ORIGINAL SCIENTIFIC PAPER

# Differential ratings of perceived exertion to quantify weekly and sessional internal load in basketball: an exploratory team-based case series

Eider Iglesias-Torres[1], Asier Gonzalez-Artetxe[1], Aaron T. Scanlan[2], Asier Los Arcos[1,3]

**Affiliations:** [1]Department of Physical Education and Sport, Faculty of Education and Sport, University of the Basque Country, UPV/EHU, Vitoria-Gasteiz, Araba, Spain (AGA: https://orcid.org/0000-0001-5007-4524; https://twitter.com/3asiergonzalez), [2]Human Exercise and Training Laboratory, School of Health, Medical and Applied Sciences, Central Queensland University, Rockhampton, Queensland, Australia (https://orcid.org/0000-0002-0750-8697; https://twitter.com/AaronTScanlan), [3]Society, Sports and Physical Exercise Research Group (GIKAFIT), University of the Basque Country, UPV/EHU, Vitoria-Gasteiz, Araba, Spain (https://orcid.org/0000-0003-1001-7706)

**Correspondence:** Asier Gonzalez-Artetxe, Faculty of Education and Sport, University of the Basque Country, UPV/EHU, Lasarteko atea 71; 01007 Vitoria-Gasteiz, Araba, Spain. E-mail: asier.gonzalez@ehu.eus

**Abstract**

Although differential rating of perceived exertion (RPE) scales have been supported in quantifying internal load across various sports, their application in basketball remains to be comprehensively investigated. Consequently, we aimed to: (1) quantify and compare session- and weekly-RPE loads using global and differential RPE scales; and (2) compare session-RPE load between individual sessions across the week using each scale in basketball players. Ten semiprofessional, male players reported RPE using global and differential (respiratory and muscular) scales following each training session and game during the in-season. RPE was multiplied by session duration to derive session-RPE load, which were summed to determine weekly-RPE load. Weekly-RPE load was higher using global ($P = 0.003$, $\eta 2 = 0.343$, large) and muscular ($P = 0.004$, $\eta 2 = 0.209$, large) scales than the respiratory scale. Likewise, session-RPE load was higher using global ($P = 0.049$, $\eta 2 = 0.314$, large) and muscular ($P = 0.054$, $\eta 2 = 0.298$, large) scales than the respiratory scale only in games, with differences between scales during other sessions being trivial-to-medium ($P > 0.05$). Across all scales, higher session-RPE loads were apparent in the second training session than all other sessions in the week ($P < 0.05$, $\eta 2 = 0.105$–$0.561$, medium-to-large), and during games than the first training session ($P < 0.001$, $\eta 2 = 0.202$–$0.223$, large). While session-to-session load changes were similarly detected across scales, the greater weekly and game muscular loads than respiratory loads support the potential for differential RPE scales to provide more detailed internal load data in basketball settings.

***Keywords:*** *periodization, training load, perceived exertion, performance, perceptual*

@MJSSMontenegro
DIFFERENTIAL RPE TO QUANTIFY INTERNAL LOAD IN BASKETBALL
http://mjssm.me/?sekcija=article&artid=274

**Cite this article:** Iglesias-Torres, E., Gonzalez-Artetxe, A., Scanlan, A.T., and Los Arcos, A. (2024) Differential ratings of perceived exertion to quantify weekly and sessional internal load in basketball: an exploratory team-based case series. *Montenegrin Journal of Sports Science and Medicine, 20 (1)*, 75–80. https://doi.org/10.26773/mjssm.240309

Received: 21 September 2023 | Accepted after revision: 10 February 2024 | Early access publication date: 01 March 2024 | Final publication date: 15 March 2024



Conflict of interest: None declared.

## Introduction

Monitoring player loads has become commonplace among basketball teams (Fox, Scanlan, et al., 2020). Player loads can be categorized as external or internal, whereby external load represents the physical stimuli applied while internal load represents the responses of players to the external stimuli (Bourdon et al., 2017). While basketball practitioners prescribe the training load according to the external load, it is the internal load that determines the training outcome in players (Impellizzeri et al., 2019). In this way, measuring player ratings of perceived exertion (RPE) following training sessions or games and multiplying these individualized ratings by the session duration to determine session-RPE load is the most frequently used approach to quantify internal load in basketball players (Piedra et al., 2021).

