Inter-Limb Coordination, Strength, Jump, and Sprint Performances Following a Youth Men's Basketball Game

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Abstract

Cortis, C, Tessitore, A, Lupo, C, Pesce, C, Fossile, E, Figura, F, and Capranica, L. Inter-limb coordination and strength, jump, and sprint performances following a youth men's basketball game. *J Strength Cond Res* 25(1): 135–142, 2011—This study aimed to verify whether basketball players are able to maintain strength (handgrip), jump (countermovement jump [CMJ]), sprint (10 m and 10 m bouncing the ball [$10m_{BB}$]), and interlimb coordination (i.e., synchronized hand and foot flexions and extensions at 80, 120, and 180 bpm) performances at the end of their game. Ten young (age 15.7 ± 0.2 years) male basketball players volunteered for this study. During the friendly game, heart rate (HR), rate of perceived exertion (RPE), and rate of muscle pain (RMP) were assessed to evaluate the exercise intensity. Overall, players spent 80% of the time playing at intensities higher than 85% HR_{max}. Main effects ($p < 0.05$) for game periods emerged for HR and the number of players involved in a single action, with lower occurrence of maximal efforts and higher involvement of teammates after the first 2 periods. At the end of the game, players reported high ($p < 0.05$) RPE (15.7 ± 2.4) and RMP (5.2 ± 2.3) values; decreased ($p < 0.05$) sprint capabilities (10 m: pre = 1.79 ± 0.09 seconds, post = 1.84 ± 0.08 seconds; $10m_{BB}$: pre = 1.81 ± 0.11 seconds, post = 1.96 ± 0.08 seconds); increased ($p < 0.05$) interlimb coordination at 180 bpm (pre = 33.3 ± 20.2 seconds, post = 43.9 ± 19.8 seconds); and maintained jump (pre = 35.2 ± 5.2 cm, post = 35.7 ± 5.2 cm), handgrip (pre = 437 ± 73 N, post = 427 ± 55 N), and coordinative performances at lower frequencies of executions (80 bpm: pre = 59.7 ± 1.3 seconds, post = 60.0 ± 0.0 seconds; 120 bpm: pre = 54.7 ± 12.3 seconds, post = 57.3 ± 6.7 seconds). These findings indicate that the heavy load of the game exerts beneficial effects on the efficiency of executive and attentive control functions involved in complex motor behaviors. Coaches should structure training sessions that couple intense physical exercises with complex coordination tasks to improve the attentional capabilities of the players.

Key Words hand-foot coordination, handgrip, countermovement jump, young basketball players

Introduction

Basketball is an open-skill team sport, strongly depending on the players' capability to move quickly, jump, and bounce the ball with coordinating lower and upper limb movements. In particular, to achieve successful performances, basketball players are required to use proper shooting, dribbling, and rebounding technique under temporal pressure and to establish a strict connection between the movement of their feet, hands, and eyes with the ball and the opponents. Basketball games place considerable demands on players (5,12,27) who show decreases in their exercise intensity during the second and fourth halves of the game, which has been attributed to a reduced capability of the players to cope with the demands of the game (5,6). However, at present no data are available to ascertain whether basketball players are actually less capable to maintain all-out and coordinative performances during the latter stages of the game or whether they change activity patterns according to the technical and tactical strategies of the competition.

In field studies, the effects of team sport play on jump and speed running performances have been used as a direct measure of fatigue (12,24,37), although scant information is available on post-competition coordinative performances (16,21,39). In particular, coordination has been evaluated by means of sport-specific tasks (17,39) or aspecific performances (15,16) that highlight the neural control needed for the maintenance of a stable phase relation between moving segments with different mechanical characteristics (3). Recently, interlimb coordination patterns under temporal pressure are frequently used to explain how the central

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nervous system manages the control of complex tasks (20,29) and to evaluate the attentional control of the individual in maintaining the less stable anti-phase movement patterns with respect to the in-phase ones (3). The time of correct execution of in-phase and anti-phase interlimb coordination at 80, 120, and 180 bpm has been used to assess the effects of chronic training on the development and preservation of coordinative performances in young and older athletes (9,15) and proved to be a precious instrument to explore the effects of a basketball game on coordinative abilities of senior basketball players (16).

