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Effects of six weeks depth jump and countermovement jump training on agility performance among netball players

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Abstract: Plyometric is types of training that can boost agility performance. However, the effects of depth jump and countermovement jump plyometric training in agility performance are not yet fully established in the actual training field. Thirty female undergraduate students participated and randomly assigned into depth jump (DJ) and countermovement jump (CMJ). Both groups performed five sets of 20 repetitions jumps from an 18 – inch plyometric box jump for two days a week for six weeks. The Illinois agility test and T-test were measured pre- and post-test. Results showed, both groups indicated significant improvement after six week of DJ and CMJ in agility performance ($p<0.05$). However, DJ group shows greater improvement in agility performance compared to CMJ group in term of time (sec). The application of these findings will vary depending on athlete goals and specificity of the training program. Future studies with wearable resistance load and placement are required to validate training contentions.

Keywords: Jumping, quickness, stretch shortening cycle, plyometric, agility

1. Introduction

The aimed of the study was to examine the effect of six weeks depth jump (DJ) and countermovement jump (CMJ) training on agility among netball players. The researcher looked for the best method to train the players when it comes to increase the player agility performance. This is because agility performance is the most important thing that needs to be focus on netball game. Besides, researcher studies the effect of plyometric training (PT) program by creating two different plyometric training profile. The agility patterns netball players will determine the most effective training profile should be applied in future.

In research and applied settings, vertical jump, sprint efficiency and agility assessments are widely used to evaluate the impact of plyometric training on team sports athletes' physical fitness (Chamari et al., 2004; Chaouachi et al., 2009; Khlifa et al., 2010; Ramírez-Campillo et al., 2015). In an effort to improve agility performance, athletes undertake various forms of additional training, such as resistance, stretching, mobility and various forms plyometric training. The plyometric training can increase power output during concentric phase of movement because it exploits stretch shortening cycle (Váczi et al., 2013). According to (Bedoya et al., 2015); (Makaruk et al., 2014); (Michailidis et al., 2013) conceptually, PT is characterised by the stretch-shortening period (SSC) operation that develops from a rapid eccentric muscle contraction (deceleration or a negative phase) to a rapid concentric muscle contraction during the transition from (acceleration or a positive phase).

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Agility training is neural adaptation of muscle spindles, Golgi tendon organs and joint proprioceptor. It can be thought to be a re-enforcement of motor programming through neuromuscular conditioning. By enhancing balance and control of body positions during movement, agility theoretically should be improved. One the most important aspect of the off-season strength and conditioning program is improving agility performance (Sporis et al., 2010) . A study have proven that, plyometric training was efficiently significant improving agility of basketball players compared to the resistance training that was not significantly improve agility performance (Mitra et al., 2013). Countermovement jump (CMJ) point that better conditioning of neuromuscular system for increasing stretching and better workload (Krol & Mynarski, 2012).Generally depth jump (DJ) require athlete to perform a maximal effort of vertical jump from a step of measuring drop height landing on ground with a short period of time. Further evidence suggesting that countermovement jump is an important aspect of total time in agility T-test because there is a relative relationship with explosive leg power (Hermassi et al., 2011).

There have been studies proven that the agility performance was being able to improve time when performing depth jump (DJ) and countermovement jump (CMJ) in their plyometric training. It shows that improvement to the effect of 6-week plyometric training on agility T-Test and Illinois agility test. In conjunction with that, a study has found that, there was 4.86% and 2.93% improvement of agility test respectively. Besides that, researcher stated that there has positive effect in agility performance with depth jump (CJ) and countermovement jump (CMJ) training because involves acceleration, deceleration and a change of direction. Study shows that, six week training program can be very useful to the athletes for last preparatory phase before in season competition (Asadi, 2012).

This information will assist understanding of how plyometric training influences athletes' physical fitness which may inform types of plyometric training recommendations for agility specific conditioning. Therefore, the purpose of the present study was to determine the most effective plyometric training can improve agility performance in netball players at a crucial phase in their playing season. We tested the hypothesis that incorporating six-week of depth jump and countermovement jump training program.