When applying the session-RPE method to measure internal load, it has been argued that a single RPE scale is insufficient to represent the various perceptual sensory responses experienced during exercise (Hutchinson & Tenenbaum, 2006). Consequently, differential RPE scales have been applied in several team sports for internal load monitoring to represent more distinct sensory inputs than traditional global RPE scales (Los Arcos et al., 2016; McLaren et al., 2017; Weston et al., 2015). Differential RPE scales were developed to distinguish between central and peripheral factors contributing to the global RPE (Ekblom & Golobarg, 1971). In this way, central factors are typically measured using perceptual RPE breathlessness scales, or respiratory RPE, and peripheral factors are typically measured using perceptual leg-muscle exertion scales, or muscular RPE (Borg et al., 2010; Ekblom & Golobarg, 1971; Pandolf et al., 1975). However, research using differential RPE scales to quantify internal load is lacking in basketball, with studies only examining basketball players during 3 vs. 3 national-level games within a two-day tournament (McGown et al., 2020) as well as 4 vs. 4 small-sided and competitive wheelchair games (Iturricastillo et al., 2016, 2017). Consequently, no research has applied differential RPE scales to quantify internal loads during training in any basketball populations and during games in traditional 5 vs. 5 competitions.

When examining load monitoring methods, it is important to ensure translatable outcomes stem from research. In this regard, basketball practitioners consistently implement load monitoring to understand how training demands differ between sessions and relative to games (Fox, Scanlan, et al., 2020). Indeed, research has supported differential RPE scales in providing unique insight compared to global RPE scales regarding differences in session-RPE loads encountered between training sessions in field-based team sport (McLaren et al., 2017); however, these findings should not be simply transferred to basketball given the varied demands encountered (Taylor et al., 2017) will likely impose specific perceived respiratory and muscular exertion across sports. Nevertheless, differential RPE scales to measure session-RPE load specifically in basketball players has been encouraged in the literature to identify whether they provide added insight into the training response (Fox et al., 2022). Therefore, this study aimed to: (1) quantify and compare session- and weekly-RPE loads using global and differential RPE scales; and (2) compare session-RPE load between individual sessions across the week using each scale in basketball players.

## Materials and methods

### *Participants*

Ten semiprofessional, male basketball players (age: 23.3 ± 3.0 years [range: 19–28 years]; height: 1.94 ± 0.12 m; body mass: 87.1 ± 13.2 kg; competitive basketball experience: 14.9 ± 3.1 years) competing in the Liga Española de Baloncesto Aficionado (EBA) were recruited for this study. Players completed 84–100% of sessions during the monitoring period. Players completed three on-court team training sessions lasting between 50–140 min and one official game each week (Table 1). All procedures conformed to the Declaration of Helsinki and the Code of Conduct Ethics Committee of Publications. This study was approved in advance by the Institutional Review Committee of the Sports and Youth Institute of Navarre. Each participant voluntarily provided written informed consent before participating.

**Table 1.** The weekly training and game schedule completed by the semiprofessional, male basketball players throughout the monitoring phase in this study.

| Day | Physical fitness contents | Basketball-specific contents |
|---|---|---|
| Monday | Core stability or agility | Technique |
| Tuesday | Rest | Rest |
| Wednesday | Strength or speed | Technique + tactics |
| Thursday | Rest | Rest |
| Friday | Injury prevention | Tactics + shooting |
| Saturday/Sunday | Official game played on either day | |

### *Study design*

An exploratory team-based case series study design was adopted. This observational approach involved all players from the same semiprofessional basketball team being monitored during a 6-week in-season period (January–March) across the 2021/22 season (Figure 1). Internal load was measured throughout the monitoring period via individualized session-RPE being collected from each player following training and games using global, respiratory, and muscular scales. Session-RPE was used to derive loads for each individual session within the week and cumulatively across the week. Comparisons in load were then made between scales (for each session and weekly) and between sessions within the week (for each scale).

