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THE INFLUENCE OF JUMPING PERFORMANCE AFTER RECTUS ABDOMINIS FATIGUE

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The purpose of this study was to evaluate the changes on lower extremity during counter-movement jump after rectus abdominis fatigue. 12 male volleyball players were recruited. The kinematics and EMG data were collect during jumping in CMJ before and after rectus abdominis fatigue. Paired sample t-test was used to assess the statistics difference. The significant level was set to α=.05. The result showed that after rectus abdominis fatigued, the COM was higher while squat, and the jumping height was lower. The players could not fully squat after rectus abdominis fatigued. It caused the jumping height lower. Based on the results from this study, coaches could strengthen the core muscles training for volleyball players to increase stability of jumping performance.

KEY WORDS: volleyball, counter-movement jump, core muscles, kinematics.

INTRODUCTION: Volleyball players have a large number of lower extremity motions, like squatting, moving, jumping and landing. Jumping height, strength and power are the most important for volleyball players to win the competition. Player, who can jump higher, can have a great advantage while spiking and blocking. Therefore, coaches usually strengthen the lower extremity muscles training for volleyball players to increase the strength of their legs.
In recent years, many researchers proposed that the core muscles were as important as lower extremity muscles during jumping. Nadler (2002) found that the player who had low back pain had poor connection between trunk and lower extremities. Based on previous studies, the core muscles was more stable, upper and lower extremities could activate faster. It means that if core muscles fatigue and reduce the function of stabilizing the spine (Buttelli et al., 1996), upper and lower extremities would have less power to activate and cause the decrease of jumping performance. The purpose of this study was to evaluate the changes on lower extremity during counter-movement jump after rectus abdominis fatigue.

METHODS: 12 healthy male volleyball players in collegiate division I were recruited (age: 19.0±0.8years, height: 183.0±6.0cm, weight: 75.5±8.4kg). The subjects had no core muscles injuries ever and no lower extremity injuries in last six months. 3D motion analysis system and surface EMG were used to collect the kinematics and muscles activation during jumping in CMJ. Three CMJ trials were collected. After CMJ test, participants were asked to perform the rectus abdominis training until fatigue. The kinematics and muscles activation in three CMJ trials were also collected after rectus abdominis fatigue. Mean amplitude of EMG data was normalized by maximum voluntary isometric contraction (MVIC). The angles of knee joint and the COM were also calculated at the lowest position while squat. Paired sample t-test was used to compare the difference of the data before and after muscle fatigue. The significant level was set to α=.05.

RESULTS: After rectus abdominis fatigued, the mean amplitude of rectus abdominis was significantly decreased. The angles of knee joint were smaller while squat which cause the COM higher. The jumping height was also lower. (Table 1)

Table1
Knee angle, COM and jumping height

Right leg (˚)		Left leg (˚)		COM(cm)		Jumping height(cm)	
before	after	before	after	before	after	before	after
107.71	103.18	107.71	103.18	68.43	70.69	53.79	52.18

DISCUSSION: Manuel (2009) found that after core muscles were strengthened, the angles of knee joint were larger. The results from this study were telling the same thing in different way. After rectus abdominis fatigued, the angle of knee joint were smaller. It means that the participants couldn't fully squat after rectus abdominis fatigued and couldn't have fully power to jump to reach the height after rectus abdominis fatigue, neither. So the COM was higher while sqant and the jumping height was lower.

CONCLUSION: After rectus abdominis fatigue, the angles of knee joint were smaller, the participants cannot fully squat, and the jumping height was decrease. Based on the results from this study, coaches could strengthen the core muscles training for volleyball players to increase stability of jumping performance.

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