# MONITORING THE EFFECT OF VOLUME LOAD ON JUMP IN WEIGHTLIFTERS

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**INTRODUCTION:** Periodic regular monitoring of athletes has been shown to be a successful means of determining how they are responding to different training stimuli (Saw, Main, & Gastin, 2015). Vertical jumping assessments are one of the most commonly used monitoring tools within the sport science community (Stone, Stone, Sands, & Sands, 2007), especially for power sports like weightlifting (Carlock et al., 2004; Garhammer, 1980). Countermovement jump (CMJ) and static jump (SJ) evaluations have been indicated as valid and reliable measures for fatigue (Sams, 2014) and strength monitoring (Stone et al., 2003). SJs are concentric only in muscle action, and thus represent the capability of the contractile elements in the lower limbs to generate force without the aid of a rapid pre-stretch, which is evident during CMJ.

Previous research has reported that changes occur in jump kinematics and kinematics across various loads and levels of fatigue (Cormie, McBride, & McCaulley, 2008; Kraska et al., 2009). Jump height has been shown to fluctuate during high volume phases of training (Kraska et al., 2009) and after tapering. With increases in jump height indicating positive adaptations to provided training stimuli. Monitoring jump height could provide a coach with valuable information about the potential of an athlete and could be used to track the fluctuations associated with fatigue that accompany training. Monitoring changes in jumps and tracking volume from week to week may indicate overtraining and possible maladaptation, or increased performance from training. Frequent jump testing may be a useful tool to integrate into the monitoring program in order to provide feedback about the effects of volume load on the athlete and each athlete's response to the applied stimuli. The perks of jump testing include allowing assessment of the preparedness of the athletes without using maximal tests and causing undue fatigue. The purpose of this paper is to provide a practical example of athlete monitoring through the use of unloaded and loaded jumps and volume loads for Weightlifters.

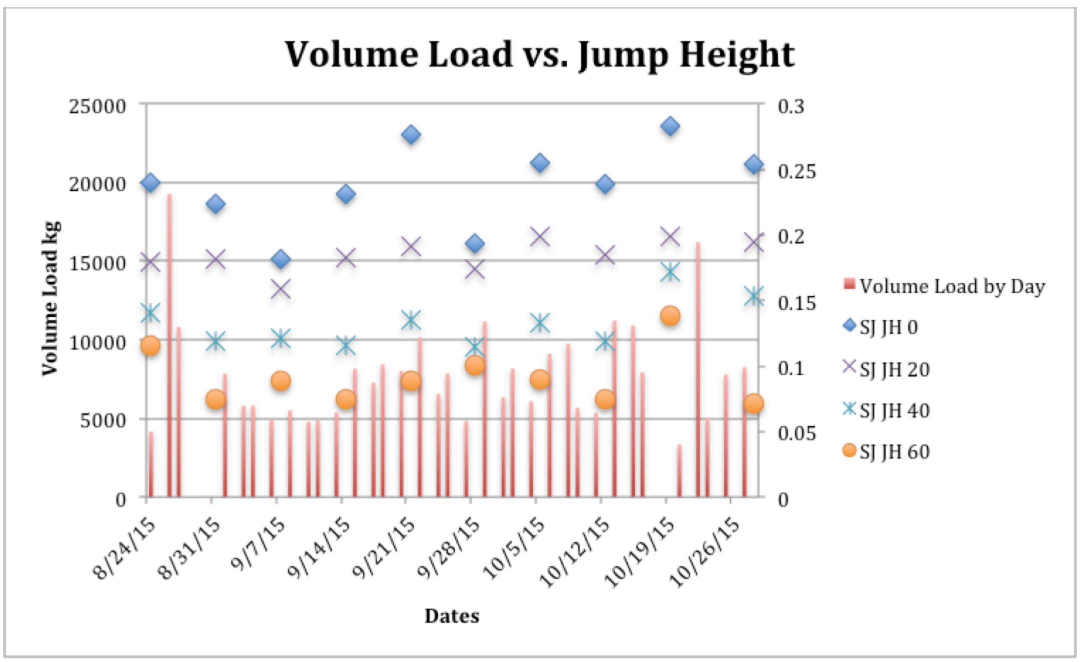
**METHODS**: Subjects included nine (four men and five women) weightlifters that participated in the ETSU Olympic Training Site monitoring program. The East Tennessee State University Institutional Review Board approved this retrospective study and all data were collected as part of an ongoing athlete-monitoring program. Training volume was quantified using volume load during all training session as the total sets and repetitions multiplied by the mass of the barbell in kilograms.

All jumps were performed on Mondays prior to first training session. Ten weeks of jumps data were analyzed. All lifters completed a standardized warm-up including: 25 jumping jacks, 10 bodyweight squats, and back squats at the prescribed jumping loads. Following the standardized warm-up, athletes performed a CMJ specific warm-up consisting of two submaximal CMJs at 50%, 75%, and a CMJ at 100% of self-perceived maximal effort. After performing the countermovement warm up jumps athletes proceeded directly to the testing session.

To eliminate the use of the arms and only measure lower-body performance, athletes performed all jumps while holding a near-weightless (0.3 kg) plastic bar or a weightlifting bar across the shoulders. Athletes performed two to four maximal CMJs at 0 kg (the plastic bar). Following the CMJs at 0kg athletes performed two to four SJs at progressively increasing loads.

A minimum of two jumps were preformed at each load with additional jumps required when the consecutive jump difference was greater than 1 cm, or when a countermovement occurred during a static jump. Due to time restrictions athletes only jumped a maximum of 4 times at each load. The loads were: Men SJ 0kg, 40kg, 60kg, and 80kg and Women SJ 0kg, 20kg, 40kg, and 60kg. The loads were chosen based on a pilot study equating power outputs between men and women. Athletes were provided 60 seconds rest between each jump. All jumps were performed on force plates sampling at 1,000 Hz. From laboratory calibrations, the voltage data obtained from the force plate were then converted to vertical ground reaction forces. All data were collection and analyzed using a custom program (LabVIEW, ver. 2010, National Instruments, Austin, TX).

**GRAPH INTERPERTATIONS:** The combination of volume load and jump height can be overlaid to provide coaches and sport scientists with the ability to interpret the effects of fluctuating volume. By overlaying jump height and volume load you can interpret the effects of one microcycle to the next or from mesocycle to mesocycle. The presented graph shows ten weeks of jump height and volume load data. Based on the weekly nature of the jump testing, we can easily observe the effect of one microcycle on the subsequent microcycle through this graphical presentation.




**DISCUSSION:** The presented graph is one of the nine athletes participating in the Olympic Training Site weightlifting-monitoring program. These graphs allow the sport science staff to track the effect of volume load on jump height. This monitoring process is an attempt to capture the residual training effects of the previous microcycle on jump height. The presented graph represents ten weeks of volume load and jump data. With the longitudinal tracking of this data norms for each individual athlete can be established. Change could then be view in relation to overtraining, maladaptation, overloads, and tapers.

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