### *Procedures*

Players reported individualized RPE from 0 (rest) to 10 (maximal) using Foster's 0-10 scale (Foster et al., 2001) sep-


DOI 10.26773/mjssm.240309

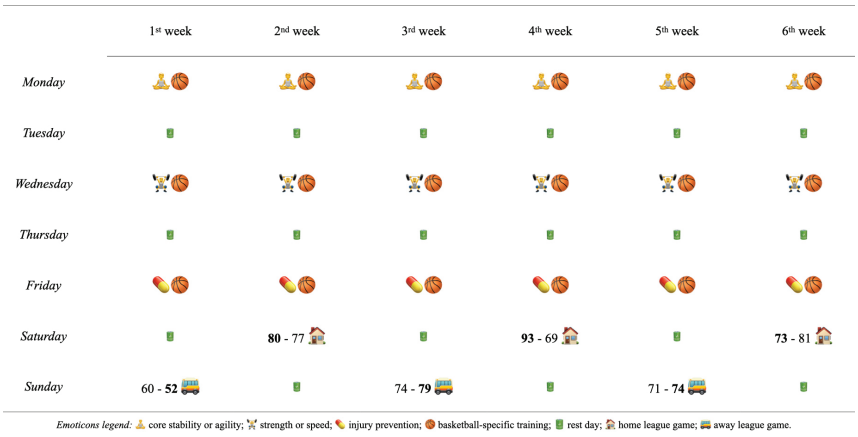


**Figure 1.** The training and match schedule completed by the semiprofessional, male basketball players throughout the six weeks of this study

arately for global, central (respiratory), and peripheral (muscular) exertion 10–20 min following each training session and game (Iturricastillo et al., 2017; Los Arcos et al., 2016; McLaren et al., 2017). Each player provided their RPE to the strength and conditioning coach in the absence of other players to avoid peer influence (Minett et al., 2022). Players consistently answered the following questions when providing their RPE (Foster et al., 2001): How hard has the session been? How hard has the session been at the respiratory level? How hard has the session been at muscular level?

The duration of each training session was recorded from the commencement of the warm-up to the completion of training activity with rest periods included and cool-down exercises excluded (Ferioli et al., 2018). The duration of each game was recorded from commencement (tip-off) to completion including rest periods (Ferioli et al., 2018). RPE using each scale were multiplied by the duration (minutes) for each training session and game to calculate session-RPE load (Foster et al., 2001). When players completed all scheduled training sessions and were available to compete in the game for a given week, their data were tabulated to calculate weekly-RPE load using each scale. Players were familiarized with using each RPE scale for four weeks prior to data collection.

*Analysis*

All variables did not meet the assumptions for a normal (Gaussian) distribution, and therefore were log-transformed (Newans et al., 2022). In turn, data are described using means and 95% confidence intervals (CI). Linear mixed models were used to compare weekly session-RPE load between scales with scale inputted as a fixed effect (43 samples per scale) and player (n = 10) inputted as a random effect to account for repeated observations. Furthermore, separate linear mixed models were used to compare session-RPE load between sessions within the week for each scale (i.e., first training session [52 samples] vs. second training session [53 samples] vs. third training session [59 samples] vs. game [48 samples]), where session number was inputted as a fixed effect, while week (n = 6) and players (n = 10) were inputted as random effects. Eta squared (η2) was calculated to assess the magnitude of pairwise differences – interpreted as: trivial, <0.01; small, 0.01–0.06; medium, 0.06–0.14; and large, >0.14 (Cohen, 1988). Statistical significance was set at P <0.05 and analyses were performed using Jamovi software (The jamovi project [2022], version 2.3.2).

## Results

Mean weekly- and session RPE loads using each scale are presented in Table 2 with effect sizes for all pairwise comparisons shown in Table 3. Comparisons between scales revealed weekly-RPE load was higher using global (P = 0.003, large) and muscular (P = 0.004, large) scales than the respiratory scale. In contrast, trivial-to-medium differences (P >0.05) in session-RPE loads were evident between scales in each session, except during games where global (P = 0.049, large) and muscular (P = 0.054, large) scales yielded higher session-RPE loads than the respiratory scale.