Thus, the primary purpose of this study was to establish the acute effects of a basketball game on physical performances of highly skilled young athletes examining changes, if any, in their jump, sprint, handgrip, and interlimb coordination capabilities before and after a competition.

Methods

Experimental Approach to the Problem

In the present study a multifaceted field-based approach of measurement was applied. To overcome the practical difficulty connected with data collection during official competitions, this study was conducted during a friendly game organized during the last 2 weeks (i.e., beginning of the playoff period) of the 2008 Italian Men's "Cadetti" (i.e., younger than 16 years of age) Basketball Championship. The game included four 10-minute periods with 2-minute intervals after the first and third periods and a 15-minute interval after the second period. To simulate a real basketball competition, the players were told that the friendly game was intended as a selection trial for their participation in the upcoming playoff games. To allow comparisons between the 4 periods, a continuous play with no substitutions was required. Appropriate rehydration was ensured, encouraging players to drink ad libitum before, during breaks, and after the game. Recently, no effect on reduced performances at the end of futsal and soccer competitions has been reported as a result of a mild dehydration (24,37). Thus, the measurement of the individual fluid intake during the experimental setting was not included to avoid additional inconvenience for the participants.

The load imposed by the friendly game was ascertained by means of physiological (heart rate [HR]), psychological (i.e., rate of perceived exertion [RPE] and rate of perceived muscle pain [RMP]), and performance (i.e., match analysis) data. If the mean exercise intensity of the friendly game was comparable (i.e., >85% of the players' maximum heart rate [HR_{max}]) to that reported for official basketball games (6,27), differences emerging in the dependent variables would be considered to have practical applications for coaches.

In basketball, jump and sprint tests are frequently used by coaches because they are easy to set and simple to interpret (8,28) and are sensitive enough to address changes in relation to the previous load of team sport games (12,16,18,24,36–39,42). Furthermore, handgrip strength is of particular interest in this sport because of the continuous use of hands engaged in catching, holding, and throwing the ball (41). Finally, decreases in coordinative performances were considered good markers of the development of fatigue at the end of team sport games. In particular, coordinative performances included synchronized hand and foot flexions and extensions under spatial (in-phase and anti-phase) and temporal (80, 120, and 180 bpm) constraints (15,16), and technical difficulty of running while bouncing the ball (16,39).

To establish whether young elite basketball players are actually able to cope with the physical demands of the whole game, in the present study the dependent variables were as follows: the time (seconds) of correct execution of in-phase and anti-phase synchronized hand and foot flexions and extensions at 80, 120 and 180 bpm (16); the time (seconds) of 10-m sprints with ($10m_{BB}$) and without (10-m) bouncing the ball, and their ratio (16,30,39); the grip strength (N) production (16,41); and the height (cm) of countermovement jump (CMJ) performances (16,34,35–37,39). High test-retest intraclass correlation coeffiecients (ICCs) were reported for in-phase (range 0.95–0.96) and anti-phase (range: 0.72–0.98) hand and foot coordination, grip strength (range: 0.96–0.98), CMJ (range: 0.80–0.98), and 10-m sprint (range: 0.83–0.98) performances (10,13,26,31,37). It was hypothesized that differences, if any, between pre- and post-game all-out and coordinative performances might provide relevant information on the young athlete's capability to cope with the demands of the basketball competition.

Subjects

Ten young (age 15.7 ± 0.2 years) male basketball players volunteered to participate in this study, approved by the local Institutional Review Board. All subjects and their parents were fully informed of the experimental procedures prior to providing parental written informed consent to participate in the study. The players were members of the men's "Cadetti" team of the Italian second league (Serie B) Stella Azzurra Roma Club. They underwent a basketball training regimen consisting of three 2-hour sessions and 1 game weekly for the previous 5 years. The team ranked first during the regular season and was directly admitted to the playoff phase of the Regional Men's Cadetti Championship.

