AN EXPLORATION OF THE EFFECT OF KNEE-TO-FEET JUMPS ON PERFORMANCE

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The purpose of this study was to test the effect of knee-to-feet jump training on power and vertical jump height. Twenty-one varsity athletes from power-emphasized sports were paired and randomly placed in the control or experimental group. All subjects completed pre- and post-tests of vertical jump height, knee-to-feet jump height, and 2 repetition maximum hang clean. The experimental group completed a 6 week program of knee-to-feet jumps. There was no significant difference in vertical jump height or hang clean weight from pre- to post-test; however, the experimental group significantly improved in knee-to-feet jump height. There was a positive correlation between knee-to-feet jump and vertical jump height indicating knee-to-feet jumps are a potentially useful tool worth further pursuit.

KEY WORDS: vertical jump, power, training program, hang clean

INTRODUCTION: Recently, knee-to-feet jumps, or ninja jumps, have become popular in lifting programs of many athletes as a tool for "improving power production" (Jones). However, to our knowledge, no research has been done to validate their efficacy. Explosive hip extension is an important part of both the knee-to-feet jump and the power clean; however, in the knee-to-feet jump the athlete starts on his knees with the tops of his feet flat on the floor and hands down by his sides. Using speed and power from his hips and arms, the athlete propels his body up and lands in a squat position on his feet (see Figure 1).

Figure 1. The Knee-to-feet Jump.

As this movement is relatively new for many athletes, this was a preliminary exploration to determine if the novel nature of this task could be learned and influence other like movements in power and explosive sports. According to Markovic (2007), vertical jump height increases with plyometric training. Wisløff, et al. (2004) found maximal squat strength to positively affect sprint performance and vertical jump height in elite soccer players. Because these athletes were improving major components of their sport performance with other movements such as plyometric training and squatting, we wanted to determine if knee-to-feet jumps could also impact sport performance. The goal of this study was to determine if knee-to-feet jump training transfers to hang clean and vertical jump performance.

METHODS: The study population consisted of 21 male and female varsity athletes (age: 20.1 ± 2.3 years; height: 177.1 ± 11.6 cm; weight: 77.7 ± 14.9 kg) from Truman State University's football, wrestling, softball, basketball, and track teams. The inclusion criteria required minimum hang clean values of 115% of body weight for men and 85% of body weight for women. Each subject was paired with another subject from his sport and position type. In order to reduce errors that occur from athletes being in or out of season, each pair was randomly split: one subject followed the six week training program which added knee-to-feet

jumps to the existing exercise schedule, the other was in the control group and continued with his or her current exercise schedule.

Since this was a novel movement to most subjects, all went through an initial training session for knee-to-feet jumps. Each subject completed the same warm-up at the training, day 1 test session, and day 18 test session. The warm-up followed recommendations of the National Strength and Conditioning Association (NSCA) regarding specific weight-lifting warm-ups and included 2 sets of small arm circles (10 forwards and 10 backwards) and 2 sets of large arm circles (10 forwards, 10 backwards), 2 sets of hurdle-unders (10 each direction), and 2 sets of 10 light squats. After warming up, investigators demonstrated proper technique for knee-to-feet jumps and subjects were allowed to practice as many times as needed until they felt confident in performing the movement. Upon completion, each subject then did a cool-down adapted from the NSCA consisting of a 200 meter jog followed by lower extremity stretching.

On the first testing day, each subject completed the warm-up described above, then tested for vertical jump height, knee-to-feet jump height, and 2 repetition maximum (2 RM) in the hang clean. This testing order was kept for each subject. Vertical jumps were taken as an average height of 3 jumps (countermovement and arms were used at each subject's discretion) with a 5 second recovery. Knee-to-feet jump height was tested by having the subject start in the kneeling knee-to-feet position directly behind a bungee 5 cm above the ground. The subject jumped and landed with his feet on the bungee. With each successful jump, the bungee was raised and jumps continued until failure. There was one attempt per height, to avoid fatigue the bungee was raised by 2 cm if the subject jumped far above it on previous trials. If he missed after raising the bungee multiple heights, the bungee was lowered 1 cm at a time until completion or reaching the highest number previously cleared. The subject then tested his 2 RM hang clean. If he successfully completed a specific weight, he moved up by a minimum of 2.25 kg until failure, or until he no longer felt comfortable increasing weight. There was a 5 minute recovery period between testing each different exercise. To minimize other unaccounted variables, all recorded numbers from day 1 testing session were kept private until termination of the program.

Subjects receiving treatment then participated in a 6 week knee-to-feet jump program. They performed the jumps three times a week, as outlined in Table 1. Subjects recorded accomplishments each day in a log provided by the investigators. On average the experimental group missed 3% of the workouts. Program duration was based on NSCA's weight program suggestions and supported by Adams, et al. (1992). Subjects in the control group continued their normal and current lifting program with no knee-to-feet jumps.

