International Journal of Sports Physiology and Performance, 2025, 20, 575-581
https://doi.org/10.1123/ijspp.2024-0325

Human Kinetics
ORIGINAL INVESTIGATION

Impact of Playing Middle and Side Pick-and-Roll Actions With Aggressive and Containing Defensive Strategies on Workload During Small-Sided Games in Male Basketball Players

Abdelaziz Qarouach,[1] Kęstutis Matulaitis,[2] Ramunas Butautas,[2] and Daniele Conte[2,3]
[1]Institute of Sports Science and Innovation, Lithuanian Sports University, Kaunas, Lithuania; [2]Department of Coaching Science, Lithuanian Sports University, Kaunas, Lithuania; [3]Department of Movement, Human and Health Sciences, University of Rome "Foro Italico," Rome, Italy

Purpose: This study aimed to evaluate the effect of executing different pick-and-roll (PnR) actions and performing different defensive strategies on workloads during basketball small-sided games. ***Methods:*** Twelve male basketball players (age: 21 [3] y; stature: 192 [5] cm; body mass: 84 [9] kg) completed 4 randomized small-sided games including PnRs executed on 2 court positions (ie, middle and side PnR) and 2 defensive strategies (ie, aggressive [ie, trap] and containing [ie, drop and ice for middle and side PnR, respectively] strategy). PlayerLoad and number of accelerations, decelerations, and changes of direction are classified as low (<2.5 $m \cdot s^{-2}$), medium (between 2.5 and 3.5 $m \cdot s^{-2}$), and high (>3.5 $m \cdot s^{-2}$), and jumps categorized as low (<40 cm) and high (≥40 cm) were used as external-load measures, while rating of perceived exertion was used as an internal-load measure. ***Results:*** Higher PlayerLoad values were found when playing middle PnR compared with side PnR ($P = .046$; effect size [ES] = 0.6; 95% CI, 0.0–1.2; moderate). Furthermore, trap defense showed moderately higher values of PlayerLoad ($P < .001$; ES = 1.1; 95% CI, 0.5–1.7), high accelerations ($P = .006$; ES = 0.8; 95% CI, 0.3–1.4), medium changes of direction ($P = .047$; ES = 0.6; 95% CI, 0.0–1.2), and high changes of direction ($P = .050$; ES = 0.6; 95% CI, 0.0–1.2) compared with drop and/or ice defense. No effects of court position and defensive strategy were found in rating of perceived exertion ($P > .05$). ***Conclusions:*** When planning small-sided games with tactical target, basketball coaches are advised to use middle PnR and aggressive defensive strategies to increase player's external load compared with side PnR and containing defensive strategies.

Keywords: defensive tactics, external load, inertial movement units, internal load, ball drills

The rise of the ball screen play as a cornerstone of basketball strategy has been a prevailing trend since the imposition of the 24-second shot-clock limitation in 2000. Teams continually seek ways to create space advantages for their key players, with pick-and-roll (PnR) being a prominent method used among the various ball screen strategies for inducing defensive miscommunication or increasing the decision-making load.[1,2] In fact, a previous study showed that PnR represent the 17.5% of all finishing actions including ball screens with points made observed across 12 play-off games of the male German 1st division during the 2016/17 season.[3]

Two of the most coached and used PnR actions are middle and side PnR, which are played on the top of the key and close to the sideline, respectively. As PnR has become one of the focal points of teams' offensive strategies, defensive PnR actions have also become fundamental. Middle and side PnR can be defended using defensive strategies such as drop (ie, the defender on the ball handler follows the assigned opponent, while the defender of the screener drops in the lane) and ice (ie, the ball handler's defender anticipates the screen and forces the ball to baseline), respectively. Furthermore, both PnR actions can be defended with a more aggressive defense such as trap (ie, the 2 defensive players double on the ball handler). Previous research identified that, in elite male German basketball league, 44.8% and 43.4% of the actions including ball screens were defended using various drop defensive actions (eg, stepping over screen and sagging under screen and sliding through screen) for winning and losing teams, respectively, and 7.2% and 8.1% of the actions were defended using trap and/or ice defenses in winning and losing teams, respectively.[3] Considering the importance of these defensive strategies to counter the offensive PnR actions, it is fundamental to stimulate in-game behavior by performing PnR defensive tasks throughout the basketball season.

