Full Title: Periodisation in professional tennis: a macro to micro analysis of load management strategies within a cluttered calendar.

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Abstract

Aim: This study analysed the periodisation of internal loads across training and competition blocks of future top 250 (T250) professionally ranked tennis players' professional transitions.

Methods: Retrospective data was analysed from 10 male and 8 female Australian tennis players aged between 16 to 18 who later achieved professional rankings inside the T250. Session-rating of perceived exertion training load (sRPE TL) was collected from all sessions using an online application. Data were collected from official matches, on-court skill-based training, and off-court sessions (i.e. strength, conditioning, body management) and classified according to their occurrence in either training or competition blocks. Weekly sRPE TL was quantified for respective training and competition periods. One-way analysis of variance and effect size analyses compared within-sex training loads between training and competition blocks.

Results: Training blocks lasted longer than competitions for both sexes ($p<0.05$). Training blocks for males had greater daily durations ($p<0.01$), but not sRPE TL ($p=0.08$). Total load for females was not different between periods ($p>0.05$). Training blocks had higher on-court and off-court loads compared to competition ($p<0.05$). No difference in weekly training and competition loads were observed ($p>0.05$). Skill-based sessions in training periods were longer with higher loads for both sexes ($p<0.05$), with no difference in duration, RPE and sRPE TL observed between periods for off-court sessions ($p>0.05$).

Conclusions: Future T250 players experience higher sRPE TL in training blocks, with reductions in both total on-court and off-court load during tournaments. Regardless, limited evidence of periodised weekly loads exists within training and competition periods.

Key Words: athlete development, racquet sports, player monitoring, load planning

Introduction

Periodised training programs for tennis players are notoriously difficult to plan, as match loads are highly variable within irregular competition schedules that exist for professional players (1, 2). Indeed, tournament opportunities occur weekly with high-level players engaged in competition for ≈30 weeks of the year, leaving ≈20 weeks sporadically dedicated to training and recovery (1). Other than expert opinion, limited evidence currently exists to guide the balance and organisation of training and competition blocks (i.e. macro-level planning), and to a lesser extent, weekly load management (i.e. meso/micro-level loading). Indeed, recommendations from Tennis Australia for 'elite-level' juniors aged 15-18 y suggest: (a) 3-5 annual performance 'peaks', (b) 18-22 tournaments resulting in 90-125 total matches, (c) 16-20 hours of tennis training per week with 6-8 hours of 'off-court' activity and (d) five hours of match-play activity per week. However, these recommendations are derived mainly from personal coaching experience (3) alongside a small body of evidence that describes the relationship of on- and off-court training load with injury outcomes in adolescent players (4, 5). Accordingly, more detailed descriptions of the training and competition loads of developing players remains an important gap to address within the tennis literature.

The annual calendars (i.e., macro perspective of training block organisation) of international-level junior players have typically been outlined in case reports (6). Although anecdotal evidence suggests approximately 2-3 dedicated training periods lasting anywhere from 4-8 weeks exists for tennis players, the variability of tournament scheduling can constrain training time to ≤3 weeks (7-9). Given this stochastic training time, detailed reports of weekly periodisation within designated training periods and resulting load management during tournaments are scarce in the tennis literature. In a rare description of a training mesocycle, Gomes and colleagues (10) reported weekly loads across a periodised five-week block, whereby overload in weeks three and four was imposed through increased off-court loads. Despite showing how weekly periodisation strategies may exist in tennis, limited context was provided regarding loads in ensuing competition blocks and the on-court tennis loads. Indeed, descriptions of junior-elite players revealed increased average daily loads during competitive periods compared to typical training blocks, resulting from increases in on-court tennis loads (11). Further, trivial changes were observed for off-court session loads and was suspected to result in detraining of speed and aerobic capacities (11, 12). Given the apparent influence of mesocycle type on overall load profiles, it is likely the weekly periodisation of such loads would differ through manipulation training session type.