2. Method

2.1 Participants

The method section should clearly describe the research design, participant's selection, equipment used, data collection process and data analysis performed. Ethics approval by relevant ethical authority must also be stated here together with approval number or code. Subject's selection included a total of 30 females (n=30) aged 18 to 20 years old recruited randomly among netball players in UiTM Pahang. The criteria of the subjects were netball players and did not have lower limb injuries. Participants who reported injuries or suffering from any medical disease were excluded from this study. The subjects were divided into two groups which are depth jump (DJ; n = 15) and countermovement jump (CMJ; n=15). In order to determine the level of activity, they were pen down the Physical Activity Readiness Questionnaire (PAR-Q). All subjects were provided a written and informed consent letter prior to the study. The testing form was kept by assistances. They were informed about the benefits and also any injuries which may result during and post to the study. The average age for both groups is 19.47±0.51. Besides that, for height (cm) DJ is 160.07±6.35 while CMJ is 162.27±3.34. In addition, for weight (kg) the average is 55.34±7.76 for DJ compared to CMJ is 52.68±7.39. The average score for body mass index is 21.54±2.64 for DJ and 20.01±2.64 for CMJ.

2.2 Study design and intervention

This study was designed to address the following research hypothesis to determine the most effective plyometric training can improve agility performance in netball players at a crucial phase in their playing season. We tested the hypothesis that incorporating six-week of depth jump and countermovement jump training program. A team of players was randomly divided into the experimental group which depth jump and countermovement jump. They completed six week of intervention plyometric training. Data were collected immediately before and after the six-week intervention. A standardized warm-up was performed before each testing session.

Testing sessions were carried out one day before starting the intervention and one day after oat the intervention. This study was designed to address the following research hypothesis to determine the most effective plyometric training can improve agility performance in netball players at a crucial phase in their playing season. We tested the hypothesis that incorporating six-week of depth jump and countermovement jump training program. A team of players was randomly divided into the experimental group which depth jump and countermovement jump. They completed six week of intervention plyometric training. Data were collected immediately before and after the six-week intervention. A standardized warm-up was performed before each testing session. Testing sessions were carried out one day before starting the intervention and one day after of the intervention.

2.3 Procedure

2.3.1 Plyometric training

Plyometric training will be conducted two days a week for six weeks. The training session for both groups with standard warm up, ballistic exercise and stretching, DJ and CMJ training and cool down session. Both group subjects performed exercises in each training session with maximal effort. Figure 1 show that the DJ group begins by standing on the 18-inch box and will instruct to lead with one foot as they step down from the box and land with two feet on the land. After contact, subject will instruct to explode of the land by jumping as quickly and as possible.

Subjects in the CMJ group will stand on the box and will instruct to drop on the land with two foot. After contact, subjects will instruct to flex their knee approximately 90º and then rebound upward in a maximal vertical jump. A two minutes rest between sets will give the sufficient time for recovery.

2.3.2 T-test

Subjects will instruct to sprint from a standing starting position to a cone 10 m away, followed by a side-shuffle left to a cone 5 m away. After touching the cone, the subjects will side shuffle to the cone 10 m away and then side shuffle back to the middle cone. The test will conclude by back-pedalling to the starting line. The test score will record as the best time of three trials, to the nearest 0.01 s (Michailidis et al., 2013). A 5-minute rest period will allow between each trial. Subjects will be disqualified if they fail to touch the base of any cone, cross the one foot in front of the other or fail to face forward for the entire test. This test was selected because of their reported validity of the test and established criteria for male and female data (Pauole et al., 2000).

2.3.3 Illinois Agility Test

A hand-held stopwatch was used to take the subjects' time to the nearest 0.01 sec. The run start with a standing start on the command "Go" and subjects will sprint for 10 m, turn, and return to the starting line. According to the (Bloomfield et al., 1994) when the subjects reach the starting line, they will perform zigzag in between four markers and complete two 10 m sprints.

