IMPACT OF THE FOCUS OF ATTENTION ON VERTICAL JUMP PERFORMANCE OF JUNIOR BASKETBALL PLAYERS

Abstract
The aim of the research was to determine the impact of the focus of attention on vertical jump performance expressed through a jump height. Thirteen basketball players (body mass = 73.4 kg, height = 186.58 cm, age = 15.12 ± 0.61 y) volunteered as participants. All the subjects represented a club which participated in the Croatian cadets 1. league in season 2008/09, and were tested during the season. The subjects performed two experiments. In both experiments, they performed 15 repetitions of countermovement jump, whereas in one of the experiments, during the performance of the jumps they were listening to an audio record of spectators. For both type of jumps, the subjects were instructed to stay in the air as long as possible during a single jump (external focus of attention). To determine the differences between jumps, a paired-sample *t*-test was used with a level of statistical significance set to *p* ≤ 0.05. Comparison for jump height between both type of jumps revealed no statistically significant difference, although the presented difference should not be denied considering a real match conditions.

Key words: EXPERTIZE / MOTOR CONTROL / SPECTATORS

INTRODUCTION

Basketball is characterised by many explosive movements such as short sprints, abrupt stops, fast changes in direction, acceleration, different vertical jumps as well as shots with and passes of the ball (Erčulj, Dežman, & Vučković, 2004). A very important motor element of the basketball play is vertical jump. A successful and efficient execution of this type of jump depends on the ability called take-off power (Strojnik, 1998). In basketball, this ability manifests itself in various situations, mainly in jumps with the ball when a player shoots at the basket and without the ball in defensive and offensive rebounds after a missed shot (Erčulj et al. 2004). The players mainly execute one- and two-leg countermovement jumps. The jumps must be fast (short take-off reaction time) and as high as possible (jump height) so that the player can catch the ball before her opponent and can execute a jump shot without hindrance. In average, during a basketball game players perform between 42 to 46 different jumps, both, offensive and defensive (McInnes, Carlson, Jones, & McKenna, 1995; Abdelkrim, Castagna, El Faza, & El Ati,. 2010), regardless of the level of playing or defensive tactical scheme they are facing with. This data depends on how much time players spend in game. Some author claim that players perform up to 100 different jumps during a game (Dežman, & Erčulj, 2005).

During a real game situation, players are exposed to various direct and indirect factors which can contribute to overall performance. As a com-
mon knowledge, the spectators are being one of the indirect factors (Dežman, & Erčulj, 1995). In the equation of basketball success, possible influence of spectators could be placed in so called real factors (O) (Karalejić, & Jakovljević, 2009). The influence of spectators, whether positive or negative, is difficult to determine. A positive influence of spectators is usually visible with teams playing their home matches. Advantage of the home court is presented in percentage of a home match victories. Percentage of home match victories in recent seasons of 1. Slovenian basketball league is 53 to 62% (Štrumbelj, Vračar, Robnik Šikonja, Dežman, & Erčulj, 2011). In NBA league, in seasons 2007/08 i 2008/09 the percentage was 61%, with a 3.5 points difference in their favor (Štrumbelj, & Vračar, 2011). In the last ten seasons of Euroleague, home team scored 63% of victories, with a 4.1 points difference in their favor (Štrumbelj et al., 2011). Gomez and Pollard (2011) investigated the advantage of home-matches in some of the European national leagues, and found an advantage in favor of home teams in range from 56 (Lithuania) do 65% (Romania), respectively. In one of the very few field studies that relates the behavior of spectators to the performance, a study of Strauss (Strauss, 2002) revealed no significant of spectators on an American football team.

The focus of attention belongs to an area of creating efficient movements patterns by using verbal instructions. An internal focus is when one’s attention is focused on the body while external focus means directing attention to the environment (Porter, Ostrowski, Nolan, & Wu, 2010). This area of research can have a significant influence on the performance of motor skills (Wulf, 2007).

External focus of attention benefits motor learning more than an internal focus of attention in tasks like stabilometer balancing (McNevin, Shea, & Wulf, 2003; Wulf, Hoß, & Prinz, 1998), static balancing (McNevin, & Wulf, 2002), ski simulation (Wulf, et al., 1998), golf putting (Wulf, & Su, 2007), pedalo riding (Totsika, & Wulf, 2003) and tennis strokes (Wulf, McNevin, Fuchs, Ritter, & Toole, 2000), although some studies have reported contrary findings (Maxwell, & Masters 2002; Poolton, Maxwell, Masters, & Raab, 2006). Individuals jump higher when they adopt an external focus of attention, relative to an internal focus or no focus of attention (Wulf, Zachry, Granados, & Dufek, 2007). Electromyographic (EMG) activity was generally lower with an external focus which suggests that neuromuscular coordination is enhanced by an external focus of attention (Wulf, Dufek, Lozano, & Pettigrew, 2010).