Procedures

Performance Evaluations. The athletes were habituated to the sprint, jump, and strength tests routinely administrated during the basketball season. The literature reported no learning effects between test sessions for the interlimb coordination performances (10). However, to avoid potential differences as a result of learning, 1 week before the experimental session the players were familiarized with the test procedures. For each anaerobic test, participants were allowed 2 trials, with a 2-minute recovery period in between, and the best performance was used for further analysis. Before starting the anaerobic tests, players underwent a 10-minute standard basketball warm-up period, consisting of jogging and strolling locomotion with and without the ball at an exercise intensity of 40 to 60% HR_{max}. Right before and after their game, the basketball players were continuously recommended to perform at their best sprint (10-m and 10 m_{BB}), CMJ, handgrip, and inter-limb coordination tests administered in a randomized order.

Sprint performances were measured with a dual infrared reflex photoelectric cells system (Polifemo, Microgate, Bolzano, Italy) positioned 10 m apart. Players began from a standing start with the front foot 0.5 m from the first timing gate. For the $10m_{BB}$, participants were instructed to keep the ball as close as possible to their body and to bounce the ball at least 3 times. Countermovement jump was evaluated using an optical acquisition system (Optojump, Microgate, Udine, Italy), developed to measure with 10^{-3}-second precision all flying and ground contact times. The Optojump photocells are placed 6 mm from the ground and are triggered by the feet of the subject at the instant of taking off and at contact on landing. Then, calculations of the height of the jump are made (22). From the standing position the basketball players were required to bend their knees to a freely chosen angle and perform a maximal vertical thrust. The effect of the arm swings was minimized by asking the players to keep their hands on their hips, to maintain their body vertical throughout the jump, and to land with their knees fully extended. Maximum isometric grip force was measured to the nearest 1 N to a maximum of 1,000 N with an adjustable digital strain-gauge dynamometer (Lode, Groningen, The Netherlands). From a standing position, the players were required to hold the measuring beam without support with their hand close to the body and to exert a maximal voluntary contraction on the dynamometer. The tests were filmed to evaluate the correct executions. Any performance perceived to deviate from the required instructions was repeated.

The interlimb coordination performance was evaluated according to a validated field test (10). Players were seated shoeless on a table with elbows and knees flexed at 90 degrees (Figure 1). This position allowed independent motion of the hand and the foot in a sagittal plane. Players had to perform flexion and extension movements around the wrist and ankle joints with a 1:1 ratio. They were instructed to make the cyclic homolateral hand and foot movements in a continuous fashion for the total duration of a trial (60-second maximum) and to preserve spatial and temporal requirements of the movement patterns. Two homolateral coordination modes were tested: in-phase mode (i.e., association of hand extension with foot dorsal flexion and hand flexion with foot plantar flexion) and anti-phase mode (i.e., association of hand flexion with foot dorsal flexion and hand extension with foot plantar flexion). Each test condition was performed at 3 frequencies (80, 120, and 180 bpm) dictated by a metronome. During the 2-minute rest between test trials, the players were allowed to stand. Following 15 seconds of the required metronome pace, a "ready-go" command indicated the start of a trial. Using a stopwatch, an observer measured the time (s) of correct execution of the homolateral hand and foot–the time from the beginning of the movement up to when the individual failed to meet either the spatial and/or the temporal task requirements. To avoid disagreement among observers, a single competent observer scored the interlimb performances. The intraindividual reliability coefficients assessed through video-recorded evaluations ranged from 0.89 to 0.95.