**Table 2.** Mean [95% CI] weekly- and session-RPE load using different RPE scales in a semiprofessional, male basketball team.

| RPE load | RPE scale | | |
|---|---|---|---|
| | Global (AU) | Respiratory (AU) | Muscular (AU) |
| Weekly-RPE load | 2407 [1933; 2880]* | 2187 [1714; 2660] | 2414 [1942; 2888]* |
| Session-RPE load | | | |
| Training session 1 | 483 [363; 602] | 442 [322; 562] | 488 [368; 608] |
| Training session 2 | 791 [646; 937]† | 745 [600; 891]† | 787 [642; 933]† |
| Training session 3 | 558 [456; 660]‡ | 517 [415; 618]‡ | 559 [457; 660] |
| Game | 633 [495; 770]‡# | 571 [433; 708]‡ | 651 [513; 788]‡ |

Abbreviations: CI, confidence intervals; RPE, rating of perceived exertion; AU, arbitrary units. Note: * significantly (P <0.01) higher weekly-RPE load than respiratory scale; † significantly (P <0.05) higher session-RPE load than training session 1, training session 3, and game for that scale; ‡ significantly (P <0.05) higher session-RPE load than training session 1 for that scale; # significantly (P <0.05) higher session-RPE load than respiratory scale during games.

**Table 3.** Effect sizes (η2) for pairwise comparisons in weekly- and session-RPE load between scales and in session-RPE load between sessions for each scale in a semiprofessional, male basketball team.

| | RPE scale | | |
|---|---|---|---|
| | Global vs. respiratory | Global vs. muscular | Respiratory vs. muscular |
| Weekly-RPE load | 0.343, large | 0.016, small | 0.209, large |
| Session-RPE load | | | |
| Training session 1 | 0.020, small | 0.001, trivial | 0.021, small |
| Training session 2 | 0.064, medium | 0.001, trivial | 0.028, small |
| Training session 3 | 0.162, large | 0.002, trivial | 0.113, medium |
| Game | 0.314, large | 0.028, small | 0.298, large |
| Comparison | Global | Respiratory | Muscular |
| Training session 1 vs. 2 | 0.561, large | 0.426, large | 0.450, large |
| Training session 1 vs. 3 | 0.045, small | 0.036, small | 0.042, small |
| Training session 2 vs. 3 | 0.433, large | 0.302, large | 0.331, large |
| Training session 1 vs. game | 0.223, large | 0.217, large | 0.202, large |
| Training session 2 vs. game | 0.182, large | 0.145, large | 0.105, medium |
| Training session 3 vs. game | 0.104, medium | 0.053, small | 0.115, medium |

Abbreviations: RPE, rating of perceived exertion. Note: All effect sizes are presented as positive values to show the magnitude of differences in pairwise comparisons.

Comparisons between individual sessions in the week using each RPE scale revealed higher (P <0.05, medium-to-large) session-RPE loads in the second training session than all other sessions, as well as during games than the first training session (P <0.05, large). Moreover, while significantly higher session-RPE loads were detected in the third training session than the first training session using global (P = 0.009) and respiratory (P = 0.024) scales, these differences were only small in magnitude.

## Discussion

Our exploratory team-based case series provides the first internal load data derived using differential RPE scales during training and games in basketball players, with some notable findings, including: (1) higher weekly-RPE loads and session-RPE loads during games were measured using global and muscular scales than the respiratory scale; and (2) all scales yielded the highest session-RPE load in the second training session as well as in games than the first training session within the week.

