Reply to Hejjel

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TO THE EDITOR: We thank Dr. Hejjel (1) for his interest in our work and appreciate his interpretation of Fig. 1 in the report (3). Because this figure is only a representative example, we analyzed the whole dataset to investigate the effects of respiratory time ratio on the second and third harmonics of heart rate variability (HRV) during 0.1-Hz breathing. The results showed the spectral powers in the range of 0.15–0.25 Hz for uncontrolled, 1:1, 1:2, and 1:3 breathing were 903 ± 808 (mean ± SD), 666 ± 662, 1,181 ± 1,040, and 1,174 ± 1,175 ms² under the supine position and 1,107 ± 1,301, 780 ± 855, 784 ± 693, and 846 ± 728 ms² under the sitting position, respectively. Spectral powers in the range of 0.25–0.35 Hz were 183 ± 181, 203 ± 153, 234 ± 236 and 204 ± 267 ms² under the supine position and 244 ± 328, 264 ± 410, 161 ± 183 and 161 ± 132 ms² under the sitting position, respectively. Statistical analysis was performed by Friedman repeated-measures analysis of variance on ranks using the Tukey test for multiple comparisons and showed a significant difference of the second harmonic between 1:1 and 1:2 breathing under the supine position. But there were no differences in other conditions. The presence of second harmonic at 1:1, the so-called symmetrical, breathing may be related to the variations of breath-to-breath respiratory time ratio (Table 1 in Ref. 3). Magnitude of harmonic was another consideration. The mean powers of 0.1-Hz peaks ranged from 5,500 to 12,000 ms² and the SDs ranged from 3,000 to 10,000 ms² (Fig. 5 in Ref. 3). Therefore, we suggest the influences of second and higher harmonics, if exist, are relatively small and can be ignored when measuring the respiratory frequency power of HRV during 0.1-Hz breathing. On the other hand, the aliasing phenomenon is not likely to be present in our study, because the respiratory signal and R-R interval time series were resampled at a rate of 4 Hz.

We also thank Dr. Hejjel and his colleagues for their valuable report concerning heart rate asymmetry (HRA) and respiratory time ratio (2). This paper is an important reference in our study. HRA is a new topic in the assessment of cardiac autonomic function by HRV analysis. Because the effects of breathing frequency and respiratory time ratio have been demonstrated (2, 3), we are now exploring the possible explanation for the effect of respiration on HRA.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the author(s).

AUTHOR CONTRIBUTIONS

Author contributions: Y.-P.W., T.B.K., and C.C.Y. conception and design of research; Y.-P.W. performed experiments; Y.-P.W. analyzed data; Y.-P.W. and C.C.Y. interpreted results of experiments; Y.-P.W. prepared figures; Y.-P.W. drafted manuscript; Y.-P.W. and C.C.Y. edited and revised manuscript; Y.-P.W. approved final version of manuscript.

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