Comparison of Water Polo Players' Dryland and In-Water Vertical Jump to Bone Strength and Power

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Summary

There are data suggesting swimmers do not have greater bone strength compared to control groups in studies [1]. One method to determine bone health in athletes and the general population is the power calculated from a vertical jump; peak vertical jump power has been shown to determine bone strength [2,6]. Although water athletes have dryland/strength training sessions, it is unclear if dryland peak vertical jump power will be predictive of these athletes' bone strength. Therefore, the purpose of this study is to determine whether dryland vertical jump is more predictive of bone strength than in-water jump in female water polo players.

Introduction

Most athletes have stronger bones due to high impact repetitive loading, especially from high impact sports [1]. However, the evidence on greater bone strength in water sport athletes is equivocal. Lower than average bone strength in water sport athletes [1] may not be a problem during activities of daily living, but may be detrimental under extreme loading conditions such as those experienced by athletes during training and competition. A method to determine bone health in athletes, specifically water athletes, may be beneficial in injury prevention. As demonstrated in previous work, power is emerging as a means to monitor bone health in athletes [2,6]. Although water athletes have dryland/strength training sessions, it is unclear if dryland peak vertical jump power will be predictive of these athletes' bone strength. The movement used in water polo to change vertical placement is not consistent with a dryland vertical jump [3].

Methods

Participants: 19 collegiate and experienced recreational females [swimmers n=9, water polo n=7, active females n=3] (20±1.4 yrs) with height 166.8±6.4 cm, body mass 68.7±12.3 kg in the study. Outcome Measures: Height and mass were measured and an online demographic survey was completed. Participants performed dryland and in-water vertical jump tests using a Vertec (JUMPUSA.com, Sunnyvale, CA, USA) and rectus femoris activation was monitored with electromyography (EMG) (BIOPAC Systems, Inc., Goleta, CA, USA). Dryland vertical jump and reach height were taken using the standard protocol [4]. In-water jump was measured in 5ft of water. Reach height for the in-water jump was determined from ASIS to fingertip. Peripheral Quantitative Computed Tomography (pQCT) was used to quantify bone strength at the tibia for cortical bone. Cortical site measures included Moment of Inertia (MoI), Cortical Area (Ct.Ar), Cortical Bone Mineral Density (cBMD), Strength-Strain Index (SSIp). Sayers Countermovement Vertical Jump (CMVJ) peak power equation (Sayers et al., 1999) was used to calculate power [4]. In-water jump power was calculated using Power=force * velocity with F=buoyancy force and v= jump height (cm) divided by length of muscle activation in seconds captured from EMG. Linear regressions with peak jump power as the predictor to bone strength variables were run for both Dryland and In-Water peak powers. All statistics were performed using Graph Pad (GraphPad Prism version 7, San Diego, CA, USA).

Results and Discussion

Average vertical jump height for the participants was 42.6± 5.7cm. The mean dryland peak vertical jump power was 3659.8±639.9W. Average in-water jump height was 50.13± 13.9cm. and average power 150.7±10.8W. Although from these preliminary data there was no significance from the regressions, the coefficient of determination for dryland peak power for Ct.Ar, MoI and SSIp (R^2= 0.0033; 0.0222; 0.0334) were much lower compared to in-water peak power values (R^2=0.2352; 0.2119; 0.3143). The number of participants where EMG allowed calculation from the time of the jump was only 10 participants. Additional data may yield a significant relationship between bone strength factors and power calculated from an in-water jump. There was no correlation between relative dryland jump heights and relative in-water jump heights (r=0.004) suggesting the motions to complete each task are very different and the in-water jump may be better suited to determine lower body power of a water athlete.

Conclusions

Both dryland and in-water power did not predict bone strength in water sport athletes. Future research needs to determine a better surrogate measure for bone strength screening in water sport athletes.

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