

Central Frequency of Low Frequency Component of RR Estimates Sympathetic Activity during Dynamic Exercise, Standing and Controlled Breathing Maneuvers

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It is known that low frequency power of RR intervals (pLF_{RR}) fails to track sympathetic activity changes during dynamic exercise (DE). Recently, we documented that the central frequencies of low frequency components (CF_{LF}) of RR ($CF_{LF_{RR}}$), systolic and diastolic pressure ($CF_{LF_{DP}}$) correctly indicated sympathetic activation during static exercise. To provide further evidence of the indicating capabilities of CF_{LF} , in 25 healthy subjects we assessed, the effects of supine position (SP), DE executed at 100 W, standing (ST) and controlled breathing (CB) –each maneuver lasting 5 min– on the time-courses of $CF_{LF_{RR}}$, $CF_{LF_{DP}}$, pLF_{RR} , high frequency power of RR (pHF_{RR}), pLF_{RR}/pHF_{RR} and $CF_{LF_{RR}}/pHF_{RR}$ ratios, all estimated by a time-frequency distribution. Comparisons and correlations among spectral measures were obtained. With respect to SP, mean values of: $CF_{LF_{RR}}$ (Table 1) and pHF_{RR} increased ($p<0.001$) in CB and decreased progressively in ST ($p<0.001$) and DE ($p<0.001$); $CF_{LF_{RR}}/pHF_{RR}$ decreased in CB ($p<0.03$) and increased progressively in ST ($p<0.001$) and DE ($p<0.001$); pLF_{RR} only decreased pronouncedly in DE ($p<0.001$); $CF_{LF_{DP}}$ augmented during CB and ST (Table 1). Mean values of pLF_{RR}/pHF_{RR} were not different between ST and DE. In SP, CB and ST, $CF_{LF_{RR}}$ was greater than $CF_{LF_{DP}}$ (Table 1). $CF_{LF_{RR}}-pHF_{RR}$ correlation was 0.77 ± 0.08 .

The progressive $CF_{LF_{RR}}$ decrement from a maximum in CB, followed by SP and ST to a minimum in DE, together with its strong correlation with the robust autonomic marker pHF_{RR} and the better discriminating capability of $CF_{LF_{RR}}/pHF_{RR}$ than pLF_{RR}/pHF_{RR} , support that $CF_{LF_{RR}}$ performs adequately as a sympathetic activity measure, relevantly in DE, and that it could replace pLF_{RR} for computing the sympathovagal balance. The striking finding that $CF_{LF_{RR}}$ is greater than $CF_{LF_{DP}}$ in CB, SP and ST, although in DE are similar, corroborates our previous report that the modulatory frequency of the cardiac sympathetic outflow is greater than the vasomotor one.

Table 1. Means \pm S.D. of $CF_{LF_{RR}}$ and $CF_{LF_{DP}}$ in SP, CB, ST and DE. N=25.

	CB	SP	ST	DE
$CF_{LF_{RR}}$ (mHz)	104 \pm 4*	94 \pm 6	90 \pm 4*	83 \pm 3*
$CF_{LF_{DP}}$ (mHz)	88 \pm 3* \dagger	83 \pm 5 \dagger	87 \pm 5* \dagger	84 \pm 3

* $p<0.003$ vs. SP. $\dagger p<0.01$ $CF_{LF_{RR}}$ vs. $CF_{LF_{DP}}$.