THE EFFECT OF KAATSU TRAINING ON BODY COMPOSITION

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Abstract:
KAATSU functions on the basis of blood flow stimulation, which is induced by placing air bands on the proximal parts of arms and legs. Blood flow moderation training produces strength gains and muscle hypertrophy at low intensity of exercise. The purpose of the study was to determine the effect of KAATSU training on body composition in recreational athletes. The participants were five men and five women, who were tested for muscle mass and fat mass. Also, we assessed differences between the right and left arm and the right and left leg, respectively. From a preventive point of view, we assessed muscle mass in the trunk region, including the visceral fat area (VFA) and waist-to-hip ratio (WHR). During the experimental period participants engaged in an 11-week intervention program, which met specific criteria of participants. Men and women showed a 1.16% and 1.10% decrease in body fat, respectively. Women showed increase in muscle mass by 0.63 kg, which manifested itself in 2.8% increase in trunk muscle mass. Men did not show increase in overall muscle mass. The analysis of segmental division for arms and legs revealed no significant differences between the left and right side of the body.

INTRODUCTION

A portmanteau of the Japanese words ka (meaning "additional") and atsu ("pressure"), Kaatsu came about in Japan in 1966. The KAATSU method is based on blood flow stimulation, which is induced by placing air bands on the proximal parts of arms and legs. Special pneumatic belts (KAATSU Air Bands) apply slight pressure around arms and legs, which engorges the limbs with blood. When using KAATSU, specific procedures are applied according to current needs of athletes. The bands may be inflated to different pressures exactly shown on a touch-screen device. According to Takarada et al. [2000] and Takano et al. [2005], KAATSU training stimulates the secretion of growth hormone as compared with the resting growth hormone levels. Growth hormone stimulates lipolysis and bone formation, which may contribute to decline in obesity and bone diseases such as osteoporosis [Beekley et al. 2005]. Blood flow moderation training produces strength gains and muscle hypertrophy also at low exercise intensities without damaging muscle tissue, which is caused by hypertrophy training. Yasuda et al. [2006] found that increases in electromyographic activity in the trunk muscles during KAATSU might be an important factor for KAATSU training-induced trunk muscle hypertrophy. Electromyographic data have shown that training aimed to produce strength gains and hypertrophy should be designed according to functions of particular muscles [Jesenský 2016]. Clinical studies have shown that regular KAATSU training recovers blood vessels by increasing the number of endothelial cells and stimulating the production of nitric oxide [Abe 2004].

THE MATERIAL AND THE METHODOLOGY

The purpose of this pilot study was to determine the effect of KAATSU resistance training on changes in body composition in recreational athletes. The participants were 10 athletes, five men and five women. Basis sample characteristics are presented in Table 1.

Table 1. Sample characteristics

N	**SEX**		**AGE**				**BH (cm)**			
10	M	W	M *M*	M *SD*	W *M*	W *SD*	M *M*	M *SD*	W *M*	W *SD*
	5	5	43.6	17.3	45.4	11.3	175.5	12.5	168.3	2.9

Note. *N* - sample size; M - men, W - women; BH - body height; *M* - arithmetic mean; *SD* - standard deviation.

The research was conducted from June to September 2017 when body composition of participants was assessed using the InBody 230 device and Lookin'Body 3.0 software. This method is based on the principle that muscle and fat tissue react differently to impedance to the flow of the electric current. The body composition analysis provided data on muscle and fat mass. We also assessed differences between the right and left arm and the right and left leg, respectively. From a preventive point of view, we also assessed trunk muscle mass, including the visceral fat area (VFA) and waist-to-hip ratio (WHR). During the experimental period participants engaged in an 11-week intervention program, which met specific criteria of participants. On average, participants performed KAATSU training three times per week:

- Exercise intensity: submaximal to maximal.
- Exercise session duration: 35 minutes.

After placing the bands on arms and legs and setting the optimal pressure, the participants performed a warm-up cycle. During the warm-up cycle the bands were inflated eight times at 20-second intervals with a 5-second rest to prepare for the upcoming KAATSU training. The participants began exercising with bands on their arms and later on their legs. The leg training was also preceded by a warm-up cycle. The training with arm bands and leg bands should last for a maximum of 15 minutes and 20 minutes, respectively. However, the exercise time need not be fully used. The standard KAATSU protocol consists of 3 to 4 sets per exercise with 15- to 30-second rest period between sets and exercises, respectively. The participants in this study followed the following protocol: 30-15-15-15 or 30-20, 20-10, 10 repetitions maximum with 20-second rest periods and 3 to 4 exercises for upper and lower body.