Heart Rate Response and Subjective Ratings of Exertion During the Basketball Game. During the friendly basketball game, players' HR was continuously recorded (Polar Team System, Kempele, Finland) as average values of 5 seconds. Intensities of effort were subsequently calculated and expressed as percentages of individuals' theoretical maximal HR (HR_{max} = 220 − age) to estimate the amount and duration of maximal efforts (>95% HR_{max}), high intensity (86–95% HR_{max}), low intensity (76–85% HR_{max}), active recovery (65–75% HR_{max}), and passive recovery (<65% HR_{max}). Furthermore, the

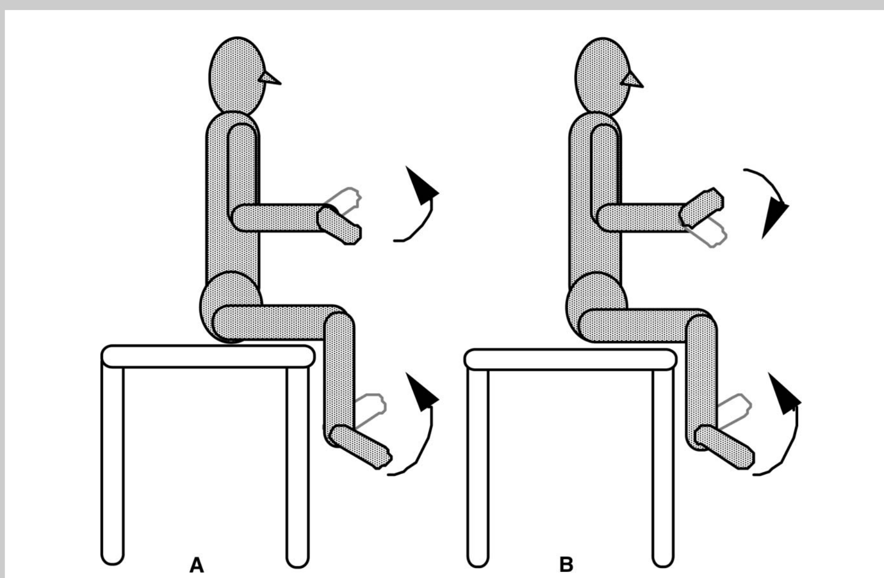

Figure 1. Schema of the in-phase (A) coordination mode (associations of wrist extension with the ankle dorsal flexion and wrist flexion with the ankle plantar flexion) and anti-phase (B) coordination mode (association of wrist flexion with the ankle dorsal flexion and wrist extension with the ankle plantar flexion).

Borg's (7) RPE scale between 6 (no exertion at all) and 20 (maximal exertion) and RMP scale between 0 (nothing at all) and 11 (maximum pain) were administered 30 minutes after the end of the game.

Match Analysis. The youth basketball game was recorded by means of a video camera (JVC DL 107) positioned at a side of the pitch, at the level of the division line, at a height of 6 m and at a distance of 5 m from the sideline. The videotape was later replayed (VHS JVC BR 8600) to evaluate the following technical-tactical parameters: (a) the number of offensive fouls; (b) the number of defensive fouls; (c) the number of offensive rebounds; (d) the number of defensive rebounds; (e) the number of lost possessions; (f) the number of assists; (g) the number of blocked shots; (h) the percentages of 2-point shots made, and (i) the percentages of 3-point shots made (39). Moreover, the whole (i.e., the time from the beginning to the end of the offensive action) and the partial (i.e., the time spent to go beyond the division line; maximal regular time = 8 seconds) duration of the actions, the number of players involved, and the number of consecutive passes were also calculated. A single observer, who previously showed no difference in evaluating the technical-tactical parameters of basketball competitions, scored the match analysis parameters.

