Reliability of overhead medicine ball throw test as a muscular power assessment tool

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RELIABILITY OF OVERHEAD MEDICINE BALL THROW TEST AS A MUSCULAR POWER ASSESSMENT TOOL

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ABSTRACT

The purpose of this study was to assess reliability of overhead medicine ball throw test which was used to assess muscular power ability. Fifty healthy males’ university students aged between 20-25 years old with body weight of 62.57 ± 9.14 kg and body height of 1.68 ± 0.06m volunteered for this study. Participants performed two sessions of overhead medicine ball throw protocol. Medicine ball weight was standardized at 2kg for all participants. One week gap provided between both sessions with each session consists of 2 trials. Average distance of both throws of each participant was taken as their final score. Participant means for each assessment were averaged to provide a group mean. First session’s mean ± standard deviation recorded was 5.38 ± 0.80m, and second session’s was 5.98 ± 0.95m. Both sessions average throw distance was 5.68 ± 0.84m. Coefficient of variation or CV (SD/mean x 100) was calculated to determine stability of measurement between the two trials. CV recorded was 7.82 %. Pearson correlation coefficient calculated was r = 0.8403. The value of R², the coefficient of determination, is 0.7061. In conclusion, the Pearson correlation coefficient indicated a strong positive correlation, which means the overhead medicine ball test is a reliable test, and thus can be trusted to produce similar results if all variables remain the same. However, further studies are needed to determine the validity of the test, which is whether it is valid test to determine muscular power ability of participants.

Key words: overhead medicine ball throw test, muscular power, reliability, standardized weight
1. INTRODUCTION

Muscle explosive strength ability (power) can be assessed using various types of field tests instruments and protocol. One of the most popular types of field test for muscular power are the jump based test such as counter movement jump test, squat jump test or standing broad jump test (Chamari et al., 2008; Moir, Mergy, Witmer, & Davis, 2011). As for the upper limb, the typically used test were such as drop push up and explosive clap push up (Contreras et al., 2012).

In monitoring strength and power performance during a systematic strength training program for a group of athletes, an appropriate yet easy to administered test that can measure if possible the overall strength or power of the body is desirable. A progress in strength training program can be seen by having a standardized test from time to time. In search for this kind of test, medicine ball throw test was seen as the choice of exercise that fulfil the intended objectives.

The medicine ball throw can be administered in many ways. Three most common methods are by using side throw, overhead backward throw and overhead forward throw (Ikeda, Kijima, Kawabata, Fuchimoto, & Ito, 2007; Shinkle, Nesser, Demchak, & McMannus, 2012; Stockbrugger & Haennel, 2001). In performing any explosive strength test or training with external load such as the medicine ball, manipulating the load involved will influence the outcome of the exercise or test (Wernbom, Augustsson, & Thomee, 2007). This are called the dose-response relationship or effect. Using an optimal load (not maximal or minimal) has been suggested for exercise involving explosive strength purposes (Kawamori & Haff, 2004). This study has selected to use standardized load which considered as optimal for participants with normal body weight and height as measured among participants in this study. Standardized load in term of test administration provide ease of use and administration rather than individualized load.

The introduction of one simple test for overall explosive strength test and training purposes is the main objective of this study. Prior engaging into further acute and longitudinal study, the researcher hopes to explore the possibility of using the exercise as a reliable assessment tools.

2. METHODS

2.1 Experimental approach to the problem

2.1.1 Participants

Fifty healthy untrained male’s participants aged between 20 to 25 years old enrolled under the Training Methodology & Physical Conditioning course at the Sultan Idris Education University (UPSI) had been recruited for this study. Participant’s average body weight was 62.57 ± 9.14 kg with average body height of 1.68 ± 0.06 m. Participation were voluntary in nature, with all participants had been well informed that they were able to withdraw from the study at anytime without the need to state the reason.
2.1.2 Equipment
A 4kg medicine ball (Body Solid, Fitness Concepts, Malaysia) was used for the throwing activity, with the distance was measured using a 50m measurement tape (Aero, China). Data were then recorded into a custom made performance form.

2.1.3 Procedures:
All participants were given a briefing prior participation in the testing session. The briefing’s consist of explanation on the nature of the study, the risk and discomfort that might be experienced, and the demonstration on overhead medicine ball throw movement required to be used in this study. Body weight and body height assessment were done during this briefing’s session. Participants were then asked to attend two testing occasions for the actual test procedures. The test procedures started with a standardized warm-up consist of slow jog around the test area for approximately 5 minutes, followed by a standardized dynamic stretching for another ~8 minutes duration. Participants were then asked to perform two trials of maximal overhead medicine ball throw. Average distance of both throws of each participant was taken as their final score. The test session’s was ended with a standardized cooling down and static stretching activities. Similar test protocol was then repeated in the second test session.

The medicine ball overhead throw action performed in this study was as below:

a) Starting position: Face facing forward with dominant leg slightly forward and another foot slightly at the back with heels on the ground. The spine was in neutral position (stand erect) with the medicine ball was held slightly above the hip with both hands (elbow flex at about 90 degrees joint angle), eyes looking directly to the targeted area of throw.
b) Movement action: Both arm swung upwards till the medicine ball went up and pass over the head towards the back till the elbow flex beyond 90 degrees at the back of the head (ball might touch the neck area), feet pressing the ground firmly while the abdominal muscles braced (isometric tension), the body weight shifted backwards with leg apart forming a small lunge position ready to throw, once into the movement of throwing out the ball, , and the core muscles (rectus abdominis, erector spinae) gave the power to throw out the ball as further as possible.
c) Throw out: body weight shifted forward from the lunge position, move towards standing position, both leg pushing the ground upwards, with ankles and knees extended for momentum generation while the arms move forward over the head, and release the ball explosively towards the target with a follow through motion.
2.1.4 Data Analysis

Jump distances of both testing occasions were recorded into a custom made form. The date were then transferred into an Excel sheet softcopy (Microsoft Office Excel 2007, Microsoft, USA) for further analysis.