Indeed, to better understand macro or meso-level training prescriptions, more thorough dissections of specific session loads - as have proven typical in other professional sports (13) - are therefore warranted in both tennis training and competition contexts. Though currently limited to acute training studies, tennis drills under movement and time pressures heighten perceptual load, while closed-technical drills are perceived as less intense, despite comparable stroke rates (14, 15). To target both skill and physical capacities, combining tennis and off-court drills show increased heart rate responses concomitant with lower perceived effort compared to solely off-court protocols (16, 17). These drill demands represent only a subset of a typical session's load though and, while useful in guiding within-session prescriptions (18), require additional descriptions of full session loads to outline the training and competition periodisation strategies. Thus, given the scarce reporting of macro, meso and micro-cycle load accumulation in tennis, the aims of this study were: to describe and compare 1) the periodised training loads during training and competition blocks (for male and female players); and 2) loads of specific session types during training and competition periods in future top 250 (T250) professionally ranked tennis players. It was hypothesised that total load would be highest during training periods, with reductions in on-court skill-based and off-court strength and conditioning session loads during competitive periods.

Methodology

Participants

Training and competition load data from 10 male and 8 female tennis players was obtained during their 16th, 17th and 18th birth years (BY) between 2012 and 2016. During this time, all players were full-time scholarship athletes within the Tennis Australia National Academy system. Player data was used based on the attainment of a ranking position inside the Association of Tennis Professionals (ATP) or Women's Tennis Association (WTA) T250 for at least one ranking week of the player's career. As players inside the T250 are accepted into the qualifying events of Grand Slams (Australian Open, French Open, Wimbledon and US Open), it was deemed that the attainment of this ranking status could be considered a 'successful' career outcome. Peak rankings for males were 134 ± 81 (range 13-227) and 177 ± 38 (130-235) for females. Transition times to T250 from first professional point were 3.8 ± 1.7y (range 1-6y) for males and 4.4 ± 1.2y (range 3-6y) for females. This study was approved by the University Human Research Ethics Committee (ETH19-4030). Participant consent was based upon the signed athlete agreement from the athlete and their parent/guardian when accepting a National Academy scholarship.

Data Collection

Training and competition loads were collected via an online Athlete Management System (AMS) application (FairPlay AMS Pty Ltd, Brisbane, Australia) which was accessible by players and coaching staff. All players were expected to complete daily training load questionnaires as part of their agreement with the Tennis Australia National Academy at the time of collection. Players self-reported their mode (i.e., tournament or training), session type (i.e. match-play, on-court training, strength session), court surface, duration and rating of perceived exertion (RPE) for each training session or competitive match in a given day. The training practices of both male and female players involved a mixture of combined and single-gender training sessions and international tours throughout the four-year period.

To account for training days that occurred during tournament periods, the self-reported training and tournament days were authenticated from internal Tennis Australia databases. Tournament days were classified as those from the official start date of the first tournament until the player's final match. A minimum of two-weeks with an absence of official tournament matches was required between the start of tournaments to be classified as a training period. The latter definition was developed based on expert opinion and previous reports of training and competition periods (7). Further, weekly (7-day) microcycles were determined within respective training and competition periods. For training periods, weeks were classified in a negative chronological fashion based on duration from the start of the ensuing competition period (i.e. week -4 is 4 weeks from competition period). However, competition weeks instead used a positive chronological approach with weeks into competition (i.e. Week 1 is the first week of competition). The terms 'competition' and 'tournament' are used interchangeably to differentiate competitive periods from dedicated training blocks.