The comparisons made in weekly-RPE load and session-RPE load between scales suggest that deconstructing global RPE into respiratory and muscular components elucidates a lower central and higher peripheral contribution to perceptual loading accumulated across the week and in games, but not during individual training sessions. Unlike our findings, similar loads have been reported using respiratory and muscular RPE scales across the week (Gil-Rey et al., 2015) and during games (Los Arcos et al., 2014) among male soccer players. These discrepancies across sports might be expected given the greater running requirements across longer periods, and therefore higher cardiopulmonary demands, during soccer activity (Bangsbo et al., 2006) compared to basketball (Stojanović et al., 2018). Consequently, muscular RPE scales may be particularly useful in quantifying internal load accumulated across weekly timeframes and during games in basketball given the high neuromuscular stress relative to the cardiopulmonary demands encountered (Stojanović et al., 2018); however, further research is warranted to explore this notion given we also found comparable weekly and game loads between global and muscular scales. The limited differences in session-RPE load between respiratory and muscular scales during individual training sessions concurs with previous research exploring entire training sessions in male soccer players (Los Arcos et al., 2014) and 16-min 4v4 small-sided games among male, wheelchair basketball players (Iturricastillo et al., 2017). Therefore, the collective evidence suggests that the combined central and peripheral inputs may limit the ability of differential RPE scales to provide unique insight into the perceptual demands experienced at the session level in training settings.

Comparisons in session-RPE load within the week revealed similar load periodization schemes were detected across scales, with elevated loads in the second training session and game alongside reduced loads in the first and third training sessions in the week. This trend mirrors those reported previously in professional, male basketball players (Manzi et al., 2010), suggesting coaches in senior basketball teams likely prescribe less stressful sessions early in the week to promote post-game recovery and late in the week as a taper to mitigate players carrying residual fatigue into games (Mujika et al., 2018). Interestingly, the game did not yield the highest session-RPE load within the week using any scale, probably due to variations in playing time during games among the monitored players (mean live playing time: 10-28 min). In this way, significantly higher session-RPE loads have been observed during games but not training in players completing high playing times compared to players completing low playing times among national-level, female basketball players (Paulauskas et al., 2019).

While our exploratory investigation provides novel insight into the use of differential RPE scales in basketball players, the team-based case series we implemented limited the sample size for each analysis. Further research incorporating larger and wider (i.e., different age groups and competition encompassing males and females) basketball player samples are encouraged to confirm our findings. Moreover, we determined internal load during on-court team training sessions in their entirety. In turn, more research is encouraged quantifying

 DOI 10.26773/mjssm.240309

session-RPE load using different scales during specific training modes in basketball players (e.g., conditioning, technical, tactical, resistance) given variations between scales have been documented to emerge according to training mode in other team sports (McLaren et al., 2017; Wright et al., 2020). Nevertheless, our study supports the potential utility of differential RPE scales in providing unique insight into the internal loads experienced among basketball teams given variations in the accumulated weekly loads and game loads observed between scales.

## Conclusions

Given the simplicity and cost-effectiveness of using RPE scales combined with the minimal burden placed on players in collecting data, basketball coaching staff may be able to easily include differential RPE reporting within team monitoring systems to gain more detailed insight into the internal load encountered among their players. More precisely, the higher weekly-RPE load and session-RPE load during games we observed with the muscular compared to respiratory scale suggests basketball activities involve a greater contribution of peripheral neuromuscular stress than central cardiopulmonary stress in eliciting perceptual demands. Consequently, differential RPE scales may inform the development of more precise player preparation strategies considering respiratory and muscular exertion each provoke specific recovery requirements and adaptive responses. Also, session-to-session fluctuations in perceptual demands across the week appear to be similarly detected using global, respiratory, and muscular RPE scales in a basketball team environment.

## Acknowledgements

This work was supported by the University of the Basque Country under Grant number PIF21-35. The authors are also deeply grateful to the players and staff of the Santurtzi Saskibaloi Kluba for participating in this study.