Coaches implement basketball drills specifically designed to train the defensive performance on PnR. Usually, these drills are played in form of small-sided games (SSGs), which represent game-based drills to optimize training approaches and prepare players for competition.[4,5] While most research examining the workload generated by basketball SSGs focused on manipulating different contextual variables including the number of players involved,[6,7] court size,[8] rules adopted,[9] work-to-rest ratio,[8] and training regimens,[10] only a limited number of studies investigated the impact of using defensive strategies on load measured during SSGs.[11,12] To the best of our knowledge, only 1 previous investigation[12] focused on the external and internal loads generated using different defensive strategies on the middle PnR actions during SSGs showing that trap defense was imposing a higher perceived demand and external load measures compared with drop and switch defenses. Nevertheless, no previous study investigated the effect of applying different defensive strategies during various typically used PnR actions such as middle and side PnR on the external and internal load during SSGs. Since different movement patterns are required across various

Qarouach https://orcid.org/0009-0001-7017-575X
Matulaitis https://orcid.org/0000-0002-0312-7141
Conte (daniele.conte@uniroma4.it) is corresponding author, https://orcid.org/0000-0003-3551-1030

PnR defensive strategies, it is important to quantify players' workload while performing different PnR scenarios during SSGs. Overall, this information would be beneficial for basketball coaches and practitioners to better manipulate exercise load during SSGs designed with different defensive strategies during PnR actions, ensuring optimal preparation for competition. Therefore, this study aimed to evaluate the effect of executing different PnR actions and performing different defensive strategies on workloads during basketball SSGs.

Methods

Participants

Twelve male basketball players (age: 21 [3] y; stature: 192 [5] cm; body mass: 84 [9] kg; playing experience: 14 [3] y) belonging to a Lithuanian male team competing in the 4th division (RKL—B divizionas—competitive level 3 according to previous categorization[13]) were recruited for this study. Players were practicing 4 or 5 times and playing 1 or 2 official games per week. Moreover, only players with no injuries in the 4 weeks preceding the data collection were included in the study. Players were informed of the purpose, benefits, and risks of the study by the research staff and signed the informed consent before their participation in the study. Ethics approval was obtained from the Institutional Scientific Board for Research of the Kaunas Regional Research Ethical Committee review board (number: BE-2-97).

Design

This observational study was conducted during the 2020/21 postseason period (starting the first week following the end of the in-season period). In the months proceeding the experimental period (in-season period from October 2020 to March 2021), players were familiarized with the devices to quantify their external load and the adopted scales to assess their recovery status and internal load as they were regularly used during training sessions. Moreover, players were familiarized with each SSGs included in the study since they were regularly adopted in training sessions during the in-season period. Successively, players completed 4 SSGs in separate randomized sessions in which the focus was to defend on PnR executed on 2 court positions (ie, middle and side) while adopting aggressive (ie, trap) and containing (ie, drop and ice for middle and side PnR, respectively) defensive strategies. Therefore, the 4 experimental sessions were organized as follows: session 1—middle trap; session 2—middle drop; session 3—side trap; and session 4—side ice. The SSGs were played across 3 weeks and were scheduled at the beginning of the training session. Each experimental session was preceded by 24 hours of rest, and, to avoid any possible circadian effect, they were carried out in a similar time of the day (~3.30 PM).

Procedure

During experimental sessions, each SSG was preceded by a 10-minute general warm-up including mobility and running exercises and basketball-specific movements. All SSG formats were played 3 versus 3 on half court using 1 basket for 4 sets of 3 minutes interspersed by 1.5 minutes of rest.[12] The rest periods were characterized by passive recovery in which players were allowed to stand or sit and drink water ad libitum.

The 4 played SSGs including the defensive strategies adopted to defend on the middle and side PnR actions are displayed in Figure 1.

A detailed description of the defensive strategies adopted on the middle and side PnR offensive action (middle PnR—drop, side PnR—ice, and middle and/or side PnR—trap) are presented in Table 1.

In each SSG, the same rules were used, as described in a previous investigation.[12] Briefly, each ball possession started from the coach positioned as shown in Figure 1A and 1D for middle and side PnR, respectively. Drill continuity was assured for the offensive team in case of a scored basket or offensive rebound, while the defensive team was getting a new ball possession in case of steal, turnover, out of bounds, defensive rebounds, or offensive foul.[12] In any case, the new ball possession started after passing the ball to the coach and after players repositioning on the court as shown in Figure 1A and 1D for middle and side PnR, respectively. No free throws were called in case of foul to guarantee the continuity of the drill, and players were instructed to complete the offensive phase as soon as possible, with no shot clock used.[12] Finally, to keep players with a high motivation, the score was communicated during each drill together with a constant verbal encouragement.[12] The 12 players participating in the SSGs were allocated into 4 balanced teams by the coaching staff, according to their initial playing positions with each team including 2 among guards, and small forward (1–2 positions and 3) and one power forward and/or center (positions 4–5). To increase the standardization of the SSGs, each team played against the same opponent across each SSG.