The array of session types that players could report through the online AMS consisted of seven categories; i) Skill-Based, ii) On-Court Conditioning (OCC), iii) Match-Play, iv) Conditioning, v) Movement/Speed/Agility, vi) Strength and vii) Body Management. Sessions were initially categorised into 'On-Court' or 'Off-Court' sessions, allowing for the analyses to be performed at a block and weekly level, before analysing loads by specific session types within respective periods. As further detail of the above categories, On-Court Training sessions included the player's group and individual tennis sessions. OCC was conditioning-based sessions that still involved the incorporation of tennis training, with either tennis or conditioning staff, and were in contrast to Conditioning sessions (i.e., off-court aerobic running session) where no tennis was involved. Movement/Speed/Agility sessions were classified separately due to their focus being more on technical movements specific to tennis without the hitting component. Match-play included any singles or doubles matches played, as distinguished from simulated match-play which was classified under on-court training. This distinction was made to ensure that local club match-play was obtained which falls under focused training periods. Strength sessions were gym-based sessions focused on improving strength or power capacities with Body Management referring to lower intensity sessions targeting, for example, lumbo-pelvic or shoulder stability. Daily session plans from coaching staff were visible to the athlete via the mobile application, confirming the sessions for the day.

Session RPE was reported using the category-ratio 1-10 (CR-10) scale. This measure has been shown to be a valid option in quantifying responses to load in tennis training and match-play activities ($r = 0.74$ and $r = 0.99$, respectively) when heart rate was used as a criterion measure (19). Training and competition loads were quantified using Foster and colleagues' (20) method where RPE is multiplied by session duration with load reported in arbitrary units (AU) termed session-RPE training load (sRPE TL). Appropriate external load monitoring systems (e.g., wearable technology, automated motion analysis) were not available at the time and thus, perceptual load measures were relied upon. However, for the purposes of this study, duration was used to best represent external load despite being used in the internal load calculation. Duration was reported for specific session types alone and also a total daily measure for days in training and competition periods. Players had prior familiarity in reporting RPE from the age of 15 for at least one year prior.

Days listed as 'modified' or 'no training' due to injury or illness were removed from the analysis, with an exception being if the athlete could still play a known competitive match. Injuries were self-reported by athletes via the online questionnaire. However, these were cross-referenced by a sport science and medical officer within Tennis Australia to ensure the injury met the Orchard Sports Injury Classification System (OSICS) and Sports Medicine Diagnostic Coding System (SMDCS) (21). Additionally, rest days were not included in the analysis of training loads and were only used to analyse training and competition period lengths.

Statistical Analysis

All statistical analyses were performed in the R language (RStudio, 1.1.463, RStudio, Inc.). The analysis of training and competition loads was conducted on those periods where compliance with data entry was ≥75%. Descriptive statistics of the mean and standard deviation were used to report the annual training and competition days for players as well as session volume, RPE and sRPE TL. Data normality was assessed via Shapiro-Wilk's test. Data that was not normally distributed were log-transformed. To analyse differences between load variables in training and competition blocks, a one-way analysis of variance (ANOVA) was performed with a Bonferroni adjustment. Analysis of load variables between weeks within respective training and competition periods was performed via a repeated-measures one-way ANOVA, with a Bonferroni adjustment. The significance level was set at 0.05. Effect size was calculated using Cohen's d statistic with $d < 0.2$ classified as trivial, $d = 0.2$-0.5 small, $d = 0.5$-0.8 medium and $d > 0.8$ large, with 95% confidence intervals (CI). Due to the structural differences of their respective competitions and tours, males and females were reported separately.

Results

For males, a total of 125 and 119 individual training and competition periods existed for possible use from the 10 players. Eighteen individual training periods and 51 tournament periods met the required compliance of data entry (i.e. ≥75%). For females, 137 and 131 respective training and tournament periods were available from eight players, of which 49 training and 85 tournament periods were included for analyses.