The purpose of this research was to determine the impact of external focus of attention on vertical jump performance by comparing countermovement jumps (one of them being performed during listening to an audio record of spectators). By simulating the real game situation with spectators, we tried to determine their influence on competitors performance. This study targeted performance and short-term changes (we haven’t conducted retention test to observe the effects on motor learning). We assumed that the audio record of spectators would create a higher psychological stimulus where, as a result, the subject would put more effort in the jump. Therefore, our hypothesis was that the values for jump height will be significantly higher for countermovement jump performed during the audio record of spectators.

**METHOD**

**Subjects**

The subjects were 13 male players from a top national basketball team (age = 15.12 ± 0.61 yr). All the subject represented a club which participated in the Croatian cadets 1. league in season 2008/09, and were tested during the season. They were experienced in exercise and were continuously participating in a sport-specific training program for at least 6 months. None of the subjects had any limitations that could have affected their performance. Exclusion criteria included self-reported pain, injury and soreness before testing. Any injuries must have healed at least 1 month before participation. The study was approved by the Institutional Review Board and all subjects signed an informed consent document according to the Helsinki Declaration. Prior to that, they obtained the informed consent from a parent. Subject were instructed to abstain from performing heavy exercise of the lower limbs for 48 hours before testing. Caffeine consumption was limited to normal daily intake, and no other ergogenic aids were allowed for consumption during the day before testing.
Procedures

We selected the countermovement jump (i.e., the natural vertical jump performed with a preparatory lowering the body; CMJ) because this kind of jump is dominant in basketball. In order to emphasize the leg thrust, countermovement jump was performed without an arm swing. Selection was also based on the fact that this type of jump is mainly used in research and it highly corresponds to the vertical jumps where the maximum performance is based on a high muscle mechanical output exerted during the natural stretch-shortening cycle (SSC).

Before the performance of jumps, the anthropometric parameters of height, body mass, and body mass index (BMI) were evaluated. Height was measured to the nearest 0.1 cm. Body mass was measured on a force platform. Body mass index was calculated as weight in kilograms divided by the square of height in meters. Each subject performed a warm-up consisting of five minutes of running on a treadmill (3 min at 8 km/h, 2 min at 10 km/h), followed by five repetitions of submaximal countermovement jumps. Verbal encouragement and instructions were standardized. Feet were approximately shoulder width apart and the subjects were instructed to look straight ahead, with their head erect and hands on their hips. The order of both type of jumps was counterbalanced between participants. For both experiments, the subjects were explained that they will be given an external focus of attention which is: “after taking off the ground, try to stay in the air as long as possible until landing”. In both experiments, the subjects performed a total of 15 repetitions of countermovement jump. In one of the experiments, subjects were explained that they will listen to an audio record of spectators during jumping. Given that the jumps were maximal, and in order to avoid the fatigue, subjects were allowed a 30 second rest between repetitions in both experiments. A one minute rest was given between both type of jumps. No specific instruction was given regarding the depth of the squat in both experiments.

The jumps were performed on a force plate (Kistler type 9290AD, Kistler Instrumente AG, Winterthur, Switzerland; sampling frequency 500 Hz) mounted according to the manufacturer’s specifications. The force signal from the force plate was filtered with the 2nd order Butterworth low-pass filter (10 Hz cut-off frequency).

An audio record of spectators have been downloaded from Internet (YouTube) using RealPlayer, converted to an mp3 file in Format Factory and played with a VLC media player. Sound is not related to a basketball game, and the sound reproduction of spectators was isolated from any on-court sound. Volume has been standardized for each subjects. External speakers were connected to portable computer. In further text (description of results), CMJ + audio will represent a countermovement jump performed during the audio record of spectators, whereas CMJ will represent a countermovement jump without an audio signal.

Statistical Analyses

All data were analysed using SPSS™ and expressed through a mean (±SD). Differences between jumps were determined using a paired-samples t-test. The level of statistical significance was set to $p \leq 0.05$.

RESULTS

Basic characteristics of subjects (age, height, body mass and body mass index-BMI) are presented in table 1. We can conclude that the subject’s characteristics are very similar to the ones in other studies that relate to the players of the same age, recruited mostly from national teams and elite international players (Erčulj, 1998; Milanović, Jukić, Dizdar, & Šentija 1996; Coelho E Silva et al., 2008).