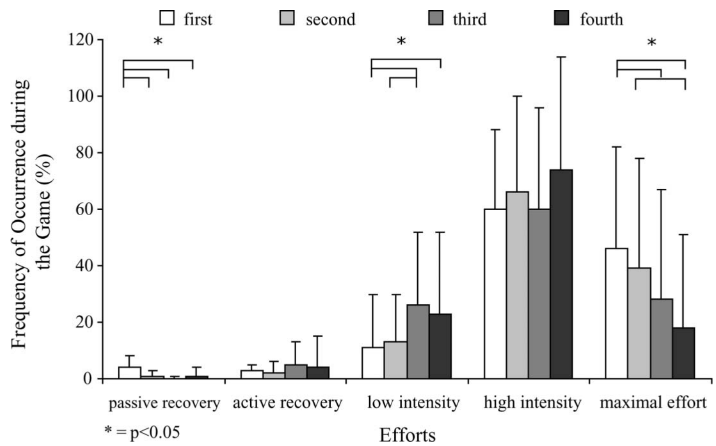

Figure 2. Means and standard deviations of the frequency of occurrence of time (seconds) spent at maximal efforts (>95% HRmax), high intensity (86–95% HRmax), low intensity (76–85% HRmax), active recovery (65–75% HRmax), and passive recovery (<65% HRmax) during the 4 periods of the basketball game.

Statistical Analyses

Means and SDs were calculated for each of the variables analyzed. Prior to the study, the level of significance was set at $p < 0.05$. Differences in frequencies of occurrence of technical-tactical parameters during the 4 game periods were verified by means of a Chi-square test. Differences between the duration (s) of intensity of efforts and between pre- and post-game sprint, jump, handgrip, and interlimb coordination performances were tested by means of analyses of variance with repeated measures. If the overall F test was significant, post hoc comparisons were performed by means of Tukey's test. To provide meaningful analysis for comparisons from small groups, the Cohen's effect sizes (ES) with respect to pre-game values were also calculated (14). An $ES \leq 0.2$ was considered trivial, from 0.3 to 0.6 small, <1.2 moderate, and >1.2 large.

Results

During the friendly game, the frequency distributions of HR showed main effects for game periods ($F(3,27) = 0.0001$, $p < 0.0001$) and intensity ($F(4,36) = 10.44$, $p < 0.0001$) and a significant game period × intensity interaction ($F(12,108) = 3.59$, $p = 0.0002$). Post hoc analysis (Figure 2) showed that players significantly decreased the intensity of efforts after the first 2 periods, with less occurrence of maximal effort and more occurrence of low intensities. Differences emerged for RPE ($F(1,9) = 29.8$, $p = 0.0004$, $ES = 0.81$) and RMP ($F(1,9) = 13.3$, $p = 0.005$, $ES = 0.50$) with higher values registered at the end of the game (RPE: 15.7 ± 2.4 points; RMP: 5.2 ± 2.3 points) with respect to pre-game ones (RPE: 8.7 ± 2.7 points; RMP: 2.2 ± 3.0 points).

Regarding the technical aspects of the game, 21 fouls (offensive: 5 ± 1; defensive: 5 ± 1), 7 blocked shots (2 ± 1), and 17 assists (4 ± 2) were observed. Players caught more defensive rebounds ($n = 49$; 12 ± 2) than offensive ones ($n = 26$; 7 ± 2) and performed more 2-point shots ($n = 91$;

Table 1. Means and standard deviations of the strength, jump, and sprint performances before and after the basketball game.

All-out performances	Pre	Post
Countermovement jump (cm)	35.2 ± 5.2	35.7 ± 5.2
Handgrip (N)	436.9 ± 73.3	426.5 ± 54.9
10 m (s)	1.79 ± 0.09	1.84 ± 0.08*
$10m_{BB}$ (s)	1.81 ± 0.11	1.96 ± 0.08*
$10m_{BB}$/10 m	1.01 ± 0.06	1.06 ± 0.06*

*$p < 0.05$.