Table 1 shows the descriptive data from training and tournament periods for males and females. For males, training periods consisted of a greater number of days than tournament periods (p=0.01, d=0.36 [0.10-0.61]). Daily total, on-court and off-court durations in training blocks were greater than during tournament periods (p<0.01, d=0.36-1.70 [0.10-2.29]). While no significant differences existed between periods for total daily sRPE TL (p=0.08, d=0.63 [0.11-1.14]), higher values were observed for on-court and off-court sessions in periods of training (p<0.01, d=0.74 [0.20-1.27] and d=0.89 [0.36-1.42], respectively). Similarly, a greater number of days existed during training periods for females than during tournament periods (p=0.02, d=0.28 [0.04-0.52]). No significant differences existed between periods for daily sRPE TL or total daily duration (p=0.54, d=0.11 [-0.24-0.46]) and p=0.96, d=0.02 [-0.33-0.37], respectively). However, on-court and off-court session duration and associated sRPE TL were greater in training compared with competition blocks (p<0.01, d=0.63-1.37 [0.26-1.77]).

*****TABLE 1 NEAR HERE*****

Figure 1 shows the weekly loads in training and competition periods for males and females, grouped by on-court or off-court sessions. For males, both on-court and off-court training loads were not significantly different (with trivial ES) between the four weeks leading up to competition (*p*=0.74 and *p*=0.88, respectively, *d*=0.00-0.43 [-0.78-1.17]; Figure 1A). Similarly, during competition for males, the on-court and off-court tournament loads were not significantly different (with trivial-small ES) within the competition period (*p*=0.71 and *p*=0.54, respectively, *d*=0.10-0.25 [-0.51-0.82]; Figure 1B). For female players, on-court and off-court session training loads were not significantly different between weeks (*p*>0.05; *d*=0.01-0.62 [-0.56-1.16]; Figure 1C). On-court and off-court loads in tournament periods for females were also not significantly different, again with trivial-small ES, between weeks (*p*=0.24 and *p*=0.87, respectively, *d*=0.00-0.32 [-0.74-1.00]; Figure 1D).

*****FIGURE 1 NEAR HERE*****

Table 2 shows the descriptive session characteristics for males. For match-play activities, duration and sRPE TL were not significantly different between periods (*p*=0.09, *d*=0.55 [-0.17-1.27] and *p*=0.11, *d*=0.91 [0.18-1.60], respectively); however, higher RPE values were observed in tournament periods (*p*=0.02, *d*=1.19 [0.44-1.94]). Skill-based sessions during training were longer with higher sRPE TL compared with tournament periods (*p*<0.01, *d*=2.43 [1.72-3.12] and *p*<0.01, *d*=1.84 [1.20-2.46], respectively). There were no significant differences between respective periods for RPE for skill-based sessions (*p*=0.06, *d*=0.77 [0.24-1.30]). No significant differences were observed for duration, RPE and sRPE TL in on-court conditioning sessions, though large effects were observed for reduced loads in competitive periods (*p*>0.05; *d*=1.03-1.16 [-0.52-2.74]). There were no significant differences between training and competition periods for strength & conditioning, or movement session loads (*p*>0.05); though, moderate to large effects were observed for higher training durations across these training sessions (*p*>0.05, d=0.56-1.11 [-0.04-2.00]).

*****TABLE 2 NEAR HERE*****

Table 3 shows the descriptive session characteristics for females. The duration of match-play activities was greater in periods of competition (*p*<0.01, *d*=0.65 [0.13-1.17]); however, no significant differences were observed for RPE or sRPE TL (*p*=0.60, *d*=0.14 [-0.37-0.65] and *p*=0.13, *d*=0.57 [0.05-1.09]). For skill-based sessions in training periods, significantly greater durations, RPE and sRPE TL existed, with moderate to large effect sizes (*p*<0.01, *d*=2.15 [1.67-2.62], *p*<0.01, *d*=0.63 [0.26-0.98] and *p*<0.01, *d*=1.85 [1.40-2.29], respectively). Training and competition load for on-court conditioning sessions were not different between the respective periods in female players (*p*>0.05); however, moderate effects existed for greater session durations in competition (*d*=0.56 [-0.43-1.25]). No significant differences were observed for duration, RPE and sRPE TL for off-court sessions (body management, strength, conditioning and movement) between training and competition periods with trivial to small effects observed (*p*>0.05, *d*=0.04-0.50 [-0.44-0.89]).

