The Effects of "AHEAHO Exercise" on Respiratory Function and Trunk Muscle Activities

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INTRODUCTION: With the progression of a super-aging society, extending healthy life expectancy has become an urgent need. Age-related declines in respiratory function and core muscle activity increase the risk of reduced mobility and quality of life. Therefore, a simple exercise method for older adults to improve these functions was needed. We have developed the "AHEAHO exercise," an innovative activity combining synchronized abdominal contractions with the vocalization of "heh" and "ho." This adaptable exercise is simple and designed for older adults to perform easily, even in large group settings. It also fosters positive moods and social interactions. However, its physiological effects on respiratory function and core muscle activity have not been thoroughly evaluated. Therefore, this study investigated the immediate impacts of the "AHEAHO exercise" on respiratory function and trunk muscle activity. These findings aim to provide foundational insights for future preventive care initiatives and strategies for active aging.

METHODS: Twenty-four healthy participants were recruited and randomly assigned to either the AHEAHO group (n=12; 9 males, 3 females; mean age 27.6±12.8 years) or the control group (n=12; 9 males, 3 females; mean age 33.1±16.1 years). The study protocol was approved by our institutional review board, and written informed consent was obtained from all subjects. The AHEAHO group performed three sets of abdominal contraction exercises while repeatedly vocalizing "heh" and "ho" in a seated position, with each session lasting approximately 10 seconds and repeated 10 times per set. The control group spent an equivalent duration seated quietly, with no specific intervention. Respiratory function was assessed pre- and post-intervention using a spirometer (MICROSPIRO HI-302, NIHON KOHDEN Corporation), measuring forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and forced expiratory ratio (FEV1/FVC). Trunk muscle activity was simultaneously evaluated via surface electromyography (MWATCH, Wada Aircraft Technology Co., Ltd.), targeting the internal oblique/transversus abdominis, external oblique, and rectus abdominis muscles during maximum exhalation. Electromyographic signals were normalized to maximum voluntary contraction levels. All values were calculated as percentages, with the pre-intervention values set at 100%. Between-group differences were analyzed using independent t-tests, with significance set at $p<0.05$.

RESULTS: There were no significant differences in age, height, or weight between the two groups. The AHEAHO group exhibited a significantly greater percentage increase in FVC ($p = 0.009$) (Fig. 1) and internal oblique/transversus abdominis muscle activity ($p = 0.026$) (Fig. 2). Compared to the control group, no significant differences were observed in FEV1 ($p = 0.147$), FEV1/FVC ($p = 0.068$), external oblique muscle activity ($p = 0.120$), or rectus abdominis activity ($p = 0.705$).

DISCUSSION: Immediately following the intervention, activity of the deep core muscles—specifically the internal oblique/transversus abdominis—increased. The “AHEAHO Exercise” demonstrated effects comparable to the conventional abdominal draw-in maneuver. Moreover, because the “AHEAHO Exercise” involves vocalization, it significantly improved FVC. This exercise, which is accessible for older adults, was found to effectively enhance the activity of the transversus abdominis muscle and lung capacity, both of which commonly decline with age. Thus, the “AHEAHO Exercise” is particularly beneficial for older adults in group-based preventive care settings.

SIGNIFICANCE: This study first showed that the “AHEAHO Exercise” increased FVC and internal oblique/transversus abdominis muscle activity.

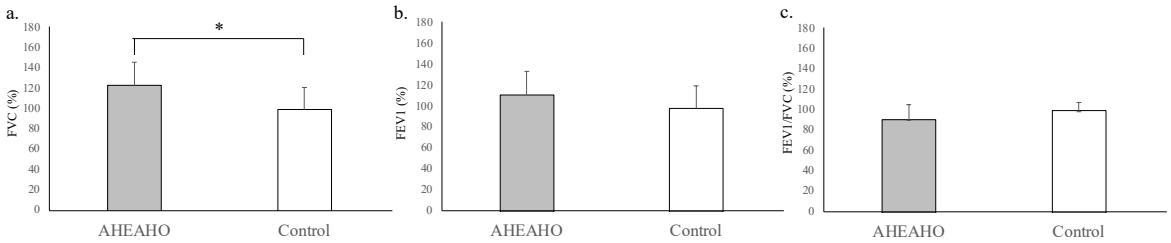

Figure 1. Respiratory function (a. FVC, b. FEV1, c. FEV1/FVC) in AHEAHO and control groups. *$p < 0.05$

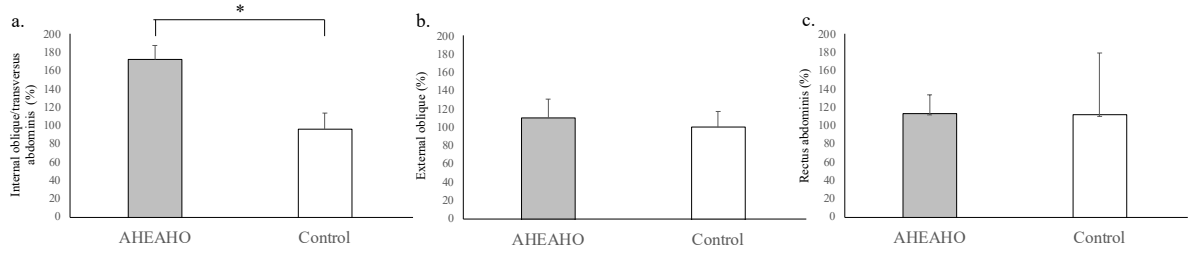

Figure 2. Trunk muscle activities (a. internal oblique/transversus abdominis, b. external oblique, c. rectus abdominis) in AHEAHO and control groups. *$p < 0.05$