Before starting the warm-up, players were asked to quantify their perceived recovery level based on a modified 10-point total recovery scale (TQR), which has been adopted in previous basketball studies.[14,15] In the TQR scale, higher scores indicate better perceptions of recovery (eg, 3 = poor recovery; 7 = very good recovery). To provide their TQR score, players were instructed to pay attention to psychophysical cues of recovery (eg, mood states, soreness, and heaviness) according to previous indications.[16]

During each SSG, external load was monitored using inertial movement units (ClearSky T6, Catapult Innovations). Before the beginning of each experimental sessions, players were required to wear neoprene vests including a pocket paced between the scapulae in which the inertial movement unit was positioned. The inertial movement units included a triaxial accelerometer to register the dynamic movements in all 3 planes (transverse, coronal, and sagittal) sampling at 100 Hz. The PlayerLoad (PL), which represents the square root of the sum of the squared instantaneous rate of change in acceleration across the transverse, coronal, and sagittal planes (x, y, and z, respectively) was used as one of the external load measures since its large use in basketball research[17–20] and since it possesses a good reliability (within-device coefficient of variance = 0.91%–1.05%; between-device coefficient of variance = 1.02%–1.90%).[21] Furthermore, the number of accelerations (ACC), decelerations, and changes of direction (COD), classified based on their intensities as low (<2.5 $m \cdot s^{-2}$), medium (between 2.5 and 3.5 $m \cdot s^{-2}$), and high (>3.5 $m \cdot s^{-2}$), were included as external load measures.[12] Finally, the number of low (<40 cm) and high (≥40 cm) jumps were measured.[12] All the data were processed and exported on a personal computer using the Open Field software (version 1.18, Catapult Innovations). For each exercise, only the four 3-minute periods were accounted for the analysis (total of 12 min), while the recovery phases were excluded.

As a measure of internal load, the rating of perceived exertion (RPE) was collected at the end of each SSG using the paper and pencil method avoiding any possible peer influence.[14,15] Specifically, the CR-10 scale modified by Foster et al,[22] which showed good validity in basketball, was used.