*****TABLE 3 NEAR HERE*****

Discussion

This study analysed meso and micro-level training and competition loads experienced by future top 250 professionally ranked tennis at ages 16-18 y. Discrete training periods analysed here lasted longer than standalone competitive periods for both males and females. For males, training periods were characterised by longer training sessions and larger sRPE TL, though females showed equivocal differences in total load between training and competition periods. A lack of statistical significance alongside small ES between weekly loads during training or competition suggests weekly periodisation approaches in tennis are subtle at best. Overall, the present results highlight the expected increases in overall load throughout training blocks, though week-to-week on-court and off-court training loads remain similar throughout both training and competition blocks.

Understanding training and competition loads that characterise the transition into professional ranks of successful players can inform future player development strategies. Our analysis shows that dispersed three-to-four week training cycles existed for players during the ages of 16-18y, which were likely implemented based on recommendations that exist for professional players (7, 22). This could be useful for Tennis Australia's current training recommendations to guide the lengths of training blocks around the 3-5 annual performance 'peaks' (23). The discrete existence of these training blocks in tennis challenges the implementation of traditional block periodisation models (i.e. 2-4 week training cycles over a 2-month period) (24) for high-level players, given the dominance of competitive periods throughout the calendar year (3). Accordingly, our results show that total loads were generally higher during periods of focused training and confirms one of our hypotheses. This was an expected finding given these designated training periods are ideal for achieving any desired physiological adaptations determined by physical preparation staff in the absence of competitive requirements, with overload typically obtained through increased weekly volumes (25-28).

Despite these apparent differences in total load through more macro/meso-level perspectives of training and competition loads, the weekly periodisation was not as pronounced. Within training and competition weeks, there were no significant differences (small ES) observed between weeks for ‘on-court’ and ‘off-court’ loads in both males and females. This weekly pattern of training load would suggest minimal existence of periodised structures, with limited discernible change in tennis and strength and conditioning loads between weeks. Direct comparisons within the tennis literature are limited due to a lack of research, though controlled settings have reported significant increases in weekly load due to manipulation of off-court loads (10). Despite our results showing no significant differences in weekly loads, medium size effects were observed for increased tennis loads one-week prior to competition with concurrent reductions in off-court loads for females. This finding may be explained through tennis coaching literature where, increased on-court time may reflect strategies to minimise feelings of anxiety prior to tournaments specific to female players (29). Alternatively, it may reflect a tapering strategy for tennis in maintaining ‘specificity’ of on-court training exposure prior to tournaments. However, for males, small-trivial effects were observed for increased on-court loads and likely reflects the varied nature of weekly periodisation for tennis where managing load may manifest itself in subtle alterations within session types (30).

A unique aspect of this study is the reporting of loads for specific session types across training and competition periods of ensuing T250 players. The loads of skill-based sessions for both sexes were expectedly higher in training periods and was reflected through increased volume (i.e., duration) and intensity (i.e., RPE) of sessions. Interestingly, practice and official match-play sessions were not different between periods, though large effects were observed towards lower durations in periods of training. This may suggest that match-play activities are underloaded in focused training periods and may be expected given previous research in adolescent tennis and rugby players (31, 32). However, in focussing on male players, overloading match-play exposures may be difficult in tennis given the increase in match durations are uncontrollable in competition and that associated RPE may also reflect competition standard and mental fatigue (33, 34). For female players, the limited difference in match-play RPE between training and competition periods may reflect unique match preparation strategies. This reveals a limitation of the present study being the absence of external loads, which may have informed this latter point. Indeed, heightened accelerations and relative distances covered have been reported in tennis competitions compared with training activities (35), which highlights the need for further descriptions of the external loads within these sessions. Further to this, on-court conditioning session loads were reduced in competition for males but not for females. While this is likely an artefact of the small sample size, it possibly reflects the uncertainty of load management strategies during tournament periods whereby success and resulting tennis loads impact the training stimulus required (11). This latter aspect has been investigated by Murphy and colleagues (11, 12), who observed reduced speed and aerobic capacities post-competition periods in junior players. In the context of the present study's results, it may be speculated that the off-court session loads represent a capitalisation of training opportunities from physical performance staff. Further, load management of individual off-court sessions appear to have sex-specific patterns. Indeed, large effects towards reduced durations of strength, conditioning and movement sessions in competitive periods for males agrees with suggestions from the tapering literature whereby training volumes are lowered while typical session intensity from training blocks are targeted at being maintained (30). In contrast, this effect was trivial-small for female players and reinforces the individual nature of planning loads for tennis players during competitive periods.