2.1.5 Statistical Analyses

Software package for statistical analysis (SPSS version 16, IBM Corporation, USA) were used to performed statistical analyses on all variables of interest. Mean and standard deviations were used as measures of centrality and spread of data. The percent difference between two groups were calculated (% Difference = (1 – Lowest Variable/Highest Variable)*100. Coefficient of variation or CV (SD/mean x 100) was calculated to determine stability of measurement between the two trials. Pearson correlation coefficient was calculated for the measure of the strength of the linear relationship between the two distances.
3. RESULTS

Participant’s body weight and body height measured indicated normal body weight in relation to body height as shown by the Body Mass Index (BMI) calculated (Table 1). Normality test performed indicated homogeneous distribution in term of participant’s body weight and body height, which ensure appropriate and statistical calculations were made.

Table 1: Body measurement of participants (n=50)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body height (m)</td>
<td>1.68 ± 0.06</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>62.57 ± 9.14</td>
</tr>
<tr>
<td>Body Mass Index (BMI)</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Both sessions average throw distance calculated was $5.68 \pm 0.84m$. Other statistical analyses performed as indicated in Table 2. Basically, the Pearson correlation coefficient indicated a strong positive correlation, which means the overhead medicine ball test is a reliable test, and thus can be trusted to produce similar results if all variables remain the same.

Table 2: Statistical analyses of the medicine ball throw test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Throw distance session 1 (m)</th>
<th>Throw distance session 2 (m)</th>
<th>% Difference</th>
<th>Coefficient of Variation (%)</th>
<th>Pearson correlation coefficient (r)</th>
<th>Coefficient of determination (R²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine ball over-head test</td>
<td>5.38 ± 0.80</td>
<td>5.98 ± 0.95</td>
<td>10.03</td>
<td>7.82 ± 5.89</td>
<td>0.8403</td>
<td>0.7061</td>
</tr>
</tbody>
</table>

4. DISCUSSIONS

The selection of overhead medicine ball throw exercise as an assessment tool for this study derived from several factors. As indicated earlier in the introduction, managing a group of students or athletes in term of their physical performance monitoring requires a test that is easy to administered, and if possible able to activate both lower and upper limb muscles, especially the core area (obliques, erector spinae and rectus abdominis). Overhead medicine ball throw movement had been was though able to do this, as the movement requires force generating capabilities from the lower limb and travels up towards the upper limb, with the core stabilization muscles plays the vital role of transferring and retaining the force prior execution. Our search on Google Scholar database on muscle activity assessment around the core region or upper limb area including shoulder during an overhead forward medicine ball throw movement
yields no results. But the search did returned results on muscle activation of upper limb region for similar movement using a soccer ball, which is much lighter (Kelly, Backus, Warren, & Williams, 2002).

One of the studies that we have reviewed has suggested the usage of standing long jump as a general index for overall muscular fitness (Castro-Pinero et al., 2010). Their results indicated strong relationship between the lower and upper body strength, in which has been stated as the reason of why the standing long jump alone can be used as an overall predictor. While the suggestion have a valid reasons, exercise such as the overhead medicine ball throw might possess similar if not better qualities to be used as an overall explosive muscle strength indicator for an individual. This contention need to be explored further, as this study at the moment is limited to test the reliability of the exercise as a test.

To the knowledge of the authors, standardized load overhead medicine ball throw had never been used as an assessment tool in any strength and conditioning monitoring program at Sultan Idris Education University or by any other University teams within Malaysia so far.

In order to establish a local based reliability assessment, this study was conducted. Output of this study is comparable to one previous study by Stokbrugger and Hannel (Stockbrugger & Haennel, 2001), with some minor exceptions due to throwing technique differences used. Their study indicated a test-retest reliability of 0.996 (p < 0.01), which was quite close to what this has found (0.8403). However, their study used the reversed overhead backward throw technique, while our study used the overhead forward throw technique. Moreover, their study had used less number of subjects (n=20), but can be considered as highly trained individuals. Our study on the other hand recruited fifty healthy and active university students but considered as untrained, due to the fact that they did not competitively engage in any systematic physical training program and competition. Stokbrugger and Hannel had also tested the validity of their test by matching it with a standard countermovement jump test for leg power. Their study indicated that overhead backward medicine ball throw has a high validity for muscular power assessment.

As a conclusion, the study indicated the overhead medicine ball throw test is a reliable testing method and can be safely and easily implemented among healthy active young university students. Further studies are needed to determine validity of the test as an explosive strength measurement tool, along with area of muscles activated during the movement for both upper and lower limb muscles.

5. PRACTICAL APPLICATIONS

The overhead medicine ball forward throw can be used by physical conditioning trainer, coaches or lecturer as a reliable assessment method. Standardized load used eliminate the need to assess one repetition maximum (1-RM) prior the use of this test. The test can be modified by using other apparatus that have similar load and shape.

6. ACKNOWLEDGEMENT

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overhead throw as one of the additional event called ‘Blaster’ for a fitness games/competition developed under the research grant (Endurolift© Games).

7. REFERENCES