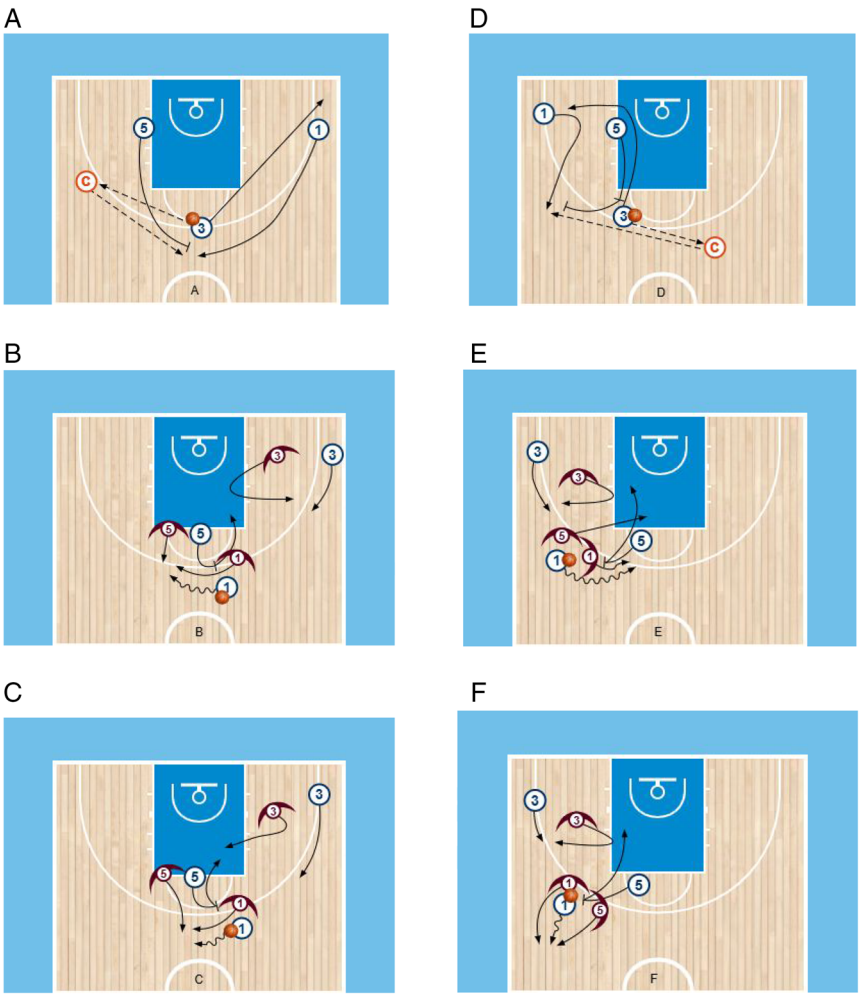

Figure 1 — Scheme of the middle and side pick-and-roll (PnR) action. (A) General representation of the start and execution of each possession from an offensive point of view of the middle PnR. The drill begins with a direct pass from ③ in the middle and the top of the court to the coach located in the wing position and then follows with a cut to the opposite corner. Successively, ① from the opposite corner of the ball cuts to the top of the key (③'s initial position) and receives the ball from the coach. ⑤ then moves from low post to the top of the key to execute the middle PnR action together with ①. After the screen, ⑤ rolls to the basket ① and can take a shot or execute a roll pass to ⑤ or an extra pass to ③. (B) Drop defense in which ⑤ stays in the paint (3s area) while ① follows ①. (C) Trap defense in which ⑤ and ① team up ① while ③ is the safety player. (D) General sequence of the beginning and execution of each offensive possession for side PnR. ③ passes the ball to the coach and receives a back screen from ⑤ and moves to the opposite corner. ① executes a V-cut and lift up to the wing position and receives a pass from the coach. Immediately after, ⑤ runs to execute the side PnR with ①. After the screen, ⑤ rolls to the basket and can take a shot or execute a roll pass to ⑤ or an extra pass to ③. (E) Ice defense in which ⑤ denies ① the drive to the baseline while ① sided ① (ie, forcing the offensive player on one side). (F) Trap defense in which ⑤ and ① double-team the ① while ③ is the help side player. Note: ①, ③, and ⑤ indicate the offensive players; ①, ③, and ⑤, defensive players; ① and ③, players with the ball; Ⓒ, coach; ⟶, movements without the ball, ⟿, movements while dribbling the ball, ⟙, movements to make a screen, ⇢, pass.

Table 1 Defensive Strategies Commonly Used Against Middle and Side Pick-and-Roll Actions

Court position	Defensive strategy	Definition
Middle	Drop (or trail and sag)	The ball handler's defender steps over the screen and the screener's defender drops into the paint to protect the basket. Can be high or low drop.
Side	Ice	The ball handler's defender anticipates and gives a side to the screen while the screener's defender drops high out of the paint to protect the dribble. This defensive action is directed to force the ball to baseline.
Middle and/or side	Trap (or double-team)	The defenders from both players involved in the screen double-team the ball handler while the help side takes care of the player who rolls to the basket (generally from the weak side).

Statistical Analysis

Mean and SD were calculated as descriptive statistics. To assess the differences in TQR values between the 4 conditions (2 court positions [ie, middle and side] and 2 defensive strategies [ie, trap and drop/ice]), a Friedman test was adopted. Successively, for all the other dependent variables (ie, external load measures and RPE), separate linear mixed models were used including the court position and defensive strategy as fixed effects and player as a random effect. All random effects were considered with random intercept and fixed slope. The assumption of normality for residual values was checked using the Shapiro–Wilk test. Post hoc analysis with Bonferroni correction was used in case of significant interactions between the fixed effects. Finally, Cohen *d* effect sizes (ESs) were also calculated for statistically significant post hoc analyses and interpreted as follows: trivial < 0.20, small = 0.20 to 0.59, moderate = 0.60 to 1.19, large = 1.20 to 1.99, and very large > 2.0.[23] An alpha level of $P \leq .05$ was set at a priori for statistical significance, and all statistical analyses were performed using the Jamovi software (the Jamovi project, version 2.3.21. 0, 2024).

Results

No differences were found across conditions for the TQR collected before each SSGs ($P = .509$). Descriptive statistics for each external load measure are displayed in Table 2.

Low COD was the only external load measure showing a statistical interaction between court position and defensive strategy ($P = .047$), although no statistical differences were found in the post hoc analyses ($P > .05$). An effect of court position ($P = .046$) and defensive strategy ($P < .001$) was found for PL, with higher values found in middle position (ES = 0.6; 95% CI, 0.0–1.2; moderate) compared with side position and in trap defense (ES = 1.1; 95% CI, 0.5–1.7; moderate) compared with drop defense. Moreover, an effect of defensive strategy was found in high ACC ($P = .006$; ES = 0.8; 95% CI, 0.3–1.4; moderate), medium COD ($P = .047$; ES = 0.6; 95% CI, 0.0–1.2; moderate), and high COD ($P = .050$; ES = 0.6; 95% CI, 0.0–1.2; moderate), with higher values found in trap compared with drop defense.

