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SHORT REPORT

Leather Balls Influence Three-Point Scores by University Basketball Players more than Synthetic or Rubber Balls Do

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Abstract

This study aimed to compare the influence of ball type on three-point shooting in university basketball players. Forty university basketball players were selected for the study (Mean±SD; for male subjects: age 22±1.3 years; height 1.68±0.85 m; body mass 66.4±7.1 kg; fat 10.3±2.28% and for female subjects: age 20±1.6 years; height 1.36±0.88 m; body mass 62.4±6.9 kg; fat 11.6±3.48%). A 2×3 repeated measures ANOVA revealed a significant main effect in score with ball type ($F_{(2,76)}$=48.37, p<0.001, partial eta squared=0.56). Further analysis with post hoc testing revealed significant differences between synthetic and leather ball (p<0.001, d=1.27), and rubber and leather balls (p<0.001, d=1.48). No significant interaction effect of gender and ball type was found (p=0.706, partial eta squared=0.009). An independent t-test found no significant differences in three-point scores between male and female players in any ball type.

Keywords: *ball type, scoring, unopposed throw, ball quality, male versus female*

Introduction

Basketball is a popular sport that is played with a ball. Even though many sports use balls, each sport is associated with a specific type of ball that is distinctly different from others. The performance of players is directly influenced by the properties or characteristics of the ball (Connor, Sinclair, Leicht, & Doma, 2019; Cooke & Davey, 2005; Santos et al., 2020). Teams accumulate points in the sport of basketball by putting the ball through the hoop. Therefore, shooting is a very important skill and directly influences the team's success (Button, Macleod, Sanders, & Coleman, 2003; Knudson, 1993; Malone, Gervais, & Steadward, 2002).

A survey paper by Okazaki, Rodacki, and Satern (2015) studied various factors that affect shooting in basketball, including (a) ball trajectory, (b) segmental movement organization, and (c) variables that influence shooting performance (basket height, ball size, etc.), but the researcher found negligible data related to the effect of various ball types on shooting.

Recent studies conducted with different types of balls suggest that changing the ball type influences the youth footballers' performance during small-sided games (Santos et al., 2020), cricket batters' performance (Connor et al., 2019), and tennis players' performance and physiological responses (Cooke & Davey, 2005). Although no recent study has been conducted on the influence of the type of basketball used for shooting performance, an earlier study by Mathes and Flatten (1982) reported that synthetic basketballs do not have the same rebound characteristics as leather basketballs. The results also suggested that in play, the leather basketball would rebound further from backboards and could be dribbled with less effort than the synthetic basketballs (Mathes & Flatten, 1982).

Rubber basketballs are made with outer and core material as rubber but with a butyl bladder (http://cosco.in). Synthetic basketballs are also made with rubber outer material but have a leather feel with high grip pebbles and broad, deep grove patterns (http://cosco.in), whereas leather basketballs are made

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with outer material as leather reinforced with multi-filament nylon (http://cosco.in).

Thus, this study aimed at finding the influence of the type of material of ball in three-point shooting through different angles from the ring.

Method

Subjects

For this study, a total of 40 university basketball players were included with 20 male and 20 female players (Mean±SD; for male subjects: age 22±1.3 years; height 1.68±0.85 m; body mass 66.4±7.1 kg; fat % 10.3±2.28% and for female subjects: age 20±1.6 years; height 1.36±0.88 m; body mass 62.4±6.9 kg; fat % 11.6±3.48%). The subjects had a minimum playing experience of four or more years in the university. Subjects with recent records of lower limb or upper limb injury, neuromuscular disorder or back injury were excluded from the study. A written informed consent form was signed by the subjects after explanation of the procedure and possible risk involved in the study. The study was approved by the institutes' Departmental Research Committee with considerations regarding ethical issues reported in Helsinki Declaration.

Procedure

A week-long familiarization session was conducted with the three different ball types after regular training sessions. Anthropometric measurements were recorded a day before the assessments. Five different positions were marked on the court at three-point arc with angles: 0°, 45°, 90°, 45° and 0°. Each participant was allowed five attempts from each angle with each ball type. A total of 25 shots with each ball were given, and only successful attempts were recorded as having scored. Different positions of shooting are shown in Figure 1.

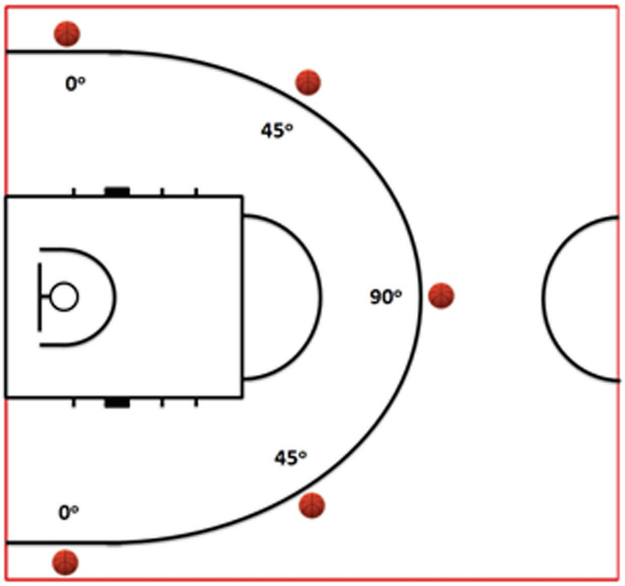

FIGURE 1. Angles of three-point shooting from the ring

Balls used in the procedure were of the Cosco brand, approved by the Basketball Federation of India (specifically with product names Cosco Dribble as the rubber ball, Cosco Hi-Grip as the synthetic ball and Cosco Championship as the leather ball). Different size balls were used for male and female subjects as used in the FIBA governed tournaments (Size 6 for females and Size 7 for males).

