To the Editor: We write in reference to the recent article “Gender differences in autonomic functions associated with blood pressure regulation” by Dr. Convertino (1). We would first like to congratulate the author on his comprehensive treatment of gender differences in blood pressure regulation. However, we believe the article contains an erroneous conclusion that we would like to help correct. The article repeatedly states that relatively lower body negative pressure (LBNP) tolerance in women is associated with a reduced heart rate response to carotid baroreceptor stimulation. This conclusion is based on data from a technique that employs changes in R-R interval per unit carotid distending pressure. Women exhibited a maximum slope of 2.61 ms/mmHg, whereas men averaged 3.93 ms/mmHg (P = 0.047). These R-R interval results may be mathematically converted to heart rate results to see if the conclusion regarding heart rate is true.

Reported resting heart rate averaged 65 beats/min for women, which corresponds to an R-R interval of 923 ms, and heart rate averaged 52 beats/min for men, which corresponds to an R-R interval of 1,154 ms. The operational point (resting heart rate) on the R-R interval-carotid distending pressure curves occurred within the span of the reported maximum slopes, as is commonly the case (e.g. Ref. 2). To correspond to reported R-R interval slopes to heart rate slopes, we first added the change in R-R interval for a 1-mmHg increase in carotid distending pressure (the R-R interval slope) to the corresponding resting R-R interval. We then divided 60,000 ms/min by the resulting R-R interval to convert it to a heart rate value, and we subtracted resting heart rate to get the change in beats per minute for a 1-mmHg increase in carotid distending pressure (the heart rate slope).

For women

\[923 \text{ ms} + 2.61 \text{ ms/mmHg} = 925.61 \text{ ms}\]

60,000 ms per min/925.61 ms = 64.82 beats/min

64.82 beats/min – 65 beats/min

= −0.18 beats/min for a 1 mmHg increase in carotid distending pressure

Applying the same calculations to data from men yielded the same value: −0.18. Therefore, no gender difference exists in heart rate responses to carotid baroreceptor stimulation.

Data from the LBNP tests in the study actually suggest that women's arterial-cardiac baroreflexes may be more sensitive than men's. The reported "heart rate slope" in response to graded LBNP equaled 0.58 for women vs. 0.37 beats·min⁻¹·mmHg⁻¹ LBNP for men (Ref. 1, Table 3; P = 0.057). "MAP slopes" in response to LBNP were essentially identical (women: −0.16 mmHg/mmHg LBNP; men: −0.15). From Ref. 1, Fig. 2, it also appears that men and women experienced identical drops in mean arterial pressure between 0 and 50 mmHg LBNP, yet the women's heart rate increased ~29 beats/min, whereas the men's heart rate increased ~17 beats/min. Therefore, LBNP responses also strongly suggest that women's arterial-cardiac baroreflex operates at a gain similar to or even greater than that of men.

R-R interval is inversely and hyperbolically related to heart rate, which can lead to confusion when drawing conclusions about one variable from the other (3), as in the present article. Also, using changes in R-R interval to assess baroreflex function ignores the important influences baseline heart rate exert on such assessments. These problems are not unique to the present article. For example, some prior studies using the same method as the present work erroneously concluded that carotid-cardiac baroreflex function is compromised after aerobic training and space flight (see Refs. 3 and 4 for discussions).

We thank Dr. Convertino for his hard work and comprehensive study. With the exception of the prob-
lem described above, the article provides a very thorough and interesting examination of gender differences in blood pressure regulation.

REFERENCES

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REPLY
To the Editor: In their letter to the Editor, Drs. Watenpaugh and Raven raise issue with reference in the manuscript entitled “Gender differences in autonomic functions associated with blood pressure regulation” (Ref. 1; abstract, line 24; DISCUSSION, paragraph 1, line 18; page R1918, paragraph 6, line 5) that lower LBNP tolerance in women was associated with reduced heart rate (HR) response to carotid baroreceptor stimulation. The observation by Watenpaugh and Raven is valid in that R-R interval rather than HR response to carotid baroreceptor stimulation was measured in this study. This is an important distinction, because R-R intervals provide more linear indications of vagal-cardiac nerve traffic response under various experimental conditions, previous investigators have correctly concluded an alteration in the carotid-cardiac baroreflex in reference to vagal-cardiac nerve traffic. The physiological meaning or significance of this alteration is less clear. Because attenuated vagal-cardiac nerve traffic response to baroreceptor stimulation in humans has been associated with less orthostatic tolerance (1–3, 6, 7), attenuated R-R interval responses may reflect a more general integrated role of the carotid baroreceptors in blood pressure regulation. This notion is consistent with the observation that R-R interval has linear relations with both sympathetic and vagal nerve activities (5) and may underscore the significance of attenuated R-R interval responses under specific experimental conditions.

Paragraph 2 of the letter by Watenpaugh and Raven may confuse the issue by discussing an integrated orthostatic response in context of the isolated carotid baroreflex response. Bed rest can attenuate the carotid-cardiac baroreflex response (Ref. 2, calculated by changes in both R-R interval and HR), whereas total arterial-cardiac baroreflex response is increased (4). Smaller tachycardia has been reported in fainters with attenuated carotid-cardiac baroreflex response (2). Therefore, the issue is not magnitude of tachycardia during orthostasis, but whether an attenuated carotid-cardiac baroreflex response may contribute to blunting an appropriate HR elevation.

I thank Drs. Watenpaugh and Raven for the opportunity to discuss these issues and, particularly, for their complimentary comments regarding this paper.

REFERENCES

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