<table>
<thead>
<tr>
<th>Variable</th>
<th>AS±SD</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>15.12 ± 0.61</td>
<td>16.2</td>
<td>14.8</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>186.58 ± 0.08</td>
<td>194.2</td>
<td>169.5</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>73.4 ± 3.8</td>
<td>89.7</td>
<td>62.1</td>
</tr>
<tr>
<td>BMI (kg ×m^{-2})</td>
<td>20.9 ± 1.2</td>
<td>23.9</td>
<td>21.5</td>
</tr>
</tbody>
</table>

Results of countermovement jumps show high level of the subject’s performance. Their results are equal or even better in comparison to the elite international players of the same age (Erčulj, et al., 2004; Erčulj, 2005; Coelho E Silva et al., 2008). Based on the results, it’s visible that there has been an increase
in jump height for countermovement jump performed during the audio record of spectators. Inspite of the increase, the difference is not significant. Numerical data are presented in table 2.

**Table 2.** Values of the jump height and the level of statistical significance of countermovement jumps

<table>
<thead>
<tr>
<th>Variables</th>
<th>AS±SD</th>
<th>Max</th>
<th>Min</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMJ (cm)</td>
<td>44.10±7.22</td>
<td>50.0</td>
<td>38.2</td>
<td>t(12) = 0.659</td>
<td>0.548</td>
</tr>
<tr>
<td>CMJ + audio (cm)</td>
<td>45.17±6.45</td>
<td>51.7</td>
<td>38.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

The aim of the study was to determine the impact of external focus of attention on jump height of countermovement jumps in competitive cadets basketball players. Although not significantly, the difference in jump height between jumps exists.

The sample consisted of top basketball players which might have been one of the reasons for non significant results. These players are experienced in this type of jumps, so the space for progress regarding the age, is narrowed. Furthermore, many studies on the focus of attention compare expert and novices. In this study, the sample consisted only of experienced subjects, as we considered, that it might be difficult for novices of this age to perform this kind of jump. Inspite of that, countermovement jump is a less demanding motor skill, so it is advisable to perform another research by comparing experts and novices of this age, securing that novices have some experience in sport (to easier perform appropriate jumps).

Several experiments have demonstrated that focusing a performer’s attention externally rather than internally enhances performance when the task requires object manipulation. Therefore, we only compared jumps in regards to external focus of attention, and also for another reason, being that the players during a game would more likely be under the influence of an external focus. Furthermore, it is possible that our study revealed no significant difference, because the subjects were getting only external instructions for both type of jumps (which have already been proved that improve the results).

A study by Zachry, Wulf, Mercer, & Bezodis (2005) investigated the effects of attentional focus in basketball. The shooting accuracy was ammended after the instructions that directed performers’ external focus of attention. Wulf and Dufek (2009) showed that participants’ kinetic parameters including jump height, were greater with an external focus compared with an internal focus. Our study doesn’t support the findings of this two studies, although the instructions targeted the external focus of attention.

A study by Castaneda and Gray (2007) differentiated instructions into four categories: skill/internal (movement of the hands in a baseball swing), skill/external (movement of the bat), environmental/external (ball leaving the bat), and environmental/irrelevant (spectators). They found experts had their best performances in the environmental/external condition while less-skilled participants demonstrated better performances in the skill conditions. The results are not in line with that study, as instructions in this study belong to an environmental/external category, and the subjects are experienced in these jumps. Although the subjects are experienced in this motor skill, a question is, are they experts. Experts have better self-monitoring skills (Chi, Glaser, & Farr, 1988) and, therefore, are more aware of movement errors even in the absence of feedback about their throwing results. Additionally, instructions have a greater effect on the movement characteristics of experts. Beilock, Carr, MacMahon, & Starkes (2002) revealed, in two experiments, better performance of experts in dual-task conditions than in skill-focused (internal) conditions.

Additional question is whether the focus of attention in general is actually beneficial for performance in motor control situations. Most studies of attentional focus in motor control situations lack a baseline check of whether external focus of attention is superior to control conditions, as found by Wulf and colleagues in studies of motor learning (McNevin, & Wulf 2002; Wulf et al. 1998). The studies by Hossner and Ehrlenspiel (2010) found no significant differences between baseline and any focus of attention conditions.
CONCLUSIONS

The study has been conducted with the aim to determine the impact of the focus of attention on vertical jump performance. Although, the difference is not significant, we must not neglect the difference in jump height between jumps, which is slightly over 1 cm, as this difference can sometimes have decisive role in situation of fatigue and stress during a game. From previous chapter, one can conclude that experience of the subjects and a questionable expertize play important roll. The greater the experience, the smaller the space for progress. Also, expertize is responsible for better results in external focus of attention. A longitudinal study on external focus of attention might yield significant difference. Regardless of a longitudinal study, the results might have been different if the subject performed a single plyometric training with fatiguing (consisted of the same type of jumps). Given that it is rather difficult to conduct this kind of experiment during the real game situation, a simulation is the only way to approach this kind of problem. Further work is necessary to determine whether the spectators can affect the players performance, so that the countermovement jump training can take place in a simulated enviroment. Further studies should be analyse differences in plyometric (Drop Jump) and concentric (Squat Jump) types of vertical jumps, to enable for clear conclusions.

REFERENCES


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