertain the sensitivity of sRPE measures in a youth soccer population. Future studies should also examine the micro-cycle structure and distribution of these loads across the different age groups and individual differences between players of the same squad. Furthering our knowledge on the age-related differences in levels of training load is essential for the planning of a long-term strategy for youth soccer players' physical development.

PRACTICAL APPLICATIONS

Systematic monitoring of players training load and its progression in elite youth soccer players provide key information that can be used as reference to understand the performance levels elicited across an elite level academy. The present results provide a novel insight into the quantity of weekly sRPE-training load elite youth soccer players are exposed to in each age group, with a progressive increase in these levels of load from U15 to U17. The observation that differences in sRPE-training load are more attributable to training duration than perceived intensity highlight that the control of session duration is appears to play an important role when aiming to control load in the academy environment. The structured nature of in-season training results in little variance being recorded across the different age groups, however there is a significant effect for playing status (starter vs non-starter).

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Figure 1. Violin plots of the total weekly sRPE-training load performed by starters and non-starters across the four age groups.

Table 1. Player's anthropometric measurements across 5 competitive seasons (mean ± SD).

	2014-2015	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**
Under 15					
n	21	18	22	23	23
Age (y)	14.4 ± 0.3	14.4 ± 0.2	14.4 ± 0.3	14.3 ± 0.3	14.4 ± 0.3
Height (m)	1.75 ± 0.07	1.74 ± 0.07	1.72 ± 0.07	1.71 ± 0.07	1.71 ± 0.07
Weight (kg)	60.7 ± 7.7	58.5 ± 6.8	60.3 ± 7.6	56.9 ± 8.1	60.1 ± 7.0
Under 16					
n	25	19	19	22	23
Age (y)	15.4 ± 0.2	15.4 ± 0.3	15.4 ± 0.3	15.3 ± 0.2	15.4 ± 0.3
Height (m)	1.76 ± 0.07	1.78 ± 0.07	1.77 ± 0.05	1.75 ± 0.05	1.76 ± 0.07
Weight (kg)	65.5 ± 6.9	64.6 ± 6.1	65.3 ± 5.6	65.7 ± 6.1	66.0 ± 6.6
Under 17					
n	20	19	19	22	24
Age (y)	16.3 ± 0.3	16.3 ± 0.4	16.4 ± 0.5	16.3 ± 0.4	16.4 ± 0.2
Height (m)	1.79 ± 0.05	1.80 ± 0.07	1.78 ± 0.08	1.77 ± 0.04	1.79 ± 0.05
Weight (kg)	68.3 ± 5.4	70.7 ± 6.8	69.0 ± 7.7	69.8 ± 5.5	69.0 ± 5.0
Under 19					
n	27	25	27	31	27
Age (y)	17.5 ± 0.6	18.0 ± 0.7	18.1 ± 0.8	17.9 ± 0.8	17.8 ± 0.6
Height (m)	1.81 ± 0.05	1.80 ± 0.06	1.80 ± 0.05	1.79 ± 0.05	1.80 ± 0.05
Weight (kg)	74.2 ± 5.4	74.2 ± 7.0	73.7 ± 6.2	73.1 ± 5.5	73.5 ± 4.9

Table 2. Estimated Means and 95% CI of the three load variables across the 4 age groups.

Age group	sRPE (AU)		Duration (min)		sRPE-training load (AU)	
	Starters	**Non-Starters**	**Starters**	**Non-Starters**	**Starters**	**Non-Starters**
U19	4.76 (4.72 – 4.80)	4.35 (4.32 – 4.38)	474 (474 – 475)	433 (432 – 433)	2427 (2406 – 2447)	2014 (1997 – 2031)
U17	4.96 (4.93 – 4.99)	4.52 (4.48 – 4.56)	498 (497 – 498)	456 (456 – 457)	2581 (2566 – 2596)	2170 (2149 – 2191)
U16	4.95 (4.92 – 4.98)	4.65 (4.62 – 4.68)	454 (454 – 455)	414 (414 – 415)	2343 (2326 – 2360)	2013 (1997 – 2030)
U15	4.22 (4.19 – 4.25)	3.90 (3.86 – 3.94)	453 (453 – 454)	414 (413 – 415)	1991 (1974 – 2008)	1668 (1647 – 1689)

Table 3. Pairwise comparisons and magnitude of differences between age groups (Cohen's *d*).

Load Variable	Age group	Age group	Mean Difference	95% CI Lower limit	95% CI Upper limit	Effect Size
sRPE (AU)	U19	U17	-0.31	-0.42	-0.20	-0.33 (small)
		U16	-0.30	-0.41	-0.18	-0.31 (small)
		U15	0.45	0.33	0.58	0.45 (small)
	U17	U16	0.02	-0.08	0.11	0.01 (trivial)
		U15	0.76	0.66	0.87	0.81 (moderate)
	U16	U15	0.75	0.67	0.83	0.78 (moderate)
Duration (min)	U19	U17	-19	-29	-8	-0.25 (small)
		U16	+18	8	28	0.24 (small)
		U15	+27	18	37	0.36 (small)
	U17	U16	+36	27	46	0.51 (small)
		U15	+45	36	55	0.62 (moderate)
	U16	U15	+9	1	17	0.12 (trivial)
sRPE-Training Load (AU)	U19	U17	-178	-256	-100	-0.28 (small)
		U16	35	-44	114	0.05 (trivial)
		U15	457	377	536	0.69 (moderate)
	U17	U16	213	144	281	0.36 (small)
		U15	634	564	705	1.02 (moderate)
	U16	U15	421	361	481	0.67 (moderate)

The mean difference is significant at the 0.05 level for all comparisons with the exception of: U17 vs U16 sRPE ($p = 1.0$) and U19 vs U16 sRPE-training load ($p = 1.0$). AU – arbitrary unit, min – minutes.

Table 4. Coefficient of Variation and Smallest Worthwhile Change of weekly sRPE-training load across the four age groups.

Period of the competitive season			Age group							
Period	Number of Weeks	Observations per week	U19		U17		U16		U15	
	n	n	CV%	SWC	CV%	SWC	CV%	SWC	CV%	SWC
Preseason	4 – 8	13 – 96	3.6%	2.1%	6.2%	4.0%	3.9%	2.6%	4.6%	2.9%
1st Half of Season	14 – 17	26 – 53	2.4%	1.6%	3.6%	2.2%	2.4%	1.6%	3.0%	2.0%
2nd Half of Season	15 – 18	18 – 52	3.2%	2.2%	2.7%	1.8%	2.9%	1.9%	2.6%	1.7%
Post-Season	3 – 10	6 – 9	2.6%	1.7%	1.6%	1.1%	2.6%	1.7%	2.5%	1.7%

Number of weeks: range of weeks included in the period of the season, Observations per week: range of individual player observations per single week in the period.

Figure 1. Violin plots of the total weekly sRPE-training load performed by starters and non-starters across the four age groups.