Initial KAATSU Cuff Tightness: Effect of Limb Anthropometrics on Blood Flow Restriction

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INTRODUCTION

KAATSU training involves low load (20%1RM) resistance exercise combined with partial blood flow restriction (BFR). BFR is achieved by positioning a specially designed pneumatic cuff around the proximal aspect of the limb, cinching it to an initial cuff tightness (ICT), then inflating the cuff to a higher restrictive training pressure. ICTs can potentially impact the degree of BFR (%BFR) caused at the higher training pressures, yet many studies use the same ICTs for all subjects (1). Identifying that discrepancies in %BFR exist between subjects with different limb anthropometrics is an important step in moving toward standardization of BFR dose for KAATSU training prescription. The purpose of this study was to identify variation in %BFR between subjects experiencing the same ICT and what limb anthropometrics (circumference, muscle, and fat composition) may be determinants.

METHODS

Forty-two volunteers (26 men, 16 women) provided informed consent. Caliper skin folds, Gulick tape circumferences, and peripheral quantitative computed tomography (pQCT) scans were performed on the randomly assigned ipsilateral arm and leg at the level of the KAATSU cuff application. %BFR was measured via pulse-wave Doppler ultrasound at baseline (no cuff) and at an ICT of 30 mmHg. Variable relationships were assessed using Pearson correlations and stepwise linear regression.

RESULTS

The average %BFR (avg±st. dev.) for the arm and leg was 16.01±11.42% and 16.75±9.27% with a range of 46.66% and 36.41%, respectively. The dependent variable for regression analysis was %BFR. In the arm, pQCT-determined muscle (R^2=0.614) and fat composition (R^2=0.587) were significant ($p<0.05$) determinants of %BFR. Circumference was also a determinant (R^2=0.163). There were no significant correlations between %BFR and the anthropometrics for the leg. pQCT fat composition and sum of skin folds correlated significantly (r=0.915, $p<0.05$). pQCT circumference and Gulick circumference measures correlated significantly (r=0.991, $p<0.05$).

DISCUSSION

Conflicting BFR training results have been reported in the literature. A potential cause could be universal ICT usage causing some individuals to receive an inadequate training stimulus. Individuals using a 30 mmHg ICT will experience different %BFR when limb anthropometrics vary. Thus a method of assigning ICTs specific to individuals' anthropometric characteristics is needed to ensure equally potent stimuli. Skin fold measures and circumference measures were highly correlated with pQCT data. As a result, skin fold and Gulick circumference measures can be used to predict arm composition at the level of the cuff and may inform prescription of appropriate ICTs that result in more consistent initial %BFR across individuals.

REFERENCES

1. Karabulut M et.al. The effects of different initial restrictive pressures used to reduce blood flow and thigh composition on tissue oxygenation of the quadriceps. Journal of Sport Science. 2011;29(9): 951-958.