## References

Bangsbo, J., Mohr, M., & Krustrup, P. (2006). Physical and metabolic demands of training and match-play in the elite football player. *Journal of Sports Sciences*, *24*(7), 665–674. https://doi.org/10.1080/02640410500482529

Borg, E., Borg, G., Larsson, K., Letzter, M., & Sundblad, B. M. (2010). An index for breathlessness and leg fatigue. *Scandinavian Journal of Medicine and Science in Sports*, *20*(4), 644–650. https://doi.org/10.1111/J.1600-0838.2009.00985.X

Bourdon, P. C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M. C., Gabbett, T. J., Coutts, A. J., Burgess, D. J., Gregson, W., & Cable, N. T. (2017). Monitoring athlete training loads: consensus statement. *International Journal of Sports Physiology and Performance*, *12*(S2), 161–170. https://doi.org/10.1123/IJSPP.2017-0208

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Ekblom, B., & Golobarg, A. N. (1971). The influence of physical training and other factors on the subjective rating of perceived exertion. *Acta Physiologica Scandinavica*, *83*(3), 399–406. https://doi.org/10.1111/J.1748-1716.1971.TB05093.X

Ferioli, D., Bosio, A., Bilsborough, J. C., la Torre, A., Tornaghi, M., & Rampinini, E. (2018). The preparation period in basketball: training load and neuromuscular adaptations. *International Journal of Sports Physiology and Performance*, *13*(8), 991–999. https://doi.org/10.1123/IJSPP.2017-0434

Foster, C., Florhaug, J. A., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., Doleshal, P., & Dodge, C. (2001). A new approach to monitoring exercise training. *Journal of Strength and Conditioning Research*, *15*(1), 109–115. http://doi.org/10.1519/00124278-200102000-00019

Fox, J. L., Scanlan, A. T., Sargent, C., & Stanton, R. (2020). A survey of player monitoring approaches and microsensor use in basketball. *Journal of Human Sport and Exercise*, *15*(1), 230–240. https://doi.org/10.14198/JHSE.2020.151.20

Fox, J. L., Stanton, R., O'Grady, C. J., Teramoto, M., Sargent, C., & Scanlan, A. T. (2022). Are acute player workloads associated with in-game performance in basketball? *Biology of Sport*, *39*(1), 95–100. https://doi.org/10.5114/BIOLSPORT.2021.102805

Gil-Rey, E., Lezaun, A., & Los Arcos, A. (2015). Quantification of the perceived training load and its relationship with changes in physical fitness performance in junior soccer players. *Journal of Sports Sciences*, *33*(20), 2125–2132. https://doi.org/10.1080/02640414.2015.1069385

Hutchinson, J. C., & Tenenbaum, G. (2006). Perceived effort — Can it be considered gestalt? *Psychology of Sport and Exercise*, *7*(5), 463–476. https://doi.org/10.1016/J.PSYCHSPORT.2006.01.007

Impellizzeri, F. M., Marcora, S. M., & Coutts, A. J. (2019). Internal and external training load: 15 years on. *International Journal of Sports Physiology and Performance*, *14*(2), 270–273. https://doi.org/10.1123/IJSPP.2018-0935

Iturricastillo, A., Granados, C., Los Arcos, A., & Yanci, J. (2017). Objective and subjective methods for quantifying training load in wheelchair basketball small-sided games. *Journal of Sports Sciences*, *35*(8), 749–755. https://doi.org/10.1080/02640414.2016.1186815

Iturricastillo, A., Yanci, J., Granados, C., & Goosey-Tolfrey, V. (2016). Quantifying wheelchair basketball match load: A comparison of heart-rate and perceived-exertion methods. *International Journal of Sports Physiology and Performance*, *11*(4), 508–514. https://doi.org/10.1123/IJSPP.2015-0257

Los Arcos, A., Méndez-Villanueva, A., Yanci, J., & Martínez-Santos, R. (2016). Respiratory and muscular perceived exertion during official games in professional soccer players. *International Journal of Sports Physiology and Performance*, *11*(3), 301–304. https://doi.org/10.1123/IJSPP.2015-0270

Los Arcos, A., Yanci, J., Mendiguchia, J., & Gorostiaga, E. M. (2014). Rating of muscular and respiratory perceived exertion in professional soccer players. *Journal of Strength and Conditioning Research*, *28*(11), 3280–3288. https://doi.org/10.1519/JSC.0000000000000540

