Inter-Rater and Intra-Rater Reliability of Videotaped Performance of the Movement Competency Screen - 2 (MCS-2)

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The purpose of this study was to determine the intrarater and interrater reliability of the Movement Competency Screen—2 (MCS-2) in seven college female volleyball athletes (age = 17.7, ±1.39 yrs; height = 163.1 cm, ± 5.09 cm; and weight = 58.1, ±6.11 kg). The subjects were videotaped performing the ten (10) movements of MCS-2. The videos were then independently analyzed and scored by three separate raters of different backgrounds for two separate sessions with an interval of five days. Interrater reliability was calculated for each movement. Data were presented using mean ± standard deviation. Typical error was represented by %CV to establish absolute reliability. Intraclass correlation coefficient (ICC) was determined to indicate relative reliability. Smallest worthwhile change (SWC) was computed using 0.2 × between-subject standard deviation. Results showed that the %CV of 16.0, 16.9, and 32.8 was seen in raters 1, 2, and 3, respectively. The ICC was 0.75 for rater 1 while 0.50 ICC was posted by rater 2 and ICC = 0.40 for rater 3. The SWC was 0.58 for rater 1, 0.62 for rater 2, and 1.77 for rater 3. For interrater values, day 1 delivered %CV = 18.1, ICC = −0.52, and SWC = 1.48. For day 2, MCS-2 %CV was 20.8 with ICC = 0.47 and SWC = 0.60. In conclusion, intrarater absolute and relative reliability for MCS-2 was poor. Test usefulness was also low for all raters. In addition, interrater absolute and relative reliability for MCS-2 was poor. Test usefulness for day 1 and day 2 was marginal.

Keywords: movement competency screening, reliability, athletes

INTRODUCTION

Movement competency and consequent muscular power production are a fundamental concern for sport and health professionals when considering long-term athlete development and injury prevention (Kritz, Cronin, & Hume, 2012). Coaches and athletes use movement description to evaluate sport-specific movement demands and force characteristics (Zernicke & Whiting, 2000); and that the level of movement competency is dependent on dysfunction and/or pain (Kritz, 2012; McGill, Andersen, & Horne, 2012). There has been an increasing interest in multijoint movement screenings in determining movement patterns. One of these is the Movement Competency Screen (MCS) (Kritz, 2012; Kritz, Cronin, & Hume, 2012). The MCS uses 5 movement tasks that aim to assess squat, lunge, upper body push, upper body pull, trunk flexion or bend, trunk rotation, and unilateral lower limb function patterns. In a study made by Kritz, Cronin, and Hume (2012), it was found that interrater and intrarater reliability for MCS ranged from 0.70 to 0.85 and 0.72 to 0.92, respectively.

Recently, MCS-2 has been developed to address advanced movement screening patterns of the athletes. The MCS-2 consists of ten (10) movement tasks such as the squat, bilateral counter movement jump, lunge-and-twist, bilateral broad jump to a unilateral land, single leg squat, bilateral counter movement jump to a unilateral land, push up, explosive push up, bend-and-pull, and bend-and-pull at speed. Given the potential of MCS-2 in athletes, there has been no inter- and intrarater reliability studies up to date. Tester reliability refers to the reproducibility of test values or other measurements in repeated trials on the same individuals by the tester (Hopkins, 2000a; Lagumen et al., 2008). Tester reliability can be interpreted using absolute and relative reliability. Absolute tester reliability refers to the degree of tester variation from repeated measurements. On the other hand, relative tester reliability is the degree of a tester's positional maintenance in a sample with repeated measurements. The purpose of this study was to determine the intra- and interrater reliability of MCS-2.

METHODS

Participants

Seven (n = 7) college female volleyball athletes from a university in Northern

Luzon, Philippines participated in this study (age = 17.7, ±1.39 yrs; height = 163.1 cm, ±5.09 cm; and weight = 58.1, ± 6.11 kg). Written informed consent was gathered from the participants prior to further participation. The procedures of the study agreed with the Declaration of Helsinki for Human Experimentation.

Procedures

The participants underwent two sessions in this study. The first session included measurement of anthropometrics and familiarization. In this session, the participants were oriented with MCS-2 wherein a MCS-2 video was shown. After, the athletes were asked to perform MCS-2 for 1 set. In the second session, MCS-2 recording was facilitated. A standardized warm-up consisting of a five-minute jog and dynamic stretching exercises of 2 sets of 6 repetitions per limb (lunge and reach, reverse lunge and twist, leg swing to toe touch, knee hug to quadriceps stretch) was performed by the subjects. A two-minute rest interval after the standardized warm-up was observed. This was succeeded by the performance of MCS-2 movement tasks.

The MCS-2 starts with 2 repetitions of bodyweight squat in the frontal and sagittal planes. After the bodyweight squat, the participants performed 2 countermovement jumps (CMJ) both in the frontal and sagittal planes. The third movement task of the MCS-2 is the lunge and twist which was performed at self-selected and at a faster speed. Two repetitions were performed with alternate legs in the frontal plane. Then facing left, the participants performed 2 repetitions of lunge and twist with the right leg forward. Facing right, the participants performed the same movement for 2 repetitions with the left leg forward. The next task performed by each participant was a broad jump with unilateral land (a broad jump with a two-foot take off and a one-foot land). This was performed for 2 repetitions with alternate legs in the frontal plane. Facing left, 2 repetitions of the broad jump with unilateral land was performed with the participants landing on the right leg. Facing right, the participant landed on the left leg. Each participant then performed 2 repetitions of a single leg body weight squat with alternate legs in the frontal plane. Then with the participants facing left, 2 repetitions of the right single leg squat was performed. Facing right, a left single leg squat was performed for 2 repetitions.

