Dribble Deficit enables measurement of dribbling speed independent of sprinting speed in collegiate, male, basketball players

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ABSTRACT

Aim: The aim of this study was to determine the relationships between sprinting and dribbling speed during linear and change-of-direction (COD) sprints, using total performance time and Dribble Deficit.

Methods: Collegiate, male, basketball players (n=10; 21.0±1.6 yr) performed 20-m linear and COD sprints with and without dribbling a ball. Linear dribbling sprints were measured separately for the dominant and non-dominant hands, while COD dribbling sprints involved bilateral use of hands. Dribble Deficit was determined as the difference between performance time (s) during each dribbling trial and the equivalent non-dribbling trial for linear and COD sprints. Simple linear regression analyses were performed during linear and COD sprints to determine the relationships (R) and shared variance (R^2) between: 1) sprint times and total dribbling times; 2) sprint times and Dribble Deficit.

Results: *Large* to *very large*, significant relationships were evident between linear sprinting and dribbling time for dominant (R=0.86; R^2=0.74, P=0.001) and non-dominant hands (R=0.80; R^2=0.65, P=0.005). Only *trivial* relationships were apparent between linear sprint time and Dribble Deficit with dominant (R=0.10; R^2=0.01, P=0.778) and non-dominant hands (R=0.03; R^2=0.00, P=0.940). Similarly, a *very large* relationship was evident between COD sprinting and dribbling time (R=0.91; R^2=0.82, P<0.001), while a *trivial* relationship was observed between COD sprinting time and COD Dribble Deficit (R=−0.23; R^2=0.05, P=0.530).

Conclusions: Dribble Deficit is recommended for use in basketball to measure dribbling speed independent of sprinting speed across linear and multidirectional movement paths.

Key words: plyometric; team-sport; physical fitness; skill; acceleration.

INTRODUCTION

Basketball players execute frequent maximal-intensity, short-duration actions, such as linear sprinting and change of direction (COD) manoeuvres, in combination with technical actions, such as dribbling.[1] Dribbling is an essential component of basketball, given that many sprints occur while dribbling the ball[2]. Moreover, dribbling initiates more successful fast break situations than passing does during basketball match-play.[3]

Assessment of dribbling speed has been traditionally performed using total movement times in basketball.[4,5] Dribbling speed measured by total performance times strongly relate to sprint speed.[6,7] In turn, players having high sprint speeds may exhibit superior performance in dribbling tests, relying on total movement time irrespective of dribbling ability. Therefore, it is important for dribbling tests to implement measures that isolate the quality of dribbling speed. The issue of sprint speed influencing total performance time during traditional dribbling tests may be countered by the recent advent of the Dribble Deficit (DD) measure.[6] The DD is calculated as the difference between performance times of sprint trials, with and without dribbling, across the same movement path. Sprint speed appears to exert little influence on DD with *trivial* to *small* relationships reported with linear (R^2=0.00–0.02) and COD (R^2=0.20) sprint time.[6] Therefore, DD may provide a better assessment of dribble speed than traditional tests by excluding the influence of sprint speed on performance outcomes. However, DD results were only presented in a sample consisting of an adult, semi-professional, male basketball team and may not be applicable to other player populations. Considering that replication studies are critical for the advancement of sport science practice[8], the aim of this study was to examine the relationships between sprint and dribble speed across linear and COD movement paths using total performance times and DD.

METHODS

Participants

Collegiate, male, basketball players (n=10; age: 21.0±1.6 yr; height: 184.4±5.4 cm; body mass: 83.4±7.1 kg), competing in the South Chilean College System Basketball League, volunteered for this study. This sample size was deemed adequate for statistical power based on recommendations in previous research examining DD in male basketball players (G*Power; version 3.1.9.2; University of Düsseldorf, Düsseldorf, Germany) (alpha=0.05; beta=0.80; coefficient of determination=0.5).[6]

Participants were from the same basketball team and trained regularly (~6.5 h·week^{-1}) for 5 months prior to study. The analysis occurred during the middle of the season. All procedures received approval from an institutional ethics committee and conformed to the Declaration of Helsinki

Procedures

Participants completed all assessments in a single session. Upon arrival to the laboratory, height and body mass were assessed with a stadiometer (Bodymeter 206; SECA, Hamburg, Germany, to 0.1 cm) and a digital scale (InBody120, model BPM040S12FXX; Biospace, Inc., Seoul, Korea, to 0.1 kg). Participants completed a standardized 15-min warm-up,[9] consisting of moderate-intensity jogging with COD, dynamic stretches, and progressive 20-m speed runs. In a randomized order, participants (all right-hand dominant) performed three maximal trials of: (i) 20-m linear sprints; (ii) 20-m linear sprints while dribbling with the dominant hand; (iii) 20-m linear sprints while dribbling with the non-dominant hand; (iv) 22-m sprints with COD; and (v) 22-m sprints with COD while dribbling the ball bilaterally. A 3-min active (walking) rest was administered between trials. Participants were habituated to the tests through their regular conditioning. Assessments were performed in an indoor gymnasium with a sprung hardwood floor between 1800 and 2100 hrs. Participants were asked to avoid intense physical activity and consumption of any substance that could alter performance within 48 h before assessments; attain adequate sleep (≥8 h) during the previous night; consume a meal rich in carbohydrates ~2-3 hours prior to the test; and to be well hydrated upon commencing testing.