During the data processing stage the qualitative analysis was based on the use of logical methods. Significant differences during the experimental period were assessed using the Wilcoxon test at $p < .05$.

RESULTS AND DISCUSSION

After 11 weeks of training changes in body mass, skeletal muscle, and fat mass between pretest and posttest were minimal. Figures 1 and 2 show changes in body composition parameters for men and women, respectively.

Figure 1. Changes in body mass, skeletal muscle, and fat mass for men

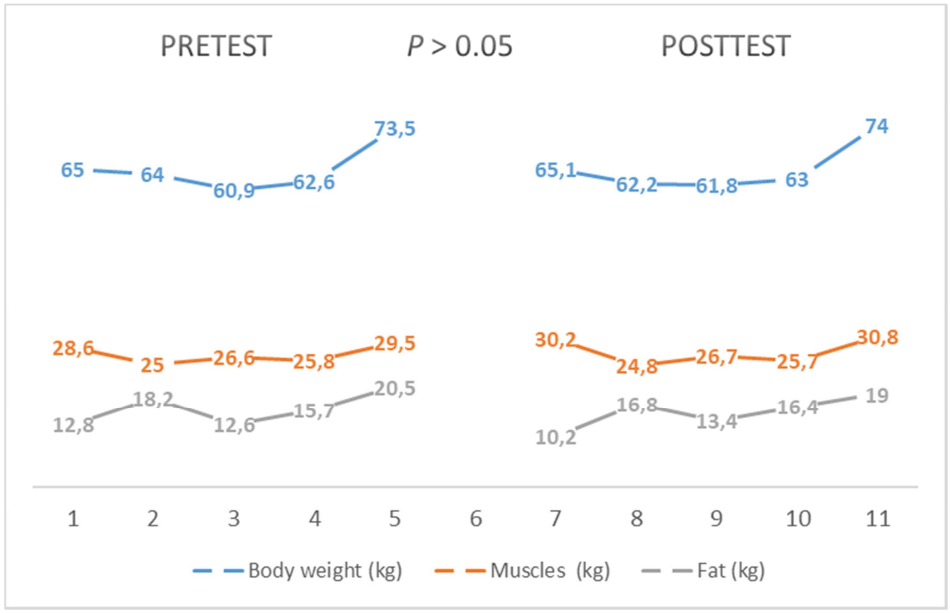

Figure 2. Changes in body mass, skeletal muscle, and fat mass for women

Body fat is one of the most frequently monitored body parameters. In most cases body fat is stored in the trunk region. Body fat percentages decreased by 1.16% and 1.10% in men and women, respectively. Figure 3 shows trunk muscle mass, visceral fat area (VFA), and waist-to-hip ratio (WHR). The waist-to-hip ratio is an indicator of abdominal obesity, which is related to visceral abdominal fat [Dwyer, Davis 2008]. Women showed a 2.8% increase in trunk muscle mass. However, men showed a 0.56% increase in trunk muscle mass as compared with the pretest.

