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LETTER

Exercise on land or in water?

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We have read with interest the study published in the *International Journal of General Medicine* entitled "Hypotensive response after water-walking and land walking exercise sessions in healthy trained and untrained women" by Rodriguez et al.[1] In this study, the authors investigated cardiovascular changes induced by walking in water in comparison with walking on land. Water exercises are commonly used in rehabilitation programs, particularly patients with mobility problems. Recently, some studies have suggested that exercise performed in water could improve cardiovascular function.[2]

Thermoneutral headout water immersion leads to important hemodynamic alterations, such as increases in both cardiac preload and cardiac output and a decrease in peripheral vascular resistance.[3] An increase in cardiac output induces an increase in peripheral blood flow and subsequently an increase in endothelial shear stress. This mechanism could be responsible for greater improvement in endothelial function after water gymnastics in comparison with land exercise. Consequently, water exercises might be of particular interest for patients with endothelial dysfunction. However, clinical interest in water exercise for the treatment of cardiovascular disease remains to be established. Further studies are needed to compare the cardiovascular effects of exercises performed in water and on land.

We have some concerns about the methods used in the study reported by Rodriguez et al[1] whereby all subjects were immersed in a bath and remained standing for 60 minutes before the exercise period. The temperature of the water was adjusted to 30°C ± 1°C. The thermoconductivity of water is 25 times greater than that of air. Consequently, the loss of body heat in water requires that thermal conditions be rigorously controlled. In the study by Rodriguez et al[1] the suitability of the water temperature is debatable. Previous studies have determined that for subjects at rest, to provide thermoneutral conditions in water, the temperature of the bath should be maintained between 34°C and 35°C. In exercising volunteers, a thermoneutral water temperature was found to be around 32°C. To accommodate these conditions, some authors have investigated resting volunteers during headout immersion in water at temperatures between 34°C and 35°C. Subsequently, to provide thermoneutral water temperature during exercise, water temperature was progressively cooled to 32.5°C.[4,5] These water temperature conditions produced a pulmonary arterial temperature in water similar to that on land at any exertion level from 40% to 100% of maximal oxygen consumption.[5]

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In the work performed by Rodriguez et al the water temperature was below thermoneutrality both at rest and during exercise. It has been documented by Park et al[6] that headout water immersion at a temperature below 34°C or 35°C modifies hemodynamic status in comparison with both thermoneutral water immersion and ambient air. During headout water immersion at thermoneutral temperature, cardiac output and stroke volume increased compared with levels in air. At a lower temperature, the increased stroke volume tended to be higher, whereas the heart rate decreased. Furthermore, the decrease in peripheral vascular resistance, commonly observed in thermoneutral water immersion, was attenuated when the temperature was decreased down from 34.5°C to 30°C. Arterial pressure was also altered, and an increase in diastolic arterial pressure was recorded at temperatures lower than 34.5°C.

Lastly, it has been demonstrated that autonomic control of the cardiovascular system is variously affected depending on water temperature. During thermoneutral headout water immersion, decreased sympathetic activity (both cardiac and vascular) and a shift towards cardiac parasympathetic predominance have been recorded.[7] In contrast, immersion in slightly cold water (temperature 25°C–30°C), leads to sympathetic vascular and parasympathetic cardiac hyperactivity.[8]

Despite these limitations, the findings of Rodriguez et al are interesting. The greater post exercise decrease in blood pressure recorded in untrained healthy women after walking in chest-deep water in comparison with walking on land suggests an enhancement of the cardiovascular outcomes of exercise in water. Furthermore, this study can be considered to be relevant to assessments made in real clinical practice. Indeed, rehabilitation programs are frequently performed in swimming pools at water temperatures below thermoneutral conditions (between 28°C and 31°C). Further studies are needed to assess the benefit of water exercises in the management of cardiac patients.

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Response

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We appreciate the comments of Doctors Boussuges and Gavarry about our study. Water exercise is frequently utilized in several rehabilitation programs, especially musculoskeletal disease,[1–3] and more recently some studies had been showed increments in functional fitness in elderly people.[4–7] Water-based exercise has been widely promoted as the optimal type of exercise because it reduces weight-bearing stresses on the skeletal joints and provides therapeutic benefits for orthopedic conditions.[7]

Regarding water, two points should be mentioned, ie, temperature and immersion. With regard to temperature and cardiovascular effects, we agree with Boussuges and Gavarry. The temperature used in our study is not thermoneutral, but a lot of research has used water-based protocols with temperatures below thermoneutrallity.[4,5,7–9] Further, according to the Aquatic Exercise Association (AEA),[10] the recommended temperature for aquatic fitness is between 28°C and 30°C. However, the temperature used in studies[4,5,11] of our group varies between 28°C and 31°C, corresponding to older people as recommended to AEA 10.[4,5] Another important point relates to the control of immersion, whereby our data was different from those of other studies,[12,13] and any conflicting results could be accounted for by differences in water temperature.

Despite these issues, our aim was to evaluate post exercise decreases in blood pressure in conditions usually found in real clinical practice, and shown by Rodriguez et al. To the best of our konowledge the results presented to Rodriguez et al, is the first to indicate positive effects on the cardiovascular system when assessing the post exercise decrease in blood pressure, but more studies are needed to investigate the role of water-based exercise on physiological mechanisms in different populations. As an example, a recent publication[14] showed that a combination of land endurance and water callisthenic exercises in patients with stable chronic heart failure was well tolerated, with significant improvements in ventricular ejection fraction, a decrease in heart rate, and a reduction in diastolic blood pressure.

Disclosure

The authors report no conflicts of interest in this work.

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