The analysis of RPE showed no difference between court positions and defensive strategy ($P > .05$; Figure 2).

Discussion

Basketball represents the intersection of several components of the game including physical and physiological factors, technical fundamentals, and tactical strategic choices. To the best of our knowledge, this is the first study to evaluate the effect of different defensive strategies (trap vs ice/drop) used to counter PnR played on different court positions (ie, middle and side) on external and internal loads during basketball SSGs. Considering court positions, higher PL values were registered during middle PnR drills compared with side PnR. Analyzing the defensive strategies adopted, higher values of PL, high ACC, and high COD were recorded in trap defense compared with other defensive strategies. Finally, no effect of court position or defensive strategy was found on players' RPE. These results provide valuable information for basketball coaches to manipulate exercise workload across various PnR scenarios in order to optimize training approaches and prepare players for competition.

Our findings showed a higher PL when defending middle PnR compared with side PnR during basketball SSGs. It should be noted that having an effective defense on middle PnR is harder compared with side PnR actions. In fact, for PnR executed on the central zone more space and consequently more possibilities for triangle passes, give and go actions or passes to open teammates are available compared with side PnR actions.[24] The lateral positions adopted during side PnR reduce the offensive possibilities reinforcing the defenders' anticipation when denied or guide the ball screen close to the sideline.[24] Therefore, during middle PnR actions, defensive players directly involved in the PnR (ie, defender on the ball handler and on the screener) have a larger area to cover to effectively pressure the offensive players consequently producing

Table 2 Means (SD) for the External-Load Measures for Each Court Position (Side vs Middle) and Defensive Strategy (Trap vs Ice/Drop)

External-load measure	Side PnR		Middle PnR		*P*		
	Trap	Ice	Trap	Drop	Court position	Defensive strategy	Interaction
PlayerLoad	146.2 (14.3)	136.4 (13.6)	157.7 (11.4)	140.9 (18.0)	**.046**	**<.001**	.421
Low ACC	15.9 (3.7)	16.8 (6.2)	26.0 (21.0)	18.1 (6.4)	.098	.302	.194
Medium ACC	7.3 (2.8)	5.3 (2.9)	7.7 (4.2)	6.1 (3.5)	.493	.054	.846
High ACC	7.0 (3.8)	4.1 (2.4)	5.7 (3.6)	4.5 (1.6)	.578	**.006**	.262
Low DEC	30.0 (14.8)	25.5 (17.4)	23.6 (6.9)	28.1 (10.4)	.620	.936	.212
Medium DEC	11.6 (9.6)	9.3 (6.8)	12.0 (15.9)	6.3 (3.1)	.601	.056	.364
High DEC	4.9 (3.3)	4.1 (3.6)	6.4 (10.3)	3.4 (2.6)	.770	.174	.435
Low COD	132.5 (15.4)	138.2 (16.5)	146.0 (16.9)	128.2 (27.2)	.823	.236	**.047**
Medium COD	36.4 (11.6)	33.4 (10.0)	42.9 (14.0)	33.1 (8.9)	.292	**.047**	.247
High COD	14.4 (6.7)	12.3 (6.1)	18.4 (14.3)	11.5 (4.9)	.392	**.050**	.216
Low JUMP	20.0 (6.4)	20.3 (6.1)	20.6 (8.6)	18.8 (4.5)	.822	.503	.458
High JUMP	3.7 (3.3)	4.8 (3.4)	4.8 (3.2)	3.6 (2.9)	.658	.874	.113

Note: PnR, pick-and-roll; Acc, accelerations; Low ACC, ACC <2.5 $m \cdot s^{-2}$; Medium ACC, ACC between 2.5 and 3.5 $m \cdot s^{-2}$; High ACC, ACC >3.5 $m \cdot s^{-2}$; DEC, decelerations; Low DEC, DEC <2.5 $m \cdot s^{-2}$; Medium DEC, DEC between 2.5 and 3.5 $m \cdot s^{-2}$; High DEC, DEC >3.5 $m \cdot s^{-2}$; COD, change of direction; Low COD, COD <2.5 $m \cdot s^{-2}$; Medium COD, COD between 2.5 and 3.5 $m \cdot s^{-2}$; High COD, COD >3.5 $m \cdot s^{-2}$; Low JUMP, jump <40 cm; High JUMP, jump ≥40 cm.

