

THE INFLUENCES OF APPROACH RUN ON MUSCLE ACTIVITY DURING DROP JUMP

Mianfang Ruan and Li Li

Kinesiology Department, Louisiana State University, Baton Rouge, USA

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INTRODUCTION: Drop jump, as one of the most popular plyometric exercise that involves stretch shortening cycle, has been proved very effective to improve vertical jump performance due to greater lower extremity power output. However, beyond optimal height, further increasing dropping height could not increase or even decrease power output. Our previous study has showed the approach run preceding the drop jump increased the power output further and decreased downward duration time and downward movement. The muscular activities associated with these changes were not clear. Therefore, the purpose of this study was to investigate the effects of approach run on the muscle activity of low extremity muscles.

METHODS: Ten healthy male university students performed drop jump from 15, 30, 45 and 60 cm with zero (standing), one, two, and three steps approach run. The surface EMG activity of the Gluteus Maximus (GM), Rectus Femoris (RF), Biceps Femoris (BF), Vastus Lateralis (VL), Tibialis Anterior (TA), Gastrocnemius (GA) and Soleus (SO) were recorded using surface bipolar electrodes (Motionlab Systems, Baton Rouge, USA) to evaluate muscle activation levels. The EMG activities were full-wave rectified and averaged (aEMG) during the pre-activation (50 ms before touchdown), downward and pushoff phases. The EMG amplitudes then were normalized as a percentage of the highest value recorded during the drop jumps. Differences between different approach steps and drop heights tested using 4 (heights) x 4 (approach steps) factorial ANOVA with repeated measures ($\alpha = 0.05$).

RESULTS AND DISCUSSION: During the preactivation phase, the aEMG of GM, RF, BF, VL, SO and GA increased with the steps of approach run significantly (see table 1). The aEMG of RF, BF, VL and SO also increased with the steps of approach run during downward phase. NO changes observed during the pushoff phase. The increased preactivation may prevent unnecessary yielding and increase the effect of stretch reflex during the downward phase. The increased muscle power output during the pushoff phase may also be the effect of greater stretch reflex and the increased of short range of stiffness.

Table 1 aEMG [Mean (SE)] increased with steps of approach run during preactivation.

Step	GM	RF	BF	VL	SO	GA
0	31.8(3.3)	26.1(2.0)	36.3(3.6)	31.5(5.0)	35.2(4.0)	45.9(3.6)
1	35.9(3.5)	42.7(3.5)	40.7(3.5)	35.6(4.0)	42.2(4.1)	52.3(4.0)
2	45.2(4.4)	47.3(4.5)	44.3(4.2)	41.3(3.7)	48.3(4.8)	59.7(3.8)
3	55.9(5.2)	54.4(4.4)	56.6(4.4)	51.3(4.6)	51.5(4.8)	60.7(4.3)

CONCLUSION: Muscle preactivation in the stretch-shortening cycle is extremely important for lower extremity muscle activities and power output during both eccentric phase and concentric contraction phases. An approach run preceding the drop jump is an effective strategy to increase muscles preactivation level. Drop jump with approach run could be a better training method for "explosive exercise", especially these events which produce extremely high impact loads, such as long jump, high jump and triple jump.