

Cardio-respiratory responses to expressiveness in piano performance

**Hidehiro Nakahara^{1,2}, Shinichi Furuya², Satoshi Obata², Peter R. Francis³,
and Hiroshi Kinoshita²**

¹ Faculty of Health Sciences, Morinomiya University of Medical Sciences, Japan

² Graduate School of Medicine, Osaka University, Japan

³ Department of Exercise and Nutritional Sciences, San Diego State University, USA

This study examined selected autonomic and cardio-respiratory responses of nine pianists during solo performances of the same single musical piece. The subjects performed the piece with and without self-perceived emotional expression, and with and without free ancillary body movements during expressive performance. Autonomic nervous system and cardio-respiratory parameters were continuously monitored during all experimental conditions. These parameters were heart rate (HR), sweating rate, the root mean square of successive difference (RMSSD) of heart rate variability, and respiratory measurements such as oxygen consumption (VO_2), minute ventilation, tidal volume, and respiratory rate. Kinematics of the trunk and arms were recorded during all conditions. The expressive condition had significantly higher levels of HR, sweating rate, minute ventilation, and tidal volume, and lower levels of RMSSD and respiratory rate than the non-expressive condition. No difference was found for VO_2 between these conditions. The expressive condition with ancillary body movements did not significantly differentiate any of the physiological measures except for respiratory rate from those without such body movements. These findings suggested that expressive musical performance could modulate the emotion-related autonomic and cardio-respiratory responses that are independent of the effect of physiological load due to expressive ancillary body movements in playing the selected music on the piano.

Keywords: expressive piano performance; heart rate; heart rate variability; autonomic nerve system; respiratory measurements

Address for correspondence

Hidehiro Nakahara, Faculty of Health Sciences, Morinomiya University of Medical Sciences, 1-26-16 Nankokita Suminoe, Osaka, Osaka 559-8611, Japan; *Email*: nakahara@morinomiya-u.ac.jp