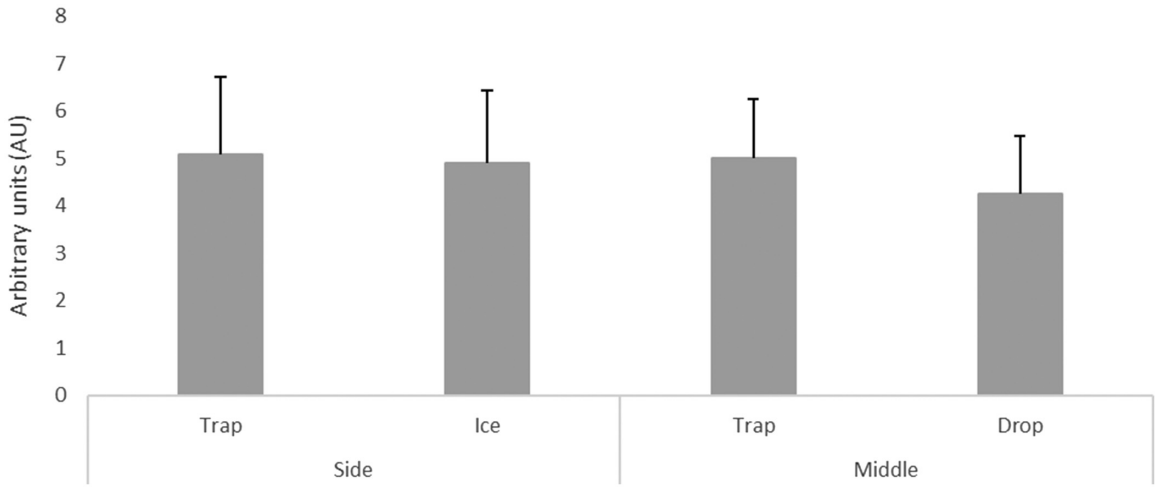

Figure 2 — Rating of perceived exertion for side and middle pick-and-roll actions, mean (SD).

a higher external load (ie, PL). Moreover, during middle PnR, the third defender (ie, the safety player) is required to help inside the center of the lane to defend on possible pass to the roller and, if needed given the situation, run back to his assigned player. Instead, during side PnR, the third defender has less area to cover since he can deny the pass to the center and recover on his assigned player quickly since the PnR action happened closer to his initial defensive position. Therefore, when monitoring external loads during SSGs adopting middle or side PnR actions, basketball coaches and practitioners should consider the higher PL induced by middle rather than side PnR.

Trap is considered an aggressive and surprising defense to be used in special moments of the match (ie, after time out or the last of ball possession of the quarter). In fact, it has been shown that trap defense on PnR represented 1% of the defensive options adopted during the 2020 Olympic Games.[25]A possible reason for this little use of this defensive strategy is the high physical demand required to properly execute it. Indeed, a previous investigation[12] showed a moderately higher PL and high ACC during SSG played with trap defense on the middle PnR compared with switch and drop defenses in female basketball players. Our results are in line with those previously reported[12] with higher PL, high ACC, and high COD found when playing SSGs using trap defense compared with drop and ice defenses, regardless of the court position (ie, middle or side PnR offense). The higher number of high ACC and high COD during trap defense can be explained by the high-intensity movements required from the defender on the screener to double team the ball handler compared with the action required during drop (middle PnR) and ice (side PnR) defenses in which the screener defender is only required to perform movements around the lane to protect the paint from the roller. Furthermore, during the trap defense, since an offensive advantage is created for the roller (who does not have a direct defender on him), the third defender has to perform a defensive help to protect the paint. Therefore, a greater number of high-intensity movements are required compared with drop and ice defense, in which the third defender is only tasked to support the defensive actions of the other 2 defensive players involved directly in the PnR actions. Overall, our findings support the idea of the higher physical load required during SSGs including trap defense, reinforcing the direct link between tactical and physical demands in basketball.

Monitoring internal load during SSGs can also provide an interesting information for basketball coaches and practitioners about the internal responses of the body to the proposed load. Our results indicate no effect of PnR court position or defensive strategy on players' RPE. This result is surprising since it does not reflect the differences found in the external load measures. Moreover, our findings are in contrast with a previous investigation[12] showing that female basketball players perceived higher exertion in SSGs including trap defense on the middle PnR compared with drills including switch and drop defenses. The different outcomes across the 2 studies might be explained by likely different player's training status. Indeed, in the study of Qarouach et al,[12] the recruited female players were training twice a week and playing 1 weekly game. Differently, in the current study, participants were training 4 to 5 times per week with 1 or 2 weekly games. This difference in training schedule might mirror a different training status, which has been shown to be a factor influencing the RPE responses.[26] Therefore, highly trained players might not feel a different perception of effort between SSGs including different defensive strategies on PnR compared with players with a lower fitness level, who can perceive the drills including trap defense as more demanding. Indeed, drop defense elicited average RPE scores of ~4 arbitrary units (AU) across the 2 studies, while higher average RPE values were found for trap defense in the study of Qarouach et al[12] (ie, ~6.5 AU) compared with the current investigation (ie, ~5 AU). Therefore, further studies are required to assess the potential effect of training status on the internal responses produced during SSGs played with different PnR options and defensive strategies.