Limitations

This study is novel in that longitudinal internal training load reports of tennis players have rarely been reported in the literature. Nonetheless, it is limited by observing only a small sample of male and female Australian tennis players at varied stages of maturation and grouping the data across birth years. Further, it is noted that the combined reporting of players across these development years suggests our results should be interpreted with caution in extrapolating to the training activities performed at a given age. The measures of training load in this study were limited to sRPE TL and hence, no external load could be reported. Additionally, the training environments at the time of data collection did not provide other training load data, such as heart rate, which represents a possible limitation in understanding on-court or conditioning-based sessions. While online training diaries have been shown to be mostly suitable for junior athletes (36) and the latency period for validly entering RPE can be up to 24 hours (37), there may still have been differences in interpreting session types for individual athletes. However, it should also be noted that RPE obtained for training sessions eliciting ≥5 RPE may be reported as lower if taken after 30 minutes post-session (38). Lastly, future studies may seek to delve deeper into the external loads associated across tennis-specific training.

Conclusions

This study is the first to describe typical training and competition blocks in future successful tennis players at a key development period (ages 16-18 y). A finding of note is that, for both males and females, the length of individual training periods are greater than competition periods. Overall on-court and off-court loads appear to follow traditional periodisation practices of being reduced during competitive periods. However, weekly periodisation strategies reflect more subtle approaches to load management in tennis players. Further, while overall off-court loads are reduced during competitive periods, individual strength, conditioning and body management sessions reflect the imposed stimulus throughout training periods and likely reinforces the need for tennis players to train within tournament blocks.