The next movement task of the MCS-2 is the countermovement jump with unilateral land (jump squat with a two-foot take off and a one foot landing). This was performed for 2 repetitions with alternate legs in the frontal plane. Then with the participants facing left, the CMJ was performed for 2 repetitions with the participants landing on the right leg. Facing right, this was again performed for 2 repetitions, however, with the participants landing on the left leg. The participants then performed 2 repetitions of the bend-and-pull at a self-selected speed and a faster speed in the frontal and sagittal planes (participants facing right). The last movement task of the MCS-2 was the performance of 2 repetitions of a standard push up followed by 2 repetitions of explosive push up in the frontal and sagittal planes (participant facing right). The MCS-2 was recorded using a Digital Single Lens Reflex camera distanced at 4–5 meters away.

The raters in this study were two (2) male and one (1) female college level physical education instructors who have more than five (5) years of teaching physical education classes. All three raters have a master's degree related to exercise science. One male instructor is a certified strength and conditioning specialist in a college basketball team while the other male instructor is the head coach of a table tennis team. The female instructor is the head coach of a women's college basketball team. No formal training was administered to the raters. The raters scored in different stations and took an average of 2 hours each in scoring all eight videos. After five days, the raters scored the videos again to determine intrarater reliability.

Rating of MCS-2 was based on the MCS-2 pack prepared by Matt Kritz (2012). Load levels were assigned to a task on the basis of a task's anatomical criteria. The lowest load level is equivalent to 1 while the highest is 5. The sum of the load scores is the overall movement competency for MCS-2.

Analysis

Data were presented using mean ± standard deviation. Typical error was represented by %CV derived from the log transformed data to establish absolute reliability. Intraclass correlation coefficient (ICC) was determined to indicate relative reliability. Smallest worthwhile change (SWC) was computed using 0.2 × between-subject standard deviation. The value in SWC was used to compare with typical error to identify test usefulness. Data were log transformed and analyzed in a reliability spreadsheet developed by Hopkins (2000b).

RESULTS

Table 1 displays the intrarater reliability of MCS-2. For rater 1, MCS-2 was scored 12.9 ± 3.60 and 13.4 ± 3.40 for day 1 and day 2, respectively. Additionally, %CV was 16.0 with an ICC of 0.75 and 0.58 SWC. Rater 2 posted MCS-2 of 12.7 ± 2.40 in day 1 and 12.7 ± 2.90 during day 2. The %CV was 16.9, while ICC = 0.50 and SWC = 0.62. For rater 3, day 1 and day 2 MCS-2 were 15.9 ± 9.50 and 13.1 ± 2.70, respectively. The %CV = 32.8, ICC = 0.42, and SWC was 1.77.

Table 1. MCS-2 Intrarater Reliability

	Day 1	Day 2	%CV	ICC	SWC
Rater 1	12.9 ± 3.60	13.4 ± 3.40	16.0	0.75	0.58
Rater 2	12.7 ± 2.40	12.7 ± 2.90	16.9	0.50	0.62
Rater 3	15.9 ± 9.50	13.1 ± 2.70	32.8	0.42	1.77

For interrater reliability, day 1 MCS-2 scores were 13.8 ± 6.10, %CV = 18.1, ICC = 0.52, and SWC = 1.48. Day 2 posted MCS-2 of 13.1 ± 3.00, %CV = 20.8, ICC = 0.47, and SWC = 0.60. Table 2 displays the day 1 and day 2 interrater reliability of MCS-2.

Table 2. MCS-2 Interrater Reliability

	MCS-2	%CV	ICC	SWC
Day 1	13.8 ± 6.10	18.1	0.52	1.48
Day 2	13.1 ± 3.00	20.8	0.47	0.60

DISCUSSION

The purpose of this study was to establish the interrater and intrarater reliability of MCS-2 utilizing college physical education instructors as raters. Atkinson et al. (1999) reported that a %CV of less than 10% serves as a criterion value for an acceptable level of absolute reliability. For relative reliability, ICC of .80 above is deemed acceptable (Atkinson et al., 1999). For test usefulness, Pyne (2003) suggested using SWC. A test is 'good' if TE is less than SWC. When TE is greater than SWC, the test is 'marginal'. If TE is about the same as SWC then the test is somehow useful. Results from this study revealed that both absolute and relative intrarater reliability posted poor reliability. Also, test usefulness is deemed marginal. Similarly, interrater absolute and relative reliability was also found to be poor during day 1 and day 2. Also, interrater test usefulness was low for day 1 and day 2.

Poor intra- and interrater absolute and relative reliabilities can be attributed to a wide margin of rater errors. First, there was no formal training administered to the raters in the study. Administration of this type of training may aid in establishing movement rating standardization, thus possibly reducing errors. Also, some of the movements in MCS-2 were not familiar to the raters. An MCS-2 familiarization phase should be warranted among the raters to reduce movement familiarization discrepancy in MCS-2 movements.

In conclusion, intrarater absolute and relative reliability for all raters in MCS-2 was poor. Intrarater test usefulness was also marginal. For interrater reliability, both days exhibited poor absolute and relative reliability. Interrater test usefulness for both days was marginal.

The MCS-2 may be used to assess the movement patterns of athletes and make necessary interventions for performance enhancement. The MCS-2 may be a useful tool in identifying athletes at risk for injury. Reliability of the MCS-2 may be improved with more precise or clearer instructions of how the MCS-2 is administered and scored to minimize the measurement error.

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