SEX-DIFFERENCE IN THE EFFECT OF ANTHROPOMETRY ON POSTURAL BALANCE PERFORMANCE

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SUMMARY
Postural sway variables have often been normalized by each subject’s height in researches for the investigation of static balance performance. However, there has been insufficient evidence for such normalization. The aim of this study was to investigate the associations of anthropometry with static postural sway variables and their possible sex differences, with various stance width conditions. Subjects performed quiet standing on a force platform in feet-together stance, narrow stance, and natural stance. There were significant sex-differences in many of the correlations between independent variables and outcome measures. Extreme care must be taken when performing normalization of postural sway variables.

INTRODUCTION
There have been many studies for the investigation of the sex-difference in balance performance. In these studies, possible effect of height on the static postural sway variables was often compensated by either normalization of postural sway variables by subjects’ height [1] or comparisons of postural sway variables using height as a covariate [2]. There has been insufficient evidence for the height compensation in the literature. The aim of this study was to investigate the effect of sex and stance width on the associations between anthropometry and static postural sway variables in young subjects. For each sex and for each stance condition, correlation analysis was performed to investigate simple associations and further stepwise multiple regression analysis was performed to investigate the relative contributions of anthropometry to balance control.

METHODS
Forty young subjects (20 men and 20 women) participated in this study. Subjects performed quiet standing on a force platform in feet-together stance, narrow stance, and natural stance. To get even distribution of subjects in terms of height, four height groups with 5cm interval were designated in each sex within the range of 161-180 cm in men and 150-170 cm in women and five subjects were recruited in each group of each sex (Table 1).

Outcome measures derived from the center of pressure included 4 global and 3 structural variables. Time-domain measures included mean distance (MD) representing the average distance of COP from the mean COP, and mean velocity (MV) representing average velocity of the COP movement. Frequency-domain measures included mean frequency (MF) representing average frequency of COP oscillation, and 95% power frequency (f95) representing the upper limit of the main power (95%) component. Structural measures included 3 distinctive features in sway-density curve (SDC), as was suggested by Jacono et al. [3]. They were the mean of peaks in SDC (MP_SD), the mean spatial distance between neighboring SDC peaks (MDSDP), the mean transition time between neighboring SDC peaks (MTSDP).

Correlations between independent variables (anthropometry as well as foot placement) and outcome measures in each sex, and their sex-difference were investigated. Finally, step-wise multiple regressions of outcome measures with independent variables were performed.

Table 1. Height groups in each sex

<table>
<thead>
<tr>
<th>Group number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>height range</td>
<td>men</td>
<td>women</td>
<td>men</td>
<td>women</td>
</tr>
<tr>
<td>[cm]</td>
<td>161-165</td>
<td>150-155</td>
<td>165-170</td>
<td>160-165</td>
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<td></td>
<td>170-175</td>
<td>165-170</td>
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<td></td>
<td>175-180</td>
<td>165-170</td>
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</tbody>
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Figure 1: Mean peak time of relatively stable posturographic targets vs. height.

RESULTS AND DISCUSSION
There were significant sex-differences in many of the correlations between independent variables and outcome measures. In women, postural sway size and frequency increased and mean stable time decreased with height and weight. In contrast, men showed no significant change in postural sway size and mean stable time but reduction in frequency with increase in height and weight. Fig. 1 shows
one example of the sex-difference in the associations of anthropometry and balance performance.

Stepwise multiple regressions revealed that height and weight were the major determinants of postural sway variables, with their effects on postural sway variables different between sexes. Foot placement-related factors were also determinants of postural sway variables only for natural stance and also showed sex-difference.

The sex-differences in associations of anthropometry and foot placement with balance performance may completely alter the interpretations of the experimental results including both male and female subjects. Therefore, extreme care must be given when performing normalization of the postural sway variables.

ACKNOWLEDGEMENTS

This work was supported by the Mid-career Researcher Program through an NRF grant funded by the MEST (No. 2007-0055291) and the Ministry of Knowledge Economy (QoLT Technology Development, No. 10036494).

REFERENCES