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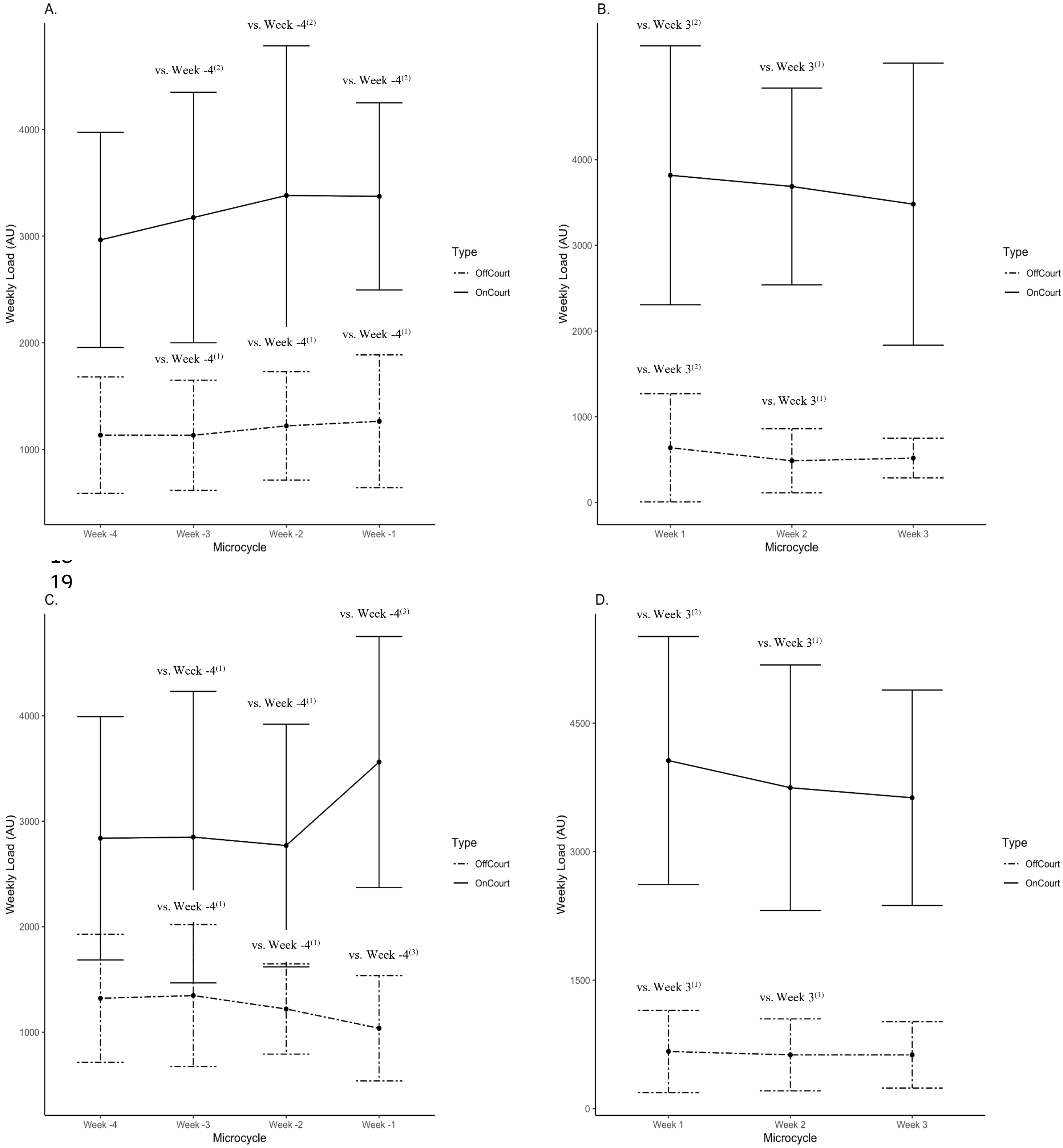

Figure 1. Mean ± standard deviation of weekly training and competition loads to represent periodisation of microcycles for males and females

A. Males (Training)
B. Males (Tournament)
C. Females (Training)
D. Females (Tournament)
(1)trivial effect size ($d < 0.2$)
(2)small effect size ($d = 0.2\text{-}0.5$)
(3)medium effect size ($d = 0.5\text{-}0.8$)
(4)large effect size ($d > 0.8$)

Table 1. Mean ± standard deviation of daily training and tournament load variables for males and females

Load Variable	Male		Female	
	Training	**Tournament**	**Training**	**Tournament**
Days in Period (n)	30 ± 22*(1)	23 ± 19	33 ± 32*(3)	21 ± 18
Total Daily Duration (min)	163.4 ± 34.3*(4)	132.9 ± 21.8	162.8 ± 35.1(1)	162.2 ± 30.4
Total Training Load (AU)	806 ± 251(3)	675 ± 160	779 ± 207(1)	757 ± 202
On-Court Duration (min)	97.6 ± 15.4*(4)	72.4 ± 14.4	82.4 ± 13.8*(4)	67.1 ± 9.4
On-Court Training Load (AU)	489 ± 131*(4)	381 ± 112	411 ± 106*(4)	327 ± 70
Off-Court Duration (min)	48.3 ± 6.7*(4)	37.3 ± 12.1	44.5 ± 11.4*(3)	37.3 ± 12.1
Off-Court Training Load (AU)	236 ± 68*(3)	173 ± 94	223 ± 81*(3)	168 ± 80