Table 1. Knee-to-feet jump program. The first number for each day represents sets and the second number represents consecutive repetitions completed.

Week	Day 1	Day 2	Day 3
1	Test day	6x3	5x4
2	4x5	3x5	4x4
3	4x4	4x3	3x3
4-deload	2x3	3x2	2x2
5	4x3	4x2	3x2
6	5x1	4x1	Test day

On day 18, all subjects from both groups were re-tested on the same three measurements following the procedures from day 1, including the warm-up, testing, and cool-down. All data was compiled by the investigators. Jump logs including any dates missed due to injuries or other issues were collected. Data was analyzed by a 2 (group) x 2 (test) repeated measures ANOVA with $\alpha=0.05$. A correlational analysis was also completed for the dependent variables.

RESULTS:

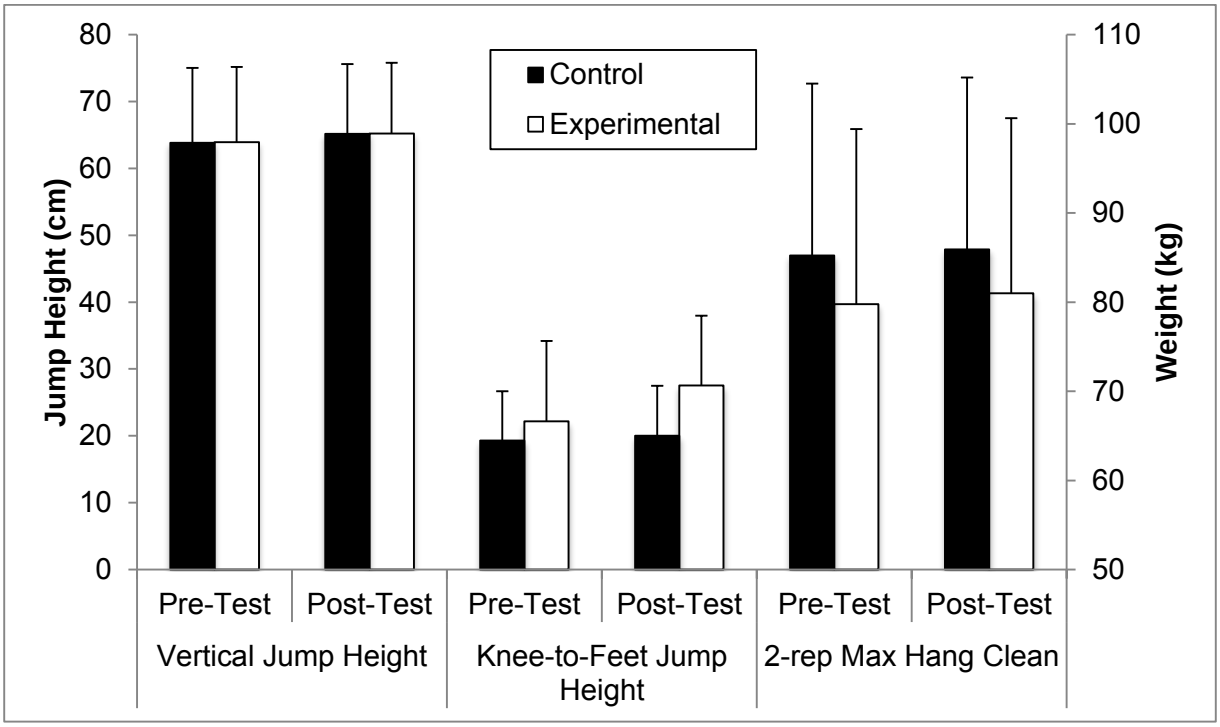

Figure 2. Pre-test vs. Post-test data for three variables of both control and experimental groups. There was a significant difference ($p<0.05$) from pre to post test in the knee-to-feet jump height of the experimental group, while the control group remained relatively constant. However, there were no significant differences from pre- to post-test for either the vertical jump or the hang clean.