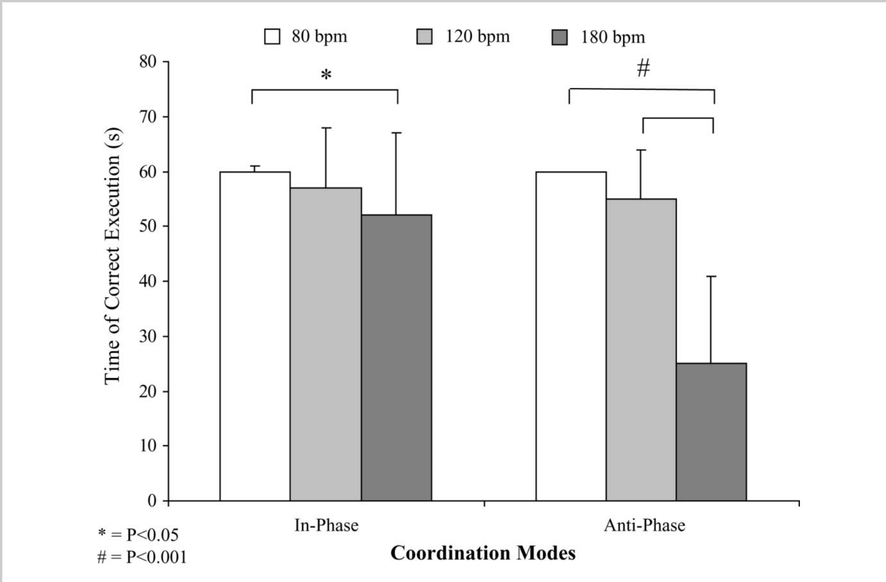

Figure 3. Means and standard deviations of the time (seconds) of correct execution of homolateral hand and foot synchronization in the in-phase and anti-phase coordination modes under temporal constraint (i.e., 80, 120, and 180 bpm).

effectiveness: 35 ± 6%) than 3-point shots (n = 26; effectiveness: 29 ± 28%). Overall lost possession was 29 balls, 26 of which were intercepted by the opposing team. Differences between game periods emerged for the number of players (F(3,158) = 2.66, $p < 0.05$, ES range: 0.09–0.32) involved in a single action. Post hoc analysis maintained differences only between the first (2.5 ± 1.0 players) and the second period (3.2 ± 1.1 players). No difference was found for the number of consecutive passes (2.3 ± 1.8), the whole (9.8 ± 5.7 seconds) and the partial (2.9 ± 1.6 seconds) duration of the action.

Table 1 reports the pre- and post-game sprint, CMJ, and handgrip performances. No difference emerged between experimental sessions for CMJ and handgrip performances. Pre-post game differences were found for 10-m (F(1,9) = 7.45, p = 0.02, ES = 0.28), and $10m_{BB}$ (F(1,9) = 15.62, p = 0.003, ES = 0.061) sprints and their ratio (F(1,9) = 5.14, p = 0.049, ES = 0.38).

Before the game, descriptive statistics show high interlimb coordination performances for both in-phase (80 bpm: 59.4 ± 1.9 seconds; 120 bpm: 53.2 ± 14.5 seconds; 180 bpm: 47.0 ± 18.1 seconds) and anti-phase (80 bpm: 60.0 ± 0.0 seconds; 120 bpm: 56.1 ± 10.4 seconds; 180 bpm: 19.6 ± 10.6 seconds) coordination modes. After the game, performances increased for the in-phase execution frequencies (80 bpm: 60.0 ± 0.0 seconds; 120 bpm: 60.0 ± 0.0 seconds; 180 bpm: 56.6 ± 9.1 seconds) and for the anti-phase mode at 180 bpm (31.2 ± 19.6 seconds). A nonsignificant decrease (around 1.5 seconds) was observed for anti-phase 120 bpm performances. Main effects were found for coordination mode (F(1,9) = 27.51, p = 0.0005) and frequency of execution (F(2,18) = 46.92, $p <$ 0.0001). Significant interactions emerged for coordination mode × frequency of execution (F(2,18) = 39.09, $p <$ 0.0001) and for frequency of execution × experimental session (F(2,18) = 3.81, p = 0.04). Post hoc analysis for coordination mode × frequency of execution (Figure 3) showed differences for in-phase coordination mode (p = 0.004) only between 80 bpm (59.7 ± 1.3 seconds) and 180 bpm (51.8 ± 14.8 seconds) frequencies of execution, whereas for the anti-phase