The fastest time of the three trials will record as the final agility time. A 5-minute rest period was allowed between each trial (Arazi et al., 2012).

2.4 Statistical analyses

All data are presented as mean ± SD and were analyzed using the Statistical Package for Social Sciences (version 20.0 for Windows, SPSS Inc., Chicago, IL, US). Independent t-test was used first to ensure consistency of both groups prior to training. Paired t-tests were used to assess any differences and comparisons between two groups in each of the test within variables of paired t-test assumptions. Baseline values was compared using a paired t-test (2 tailed) to determine whether baseline values differed between the 2 testing sessions. Statistical difference between conditions was accepted at $p<0.05$.

3. Result

No injuries occurred throughout the study period, and the testing and training procedures were well tolerated by the subjects. After six weeks of training program the result indicates that, there is a significant different for both group between pre and post-test. Pre-test for agility test is 13.04±0.80 while post-test is 12.53±0.74, $p = 0.04$. In addition, for Illinois test result show that pre-test is 16.11±0.84 while post-test is 15.56±0.91, $p=0.00$.

3.1 Agility T test

There is a significant difference between pre and post-test of DJ and CMJ group in agility among netball players in. CMJ group mean average for agility T test is 13.57±0.49 for pre-test while post-test shows reduction in time which 13.05±0.30. However, for DJ group mean average for agility T test is 12.33±0.41 for pre-test while post-test is 11.96±0.34. CMJ (13.57±0.49) shows higher significant score compared to the DJ (12.95±0.67) group.

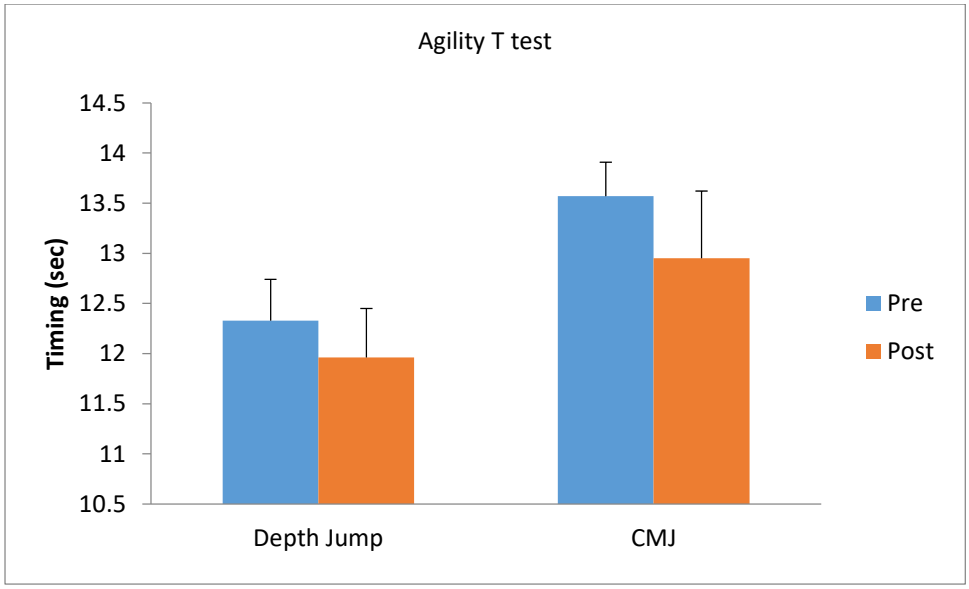

Fig 1. Comparison between pre and post-test for agility T test

3.2 llinois Test

Result for Illinois test for each group indicates DJ group shows a significant different between pre and post-test (15.44±0.73) while post-test resulted (14.99±0.65). Both groups show the improvement, but in this study CMJ shows more slower reduction in time (s) which (15.96±1.01) for pre -test while post-test (15.46±0.99).