Although this study provides interesting findings for basketball coaches and practitioners, some limitations should be addressed. First, some of the defensive strategies typically executed on middle and side PnR have not been investigated such as hedge and switch from both the middle and the side PnR, which might lead to different physical and perceived loads. Additionally, although PnR is one of the most adopted offensive strategies including ball screens, other offensive strategies are currently used and trained by basketball coaches including pick and pop, pick and flare, and pick and repicks. Therefore, future studies should focus on the analysis of external and internal loads of SSGs including other PnR defensive strategies and picks with different finishing than the roll.

Practical Applications

Following the current results, male basketball coaches can manipulate the external loads imposed on their players during SSGs by designing various tactical scenarios when defending the PnR on the middle or the side. Specifically, SSGs including middle PnR can be used to target higher PL, while the use of drills including trap defense should be used to produce higher values of PL and higher number of high ACCs and CODs compared with drop or ice defense on middle and side PnR, respectively. Nevertheless, using the proposed defensive strategies on the middle and side PnR does not modify the perceived internal load, suggesting the use of different SSG variations that can alter players' perceived responses. Overall, these practical applications can be considered fundamental for basketball coaches, sport scientists, and practitioners to design SSGs to control and develop players from a tactical, technical, and physical standpoints.

Conclusions

The present findings showed that small-sided games (SSGs) including middle pick-and-roll (PnR) actions induced a higher external load (ie, PlayerLoad) compared with SSGs including side PnR actions. Moreover, including trap defense during SSGs resulted in greater PlayerLoad and high accelerations and changes of direction compared with drop and ice defenses during middle and side PnR, respectively. The differences in external load did not reflect the differences in ratings of perceived exertion. These results provide interesting insight for basketball coaches using SSGs to develop players' physical condition while adopting various tactical aspects of the game (ie, PnR defense).

Acknowledgment

The authors would like to thank all the players and coaches from the Lithuanian Sports University men's team for participating in the study.