Manzi, V., D'Ottavio, S., Impellizzeri, F. M., Chaouachi, A., Chamari, K., & Castagna, C. (2010). Profile of weekly training load in elite male professional basketball players. *Journal of Strength and Conditioning Research*, *24*(5), 1399–1406. https://doi.org/10.1519/JSC.0B013E3181D7552A

McGown, R. B., Ball, N. B., Legg, J. S., & Mara, J. K. (2020). The perceptual, heart rate and technical-tactical characteristics of 3×3 basketball. *International Journal of Sports Science & Coaching*, *15*(5–6), 772–782. https://doi.org/10.1177/1747954120930916

McLaren, S. J., Smith, A., Spears, I. R., & Weston, M. (2017). A detailed quantification of differential ratings of perceived exertion during team-sport training. *Journal of Science and Medicine in Sport*, *20*(3), 290–295. https://doi.org/10.1016/J.JSAMS.2016.06.011

Minett, G. M., Fels-Camilleri, V., Bon, J. J., Impellizzeri, F. M., & Borg, D. N. (2022). Peer presence increases session ratings of perceived exertion. *International Journal of Sports Physiology and Performance*, *17*(1), 106–110. https://doi.org/10.1123/IJSPP.2021-0080

Mujika, I., Halson, S., Burke, L. M., Balagué, G., & Farrow, D. (2018). An integrated, multifactorial approach to periodization for optimal performance in individual and team sports. *International Journal of Sports Physiology and Performance*, *13*(5), 538–561. https://doi.org/10.1123/ijspp.2018-0093

Newans, T., Bellinger, P., Drovandi, C., Buxton, S., & Minahan, C. (2022). The utility of mixed models in sport science: a call for further adoption in longitudinal data sets. *International Journal of Sports Physiology and Performance*, *17*(8), 1289–1295. https://doi.org/10.1123/IJSPP.2021-0496

Pandolf, K. B., Burse, R. L., & Goldman, R. F. (1975). Differentiated ratings of perceived exertion during physical conditioning of older individuals using leg-weight loading. *Perceptual and Motor Skills*, *40*(2), 563–574. https://doi.org/10.2466/PMS.1975.40.2.563

Paulauskas, H., Kreivyte, R., Scanlan, A. T., Moreira, A., Siupsinskas, L., & Conte, D. (2019). Monitoring workload in elite female basketball players during the in-season phase: weekly fluctuations and effect of playing time. *International Journal of Sports Physiology and Performance*, *14*(7), 941–948. https://doi.org/10.1123/IJSPP.2018-0741

Piedra, A., Peña, J., & Caparrós, T. (2021). Monitoring training loads in basketball: a narrative review and practical guide for coaches and practitioners. *Strength and Conditioning Journal*, *43*(5), 12–35. https://doi.org/10.1519/SSC.0000000000000620

Stojanović, E., Stojiljković, N., Scanlan, A. T., Dalbo, V. J., Berkelmans, D. M., & Milanović, Z. (2018). The activity demands and physiological responses encountered during basketball match-play: a systematic review. *Sports Medicine*, *48*(1), 111–135. https://doi.org/10.1007/S40279-017-0794-Z

Taylor, J. B., Wright, A. A., Dischiavi, S. L., Allison Townsend, M., & Marmon, A. R. (2017). Activity demands during multi-directional team sports: a systematic review. *Sports Medicine*, *47*, 2533–2551. https://doi.org/10.1007/s40279-017-0772-5

Weston, M., Siegler, J., Bahnert, A., McBrien, J., & Lovell, R. (2015). The application of differential ratings of perceived exertion to Australian Football League matches. *Journal of Science and Medicine in Sport*, *18*(6), 704–708. https://doi.org/10.1016/J.JSAMS.2014.09.001

Wright, M. D., Songane, F., Emmonds, S., Chesterton, P., Weston, M., & McLaren, S. J. (2020). Differential ratings of perceived match and training exertion in girls' soccer. *International Journal of Sports Physiology and Performance*, *15*(9), 1315–1323. https://doi.org/10.1123/IJSPP.2019-0595

 DOI 10.26773/mjssm.240309