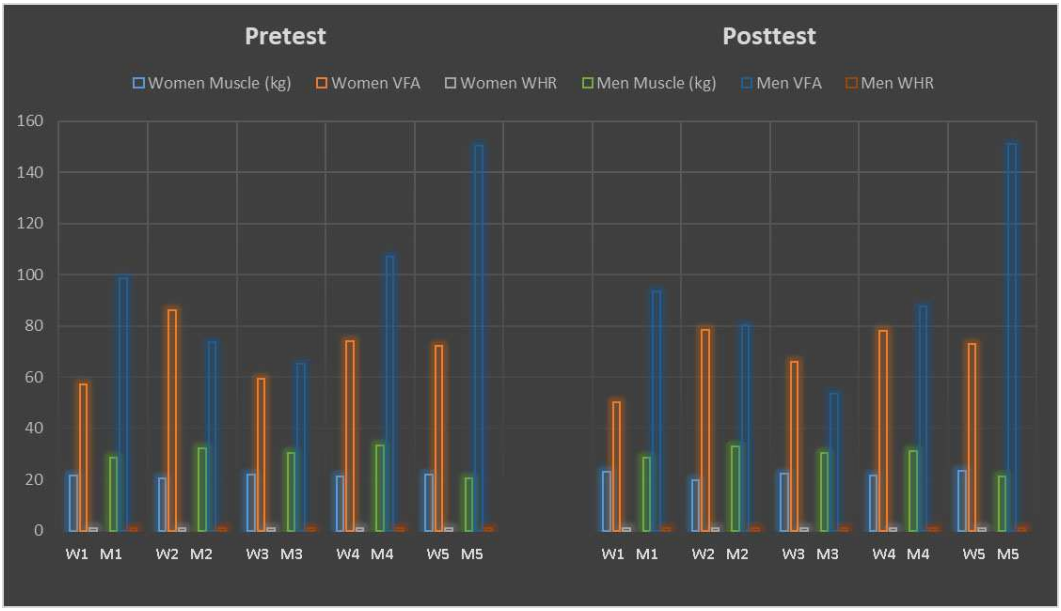

Figure 3. Trunk muscle mass, VFA, and WHR

The segmental analysis based on the differences between the right and left side of the body showed minimal differences. Figure 4 shows differences after 11 weeks of training. More significant differences were found for men who showed a 0.016 kg difference in the muscle mass of right and left arm and 0.024 kg difference in the muscle mass of right leg and left leg. Women showed a 0.002 kg difference for both arms and legs.

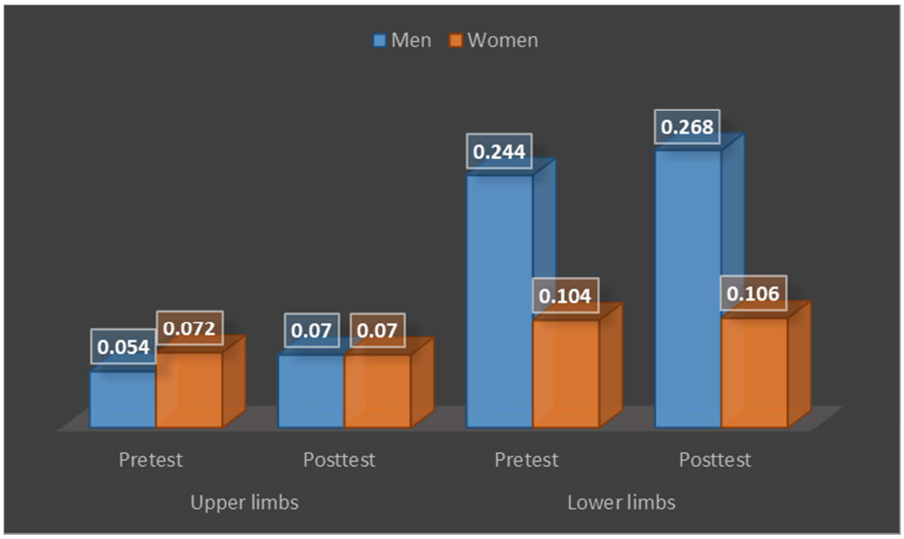

Figure 4. Differences in muscle mass of upper and lower limbs (kg)

Yasuda et al. [2005] found that skeletal muscle and fiber hypertrophy, especially type-II fiber, occur after high frequency KAATSU training. As reported by Nakajima et al. [2006], low-intensity resistance exercise can effectively induce muscle hypertrophy and increases in strength when combined with moderate blood flow restriction. Kaatsu training appears to be a safe and effective method to induce skeletal muscle strength and hypertrophy [Abe et al. 2005]. KAATSU training is a safe and promising method for training athletes and healthy persons, and can also be applied to persons with various physical conditions [Nakajima et al. 2006].

CONCLUSIONS

Complex assessment of participants has not shown any statistically significant changes between pretest and posttest. The results of the study indicate a trend characterized by gains in muscle mass and fat reduction. Therefore, KAATSU training duration of 35 minutes may be considered effective. Present study forms the basis for a long-term research that will be based on varied resistance programs, which, by the volume and intensity of exercise, allow effective engagement in exercise by athletes of various performance levels.

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