References

1. Foteinakis P, Pavlidou S, Stravopulos N. Performance analysis of switching defense to ball screens in the fourth quarter of close Euroleague matches. *J Phys Educ Sport*. 2024;24(2):425–432.
2. Matulaitis K, Bietkis T. Prediction of offensive possession ends in elite basketball teams. *Int J Environ Res Public Health*. 2021;18(3):1083. doi:10.3390/ijerph18031083
3. Remmert H, Chau AT. Players' decisions within ball screens in elite German men's basketball: observation of offensive–defensive interactions using a process-orientated state-event model. *Int J Perform Anal Sport*. 2019;19(1):198. doi:10.1080/24748668.2018.1534198
4. Sansone P, Tessitore A, Lukonaitiene I, Paulauskas H, Tschan H, Conte D. Technical-tactical profile, perceived exertion, mental demands and enjoyment of different tactical tasks and training regimes in basketball small-sided games. *Biol Sport*. 2020;37(1):15–23.
5. O'Grady CJ, Fox JL, Dalbo VJ, Scanlan AT. A systematic review of the external and internal workloads experienced during games-based drills in basketball players. *Int J Sports Physiol Perform*. 2020;15(5):603–616. doi:10.1123/ijspp.2019-0785
6. Conte D, Favero T, Niederhausen M, Capranica L, Tessitore A. Effect of number of players and maturity on ball-drills training load in youth basketball. *Sports*. 2017;5(1):10003. doi:10.3390/sports5010003
7. Conte D, Favero T, Niederhausen M, Capranica L. Effect of different number of players and training regimes on physiological and technical demands of ball-drills in basketball. *J Sports Sci*. 2016;34(8):780–786. doi:10.1080/02640414.2015.1069384
8. Sansone P, Gasperi L, Makivic B, Gomez-Ruano MA, Tessitore A, Conte D. An ecological investigation of average and peak external load intensities of basketball skills and game-based training drills. *Biol Sport*. 2023;40(3):649–656. doi:10.5114/biolsport.2023.119291
9. Conte D, Favero TG, Niederhausen M, Capranica L, Tessitore A. Physiological and technical demands of no dribble game drill in young basketball players. *J Strength Cond Res*. 2015;29(12):3375–3379. doi:10.1519/JSC.0000000000000997
10. Sansone P, Tessitore A, Paulauskas H, et al. Physical and physiological demands and hormonal responses in basketball small-sided games with different tactical tasks and training regimes. *J Sci Med Sport*. 2019;22(5):602–606. doi:10.1016/j.jsams.2018.11.017
11. Suárez-I D, Dehesa R, Scanlan AT, Rodríguez-Marroyo JA, Vaquera A. Defensive strategy and player sex impact heart-rate responses during games-based drills in professional basketball. *Int J Sports Physiol Perform*. 2020;16(3):360–366.
12. Qarouach A, Sansone P, Pernigoni M, Kryveite R, Conte D. Inside the defensive playbook: Pick and Roll tactical adjustment impact the external and internal loads during small sided games in female basketball. *Int J Sports Physiol Perform*. 2024;19(12):1367–1373.
13. Russell JL, Mclean BD, Impellizzeri FM, Strack DS, Coutts AJ, Russell JL. Measuring physical demands in basketball: an explorative systematic review of practices key points. *Sports Med*. 2021;51(1):81–112. doi:10.1007/s40279-020-01375-9
14. Pernigoni M, Kreivytė R, Lukonaitienė I, Toper CR, Kamandulis S, Conte D. Is foam rolling as effective as its popularity suggests? A randomised crossover study exploring post-match recovery in female basketball. *J Sports Sci*. 2023;41(18):1718–1725. doi:10.1080/02640414.2023.2296718
15. Pernigoni M, Calleja Gonzalez J, Lukonaitiene I, Tessitore A. Comparative effectiveness of active recovery and static stretching during post-exercise recovery in elite youth basketball. *Res Q Exerc Sport*. 2023;95(1):272–280. doi:10.1080/02701367.2023.2195457
16. Kenttä G, Hassmén P. Overtraining and recovery. a conceptual model. *Sports Med*. 1998;26(1):1–16. doi:10.2165/00007256-199826010-00001
17. Pernigoni M, Ferioli D, Butautas R, La Torre A, Conte D. Assessing the external load associated with high-intensity activities recorded during official basketball games. *Front Psychol*. 2021;12:668194. doi:10.3389/fpsyg.2021.668194
18. Kamarauskas P, Scanlan AT, Ferioli D, Conte D. Weekly fluctuations in, and associations between, salivary hormone responses, load, and well-being during the pre-season in professional male basketball. *J Strength Cond Res*. 2024;38(1):128–135 doi:10.1519/JSC.0000000000004589
19. Kamarauskas P, Lukonaitienė I, Kvedaras M, Venckūnas T, Conte D. Relationships between weekly changes in salivary hormonal responses and load measures during the pre-season phase in professional male basketball players. *Biol Sport*. 2022;40(2):353–358. doi:10.5114/biolsport.2023.114290
20. Kamarauskas P, Lukonaitienė I, Scanlan AT, Ferioli D, Paulauskas H, Conte D. Weekly fluctuations in salivary hormone responses and their relationships with load and well-being in semiprofessional, male basketball players during a congested in-season phase. *Int J Sports Physiol Perform*. 2021;17(2):263–269. doi:10.1123/ijspp.2021-0106

21. Boyd LJ, Ball K, Aughey RJ. The reliability of MinimaxX accelerometers for measuring physical activity in Australian football. *Int J Sports Physiol Perform*. 2011;6(3);311–321. doi:10.1123/ijspp.6.3.311
22. Foster C, Florhaug JA, Franklin J, et al. A new approach to monitoring exercise training. *J Strength Cond Res*. 2001;15(1):109–115.
23. Hopkins W, Marshall S, Batterham A, Hanin J. Progressive statistics for studies in sports medicine and exercise science. *Med Sci Sports Exerc*. 2009;41(1):3–12. doi:10.1249/MSS.0b013e31818cb278
24. Gomez AM, Battaglia O, Lorenzo A, Lorenzo J, Jimenez S, Sampaio J. Effectiveness during ball screens in elite basketball games. *J Sports Sci*. 2015;33(17):1844–1852.
25. Bismpos M, Karamousalidis G. The use and efficacy of the offensive action of pick and roll in the Olympic Games of 2020. *J Phys Educ Sport*. 2022;22(10):2513–2521.
26. Haddad M, Stylianides G, Djaoui L, Dellal A, Chamari K. Session-RPE method for training load monitoring: validity, ecological usefulness and influencing factors. *Front Neurosci*. 2017;11:612. doi:10.3389/fnins.2017.00612