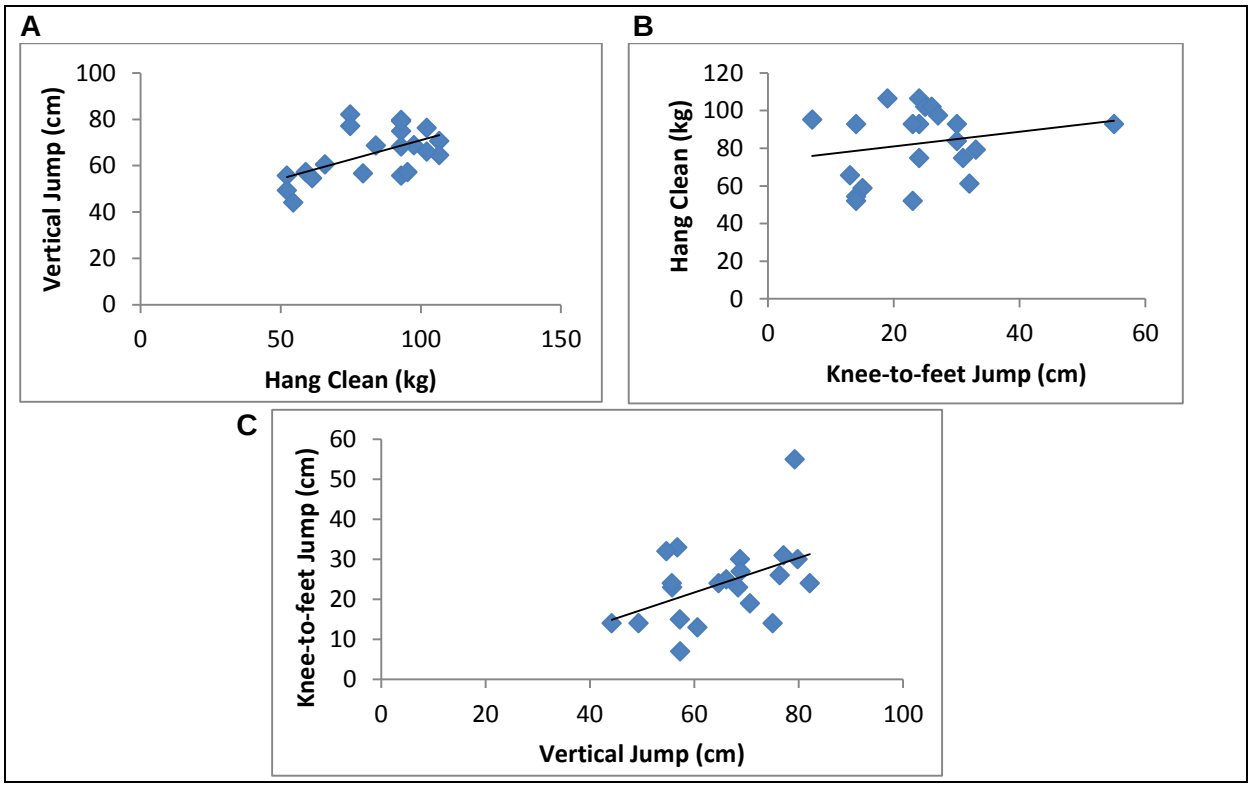

Figure 3. Scatterplots for the dependent variables and both groups; for A, r=0.62; for B, r=0.24; for C, r=0.46.

DISCUSSION: A non-weighted 6 week knee-to-feet jump training program was sufficient in producing significant knee-to-feet jump height improvements, but did not seem to impact performance in the power clean or vertical jump over that time period. If there is a strong correlation in two movements, training one might influence performance in another. Even with adequate experimental control and motivated subjects, the novelty of the knee-to-feet jumps may have limited improvement in other power-related movements. The correlation of the hang clean and vertical jump supports the idea of those variables being moderately related to each other. Similarly, the knee-to-feet jumps and the vertical jumps were related. However, knee-to-feet and hang clean performance did not seem to be related. While all are full body power movements, the differences in correlations and lack of influence from training may be due to technique or other performance differences.

When observing the subjects performing the knee-to-feet jump, investigators noticed the arm coordination used by many of the athletes was similar to countermovement jumps with arms in that arm flexion began before hip extension. One study found that arm swing significantly improved jump height by increasing total body center of mass by 21% (Harman, et al., 1990). Therefore, the height of the knee-to-feet jump could be greatly impacted if the arm flexion was not well coordinated with the hip extension. Perhaps the knee-to-feet jump requires more speed emphasis than the power emphases of the vertical jump and hang clean. This may explain the lack of significant increases in the vertical jump height and hang clean weight after training.

CONCLUSION: Using a knee-to-feet jump training program as another form of sport-specific training did not have an immediate impact on other power-related movements- the hang clean and the vertical jump. However, the program did increase knee-to-feet jump performance. Knee-to-feet and vertical jumps had a strong positive correlation which makes the knee-to-feet jumps a potentially useful tool worth further pursuit. The moderate positive correlation between knee-to-feet jump height and vertical jump height suggests that the proper training of knee-to-feet jumps could affect vertical jump height. Future research may examine the impact of knee-to-feet jumps on short sprints and other speed-related movements. Coaches from power-emphasized sports (e.g., American football, wrestling, rugby, softball, basketball, and track) may find knee-to-feet jumps to be valuable in coordination and speed, therefore leading to a higher and more competitive performance.

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