Linear and COD sprints

The 20-m linear sprinting and COD sprinting tests have been previously used in basketball players.[6] In the 20-m linear sprinting test, participants ran with maximal effort in a straight line. In the COD sprinting test, participants ran around markers at maximal effort in a zigzag formation. They ran toward a marker positioned 3 m to the right, and 2.5 m forward, from the start position. They then ran toward a second marker positioned 3 m to the left and 2.5 m forward from the first marker, before running to a third marker positioned 3 m to the right and 2.5 m forward from the second marker. They then moved toward the finish line positioned 3 m to the left and 2.5 m forward from the third marker. During the dribbling tests, participants used each hand separately across linear sprints and alternated hands with crossover dribbles at each marker during the COD sprints. Electronic timing gates (Brower Timing System, Salt Lake City, UT) were positioned at the starting point and finish line for each test, with participants commencing 0.3 m behind the starting line to avoid inadvertent triggering of the timing gates. During dribble testing, a size 7 basketball (GF7X; Molten; Hiroshima, Japan) was utilised. The fastest of the three trials for each test was used for analysis. Table 1 shows the inter-trial reliability for all dependent variables.

*****Table 1 here*****

Dribble Deficit (DD)

DD (s) was calculated as the difference between the fastest time in each non-dribbling time trial minus the fastest time recorded in the equivalent dribbling time trial for each linear and COD sprint.

Statistical analyses

Normality and homoscedasticity of the data were confirmed and simple linear regression analyses were performed to determine the relationship (R) and shared variance (R^2) between: (i) linear sprint time and linear dribble time (for each hand); (ii) linear sprint time and linear DD (for each hand); (iii) COD sprint time and COD dribble time; and (iv) COD sprint time and COD Dribble Deficit. Mean ± standard deviation with 95% confidence intervals were calculated for all dependent variables. Significance was determined *a priori* at $P<0.05$. The magnitude of the R values were determined according to established criteria: *trivial* (0–0.10)*; small* (0.11–0.30); *moderate* (0.31–0.50); *large* (0.51–0.69); *very large* (0.70–0.89); and *almost perfect* (0.90–1.00) [10]. Statistical analyses were performed with STATISTICA statistical package (Version 8.0; StatSoft, Inc., Tulsa, OK, USA).

RESULTS

The mean ± standard deviation for each dependent variable are shown in Table 2. *Large* to *very large* significant relationships were evident for linear sprint time and linear dribble time with the dominant hand and non-dominant hand. *Trivial*, non-significant relationships were found between linear sprint time and linear DD with the dominant hand and non-dominant hand. A *very large*, significant relationship was evident for COD sprinting time and COD dribbling time, while a *trivial*, non-significant relationship was observed between the COD sprinting time and COD DD (Table 3).

*****Table 2 here*****

*****Table 3 here*****

DISCUSSION

The aim of the present study was to examine the relationships between sprinting and dribbling speed during linear and COD tasks using total performance times and DD in collegiate male basketball players. The main findings indicated that, contrary to total performance times with and without dribbling, DD permitted the assessment of dribbling speed without a strong influence of sprinting speed on performance outcomes.

Scanlan et al. reported *large* to *very large*, significant relationships ($P<0.05$) between total performance times in linear and COD sprints with and without dribbling a ball ($R=0.64-0.88$; $R^2=0.41-0.77$) [6]. Collectively, the results from Scanlan et al. (2018) paired with our findings indicate dribble speed measured using total performance time is strongly related to sprint performance time in adult male basketball players across linear and COD bout distances indicative of basketball match-play.[11] In this regard, dribble tests predicated on total performance time to complete the task are of limited value to detect improvements in the measure of interest, dribble speed. To address this concern, basketball practitioners may consider assessing dribble speed using DD in favor of total dribbling time. We observed DD to possess *trivial-small*, non-significant, relationships with linear and COD sprint time using the dominant and non-dominant hand.

Future studies should examine the efficacy of DD in other sports such as soccer and in participants of different sex, competitive level, playing position, and maturation level. In addition, longitudinal studies are needed to assess the sensitivity of DD to assess the effects of different training plans on sprint speed, dribble speed, or both, at different time points across the season.

In conclusion, DD is recommended to assess dribble speed in isolation from sprint speed in collegiate, male, basketball players. The assessment of DD currently offers the best approach to measure dribble speed in basketball players.

PRACTIAL APPLICATIONS

The low variance shared between DD and sprint time suggests these assessments measure separate traits. This finding has important practical applications. Specifically, use of sprinting speed and DD assessments may allow basketball practitioners to precisely determine the effects of training approaches on sprinting speed and dribbling speed separately. This point is particularly important given basketball practitioners regularly implement programs aimed at developing short-duration accelerative and speed properties as well as technical skills during year-long training schedules.[12]

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