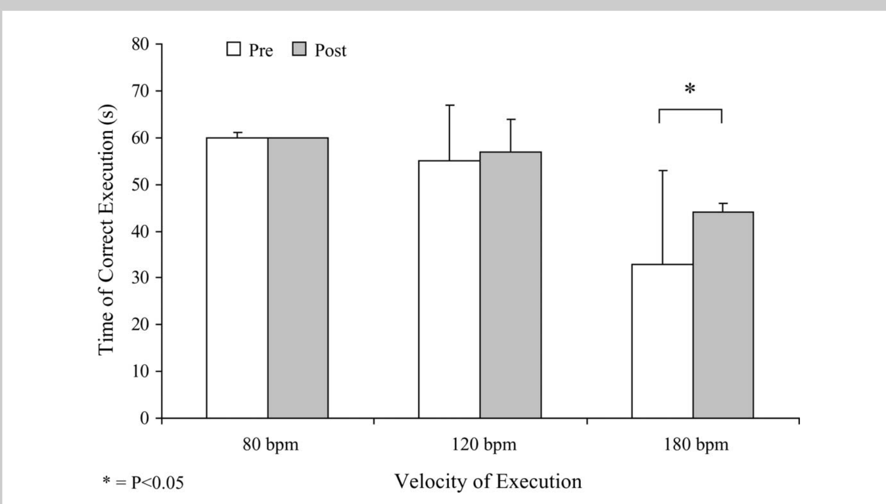

Figure 4. Means and standard deviations of the time of correct execution of homolateral hand and foot synchronization in relation to the velocity of execution (i.e., 80, 120, and 180 bpm) before and after the basketball game.

coordination mode, differences ($p < 0.0001$) were found between 180 bpm (25.4 ± 16.4 seconds) and the other frequencies of execution (80 bpm: 60.0 ± 0.0 seconds; 120 bpm: 55.3 ± 9.4 seconds). Post hoc analysis for frequency of execution × experimental session (Figure 4) showed differences ($p = 0.015$) between pre (33.3 ± 20.2 seconds) and post game (43.9 ± 19.8 seconds) performances only at 180 bpm.

Discussion

The competitive level of the friendly game was high because the players expected to be selected for the upcoming playoff phase of their national championship. Similar to the exercise load reported for elite (27) and young male basketball players (5) during official competitions, in this study 80% of the time was spent playing at intensities higher than 85% HR_{max}. These results support the validity of the present research design and the generalization potential of its findings regarding the capability of young (i.e., age 15–16 years) male basketball players to maintain their strength, power, and coordinative performances at the end of a game. In this study, pre-game evaluations indicated that the young basketball athletes had high values of speed (1,25,41), power (1,25,41), strength (41), and coordination (10,16). At the end of the friendly game players significantly decreased their sprint performances, maintained their jump and grip capabilities, and increased their interlimb coordination under high temporal constraints (i.e., 180 bpm).

According to the literature (5), after the first period of the game the young athletes partially reduced the occurrence of maximal efforts in favor of high-intensity ones, playing longer actions, involving more teammates, and performing more passes. Significant decreases in heart rate responses toward the end of a game often have been attributed to fatigue (5), although post-competition performance has been poorly investigated. Considering that at the end of the game the young players decreased their sprint performances but preserved jump and coordinative capabilities, one could speculate that they reduced the intensity of their activities according to the technical and tactical strategies of the game.

Despite the players showed high heart rate responses, their subjective rating of perceived efforts was "somewhat hard." It could be speculated that the intermittent nature of the game and the high fitness and skill levels of the players might have determined the underestimation of their efforts (11,36,37). Although at the end of their game the players were not exhausted, they perceived the muscle pain of the lower limbs as "heavy." This indicates that fatigue is localized in the lower-limb muscles that are heavily taxed in basketball because of the need for rapid accelerations, abrupt decelerations, frequent changes in running directions, and all-out jumps. In line with previous studies on basketball (12), futsal (37), and soccer (24) players, a negative effect of the game emerged for sprint performances. It has to be noted that basketball and futsal players have both defensive and offensive responsibilities and players strongly rely on their repeated sprinting ability (27,37). Because it could be speculated that under fatigue players change muscle stimulation and segmental movement pattern in sprinting (32), coaches are suggested to substitute players when game intensity does not allow passive recovery from free throwing or ball out of play (11).