All the subjects were evaluated on the same day (09:00 to 16:00) by conducting three sessions with a gap of 2 hours between the sessions to avoid any carryover effect. At the beginning of every session, subjects first underwent a 10-minute warm-up to familiarize themselves with the ball, followed by the first trial which included 25 shots in total from five different angles with a particular ball type. After the completion of the first trial, a break of 10 minutes of active recovery was given, followed by the second trial. The total baskets made out of the 25 shots were taken as the score. The best score out of the two trials was considered to be the final score.

Statistical analysis

IBM SPSS (version 20.0.0) software was used for the analysis of the data. Data are presented as Mean±SD. Normality of the data was verified using a Shapiro-Wilk test. A 2×3 repeated measures ANOVA with gender (male and female) as between-subject factor and ball type (synthetic, rubber, and leather) as within-subject factor was used for analysis of the effect of ball type on three-point shooting. Post-hoc test with Bonferroni correction was used for further analysis of the data. Independent t-tests were used for comparison of male and female three-point scores with different ball type. Cohens' d and partial eta squared were calculated as effect sizes.

Results

A 2×3 repeated measures ANOVA revealed a significant main effect in score with ball type ($F_{(2,76)}$=48.37, p<0.001, partial eta squared=0.56). Further analysis with post hoc testing revealed significant differences between synthetic and leather ball (p<0.001, d=1.27), and rubber and leather ball (p<0.001, d=1.48). No significant interaction effect of gender and ball type was found (p=0.706, partial eta squared=0.009). Independent t-test found no significant differences in three-point scores between male and female players in any ball type. All the data are presented in Table 1.

Table 1. Mean and SD of scores using different ball type

Ball type	Gender	Scores (Mean±SD)	p-value and ES (d) male vs female	p-value and ES (partial eta squared) (main effect)	p-value and ES (partial eta squared) (gender×ball type)	p-value and effect Size (d) in comparison with leather ball
Synthetic	Male	10.65±2.7	0.112 (0.51)			<0.001* (1.27)
	Female	11.85±2.3				
Rubber	Male	10.15±1.95	0.089 (0.55)	<0.001* (0.56)	0.706 (0.009)	<0.001* (1.48)
	Female	11.4±2.54				
Leather	Male	14.05±2.8	0.423 (0.26)			-
	Female	14.7±2.25				

Legend: SD - standard deviation; ES - effect size; d - Cohens' d

Discussion

The main objective of this study was to compare the three-point scoring ability of university basketball players using different types of basketballs (viz. synthetic, rubber and leather balls). The result suggests an influence of ball type in scoring ability with more favourable scoring conditions with leather balls than rubber or synthetic balls.

A recent study conducted by Connor et al. (2019) on the effect of two different types of cricket balls utilized during a competition reported that pace bowlers were more successful in transferring their skill to the one type of ball (Duke™), while the spin bowlers were more successful with another type (Kookabura™). In the same vein, our findings also showed that the type of ball influenced the three-point shooting ability with more successful shots with a leather ball. Although the authors do not have sufficient evidence to support the statement, there may be a possibility of leather balls being more comfortable to hold during the throws than rubber or synthetic balls. The feeling of the leather grip may have also affected the throws.

In addition to this, a study by Julian & Price (2017) reported that the official game ball for the National Basketball Association (NBA) was changed from leather to synthetic in the 2006–2007 season. The NBA argued that a synthetic ball to be superior to the leather ball and suggested that it would improve performance. However, the league reverted to use leather ball after the National Basketball Association Players Association (NBAPA) filed an unfair practice labour grievance against the league. The NBAPA argued that it decreased performance, in contradiction to the suggestion by the NBA. This suggests that the use of leather balls was found to be suitable by the players, similar to what our finding suggests.

Previous studies have reported that materials used in manufacturing the balls influence the properties of the ball. Mathes and Flatten (1982) found that leather basketballs rebounded significantly higher than synthetic basketballs on different playing surfaces (polyurethane, asphalt, glass, concrete, hardwood). A study by Inaba et al. (2017) also found different coefficients of restitution, friction, and trajectories in table tennis ball post-collision for celluloid and plastic balls. These two studies show that material used in ball does affect the properties of the ball. Although the researchers did not study collisions, differences in the material of the ball must have influenced the three-point shooting scores.

Furthermore, there was no significant interaction effect between gender and ball type in the three-point shooting ability. Both male and female players showed a similar trend in the scoring ability to the ball type, which suggests that the differences in scoring ability is not a mere chance of gender influence but the type of ball used.

The study concludes that the type of material used in balls do influence the three-point shooting in both male and female university players. Therefore, the use of leather balls during training sessions would be beneficial for players as more score during drills would provide more stimulus and motivation. Although the cost of leather balls is on the higher side than other types of ball, the ultimate goal of training is to improve players, and thus the quality of the ball should not be compromised.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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