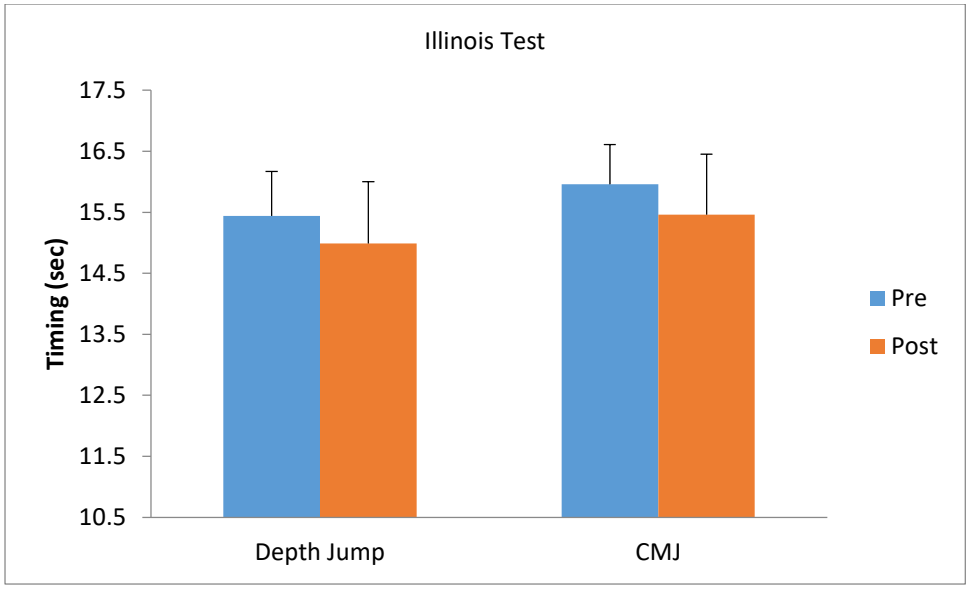

Fig 2. Comparison between pre and post-test for agility T test

4. Discussion

We tested that whether six weeks of in-season plyometric training would lead to improvement in agility performance among university netball players. It was observed that both plyometric training showed improvement in agility performance. However, DJ group showed greater improvement than CMJ group. This is because, the depth jump is performed by stepping out of the box, dropping to the ground, and then attempting to jump back up. This movement usually requires the athlete slowing down and preparing to reverse or fight the movement (eccentric to concentric muscle action) as soon as the stimulus is felt (when the foot contacts the ground) (Ferdiana et al., 2020). This rapid combination of eccentric and concentric muscle activity includes repeated stretching cycles, also known as stretch-shortening cycles (SSC), which provide physiological benefits due to muscle strength developed during concentric phases amplified by previous eccentric actions (Chatzinikolaou et al., 2010).

Since both groups increases, (Asadi, 2012) concluded that both DJ and CMJ group can be effective training to increasing an athlete's agility performance. The current study found that, both the DJ group and CMJ group were able to improve their completion times significantly on both the Illinois and agility T test. These current finding was supported by (Miller et al., 2006)who examined the effects of six week plyometric training on T test and Illinois test, and found 4.86 % and 2.93% improvement, respectively.

These results showed the need for a plyometric training programme to enhance performance in activities involving acceleration, deceleration and change of direction. In addition, the plyometric training programme will enhance the lower limb's eccentric strength and result in improved agility results. It has been well documented that agility requires the development of muscle factors (e.g., strength and power) to improve directional change, and it appears that agility has a high relationship with strength and power (Sheppard & Young, 2006).

Therefore, further studies are necessary to determine mechanisms of agility improvement by plyometric training. Also, future study should explore the acute and chronic effect on wearing wearable resistance training during performing plyometric training.

5. Conclusion

In conclusion, the results provide the best types of plyometric training that can be applied to the coaches and athletes to improve agility performance. The collected findings of this study may serve as a guideline for the coach and may include this training in their training program.

Besides that, it is also will be utilized to enhance athletes in terms of conditioning season. In addition, the findings from present study will be able to assist all coaches with various sports especially in coaching field to be more aware in providing systematic training program and guidance to the sports community.

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