However, this study showed that the magnitude of change of the countermovement test failed to discriminate differences between pre- and post-game conditions (12). Actually, Rodacki and colleagues (33) claimed that continuous practice under fatigue likely prevents potential disruption of the preprogrammed muscle stimulation patterns of vertical jump. Because CMJ performances are crucial in basketball (i.e., lay-up, jump shot and rebound, shot block and intercepting passes) and are generally trained under maximal and fatigue conditions, it could be speculated that the young players developed not only a good jumping capacity, but also the ability to preserve this skill during the whole game.

The young players also maintained their grip strength, despite a significant reduction in handgrip performances has been reported for senior basketball players at the end of their game (16). Although it could be reasonable to hypothesize that these discrepancies might be attributed to an age-related effect, it is also possible that the higher training volume and intensity of young players (i.e., three 2-hour sessions and 1 game weekly) with respect to their older counterparts (i.e., one 1.5-hour session weekly) help them to preserve this capability, crucial to grasp, hold, and pass the ball.

In line with the literature (9,10,15), the present results confirmed that movement complexity of interlimb coordination performances is a function of frequency of execution, coordination mode, and training. In particular, the young basketball players showed better interlimb coordination values than sedentary adults (10) and evident decreases only at 180 bpm when the timing capacities of the individual are stressed by the high time constraints. Thus, the practice of sports with high coordinative demands tends to nullify the regression of motor coordinative performance normally observed at the slowest execution frequencies in sedentary individuals (15). This substantiates that training enhances the efficiency of those executive and attentive control functions involved in complex motor behaviors (19,23). Recently, it has been reported that expert athletes tend to adjust motor coordination strategies to preserve task requirements under fatigue (2). After the basketball game, no difference was found for the slowest frequencies of execution, whereas the performances at 180 bpm significantly improved. Actually, the pre-game values registered at 80 and 120 bpm tended to a ceiling effect with correct executions close to the total duration of the test (i.e., 60 seconds), which dramatically limits the margin for improvement. However, the lack of improvements in the studied all-out performances indicate that the beneficial effects of the previous intense exercise on the most complex interlimb motor behavior might be a result of an enhanced arousal that allows the player to allocate attentional resources to the ongoing task (40). However, the linked effect of chronic (i.e., years of practice) and acute (i.e., actual game play) exercise on both coordinative and cognitive aspects in situational sports needs further investigation. In fact, there is the need to address the critical factor responsible for the observed far transfer between the acyclic open skill basketball activity on the cyclic interlimb coordination task (4) and to provide exercise scientists and professionals a foundation for the structure and design of effective exercise training programs.

Practical Applications

The significant decrease in sprinting ability observed at the end of the basketball game suggests that a training program for competitive youth basketball should enhance the repeated sprinting ability of players to maintain high-intensity efforts toward the end of the game (5,11). The ability to produce maximal speed in a single-sprint effort is an important component of the repeated-sprint ability. In general, exercise protocols to improve speed include speed ladder, varied pace running, and repeated sprints of 3 to 5 seconds duration repeated 5 to 7 times and separated by active recovery periods of approximately 10 seconds. In particular, coaches of young basketball players should also structure technical and tactical drills, which couple intense physical exercise with technical and tactical skills similar to situations experienced during the game. Furthermore, the results of this study encourage coaches to include complex coordination tasks under time pressure to induce higher attentional control and executive function of players. High-intensity court drills should be organized toward the end of the training session, when the attentional level and sprint abilities of the players might be overwhelmed by fatigue. Finally, the proposed coordination tests have the potential to be integrated in field test batteries for monitoring training programs, being easily and inexpensively administrable by coaches.

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