All data presented as mean ± standard deviation
*significant difference between training and competition within respective sex ($p < 0.05$)
(1)trivial effect size ($d < 0.2$)
(2)small effect size ($d = 0.2$-0.5)
(3)medium effect size ($d = 0.5$-0.8)
(4)large effect size ($d > 0.8$)

Table 2. Mean ± standard deviation of load variables for male players for session types in training and tournament periods

	Match-Play		Skill-Based		On-Court Conditioning		Strength		Conditioning		Movement/Speed/Agility		Body Management	
	TRA	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**
Duration (min)	82.9(3) ± 25.0	94.9 ± 18.3	100.3*(4) ± 16.8	57.0 ± 18.8	60.8(4) ± 25.5	36.3 ± 22.1	61.9(3) ± 6.6	56.8 ± 11.4	43.9(3) ± 15.1	34.1 ± 11.5	35.6(4) ± 8.3	26.6 ± 8.0	32.2(1) ± 7.6	31.0 ± 8.6
RPE	4.3*(4) ± 1.1	5.6 ± 1.2	4.7(3) ± 0.7	4.0 ± 1.0	7.7(4) ± 2.5	5.5 ± 1.1	5.2(1) ± 0.8	5.3 ± 1.4	6.4(1) ± 1.9	6.1 ± 1.4	3.7(1) ± 0.7	3.9 ± 1.6	2.4(1) ± 0.9	2.3 ± 0.9
Load (AU)	384(4) ± 210	569 ± 192	502*(4) ± 138	259 ± 125	504(4) ± 355	198 ± 113	328(2) ± 64	308 ± 103	286(3) ± 136	208 ± 74	134(3) ± 49	105 ± 61	90(1) ± 34	88 ± 40

All data presented as mean ± standard deviation. TRA = Training, TOU = Tournament, RPE = Rating of Perceived Exertion
*significant difference between training and competition within respective sex ($p < 0.05$)
(1)trivial effect size ($d < 0.2$)
(2)small effect size ($d = 0.2\text{-}0.5$)
(3)medium effect size ($d = 0.5\text{-}0.8$)
(4)large effect size ($d > 0.8$)

Table 3. Mean ± standard deviation of load variables for female players for session types in training and tournament periods

	Match-Play		Skill-Based		On-Court Conditioning		Strength		Conditioning		Movement/Speed/Agility		Body Management	
	TRA	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**	**TRA**	**TOU**
Duration (min)	77.7*(3) ± 25.1	90.6 ± 12.5	84.8*(4) ± 13.7	53.5 ± 15.3	46.3(3) ± 23.3	64.2 ± 38.5	61.8(2) ± 8.8	57.7 ± 12.6	35.2(2) ± 16.8	30.0 ± 11.7	34.7(1) ± 11.2	35.1 ± 11.5	33.1(2) ± 9.8	28.5 ± 11.7
RPE	4.8(1) ± 0.7	5.0 ± 0.8	4.8*(3) ± 0.7	4.4 ± 0.7	6.6(1) ± 1.1	6.5 ± 1.4	5.1(2) ± 0.8	4.8 ± 0.9	6.5(1) ± 1.2	6.3 ± 1.5	4.9(2) ± 0.8	5.1 ± 1.1	2.2(2) ± 1.0	2.0 ± 1.2
Load (AU)	389(3) ± 150	464 ± 107	420*(4) ± 104	246 ± 83	312(3) ± 170	450 ± 341	318(3) ± 65	280 ± 84	226(2) ± 118	186 ± 79	173(1) ± 72	178 ± 70	88(2) ± 60	75 ± 36

All data presented as mean ± standard deviation. TRA = Training, TOU = Tournament, RPE = Rating of Perceived Exertion
*significant difference between training and competition within respective sex ($p < 0.05$)
(1)trivial effect size ($d < 0.2$)
(2)small effect size (d = 0.2-0.5)
(3)medium effect size (d = 0.5-0.8)
(4)large effect size ($d > 0.8$)