

水による体性感覚への刺激が
立位バランス調節機能に与える効果
～水中運動の神経生理学的効果の検証～

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**Effect of Water Immersion of Fingertip Somatic Sensation on
Quiet Bipedal Stance:
A Basic Study for Neurophysiological Effect of Water Exercise**

by

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ABSTRACT

Studies have shown that a fingertip lightly touching a stable surface reduces postural sway, by providing additional tactile feedback information to the postural control system. In the present study, we examined whether or not water immersion of a fingertip enhances the postural control system during quiet standing. Eight young and nine elderly subjects maintained quiet standing for 40s with the index fingertip in the water (water touch, WT) or on the stable surface (light touch, LT). The temperature

of water in the WT condition was 20, 30, or 40°C for young subjects and 30°C for elderly subjects. In the control condition (CON), a no touch trial, the subject quietly stood on a force platform for 40s, with their arms by their sides. In the young subjects, eight trials were conducted for each condition; while the elderly subjects completed three trials for each condition. The results showed that, in the young subjects, the mean velocities of the foot center of pressure (CoP) in the anteroposterior (AP) direction was significantly reduced in the LT and WT at individual optimal temperature, compared to that in the CON condition ($P<0.05$). On the other hand, in the elderly subjects, the power of low-frequency CoP sway (below 1Hz) in the AP direction significantly decreased at LT and WT conditions ($P<0.05$). These results indicate that WT can enhance the postural control system, as well as the LT. This promises the neurophysiological effect of water exercise on the postural control system.

要 旨

本研究は水中運動における水と皮膚の接触による体性感覚フィードバック情報の入力、立位バランス調節システムに与える効果について実験的に検証した。若年者8名、高齢者9名を被験者とし、床反力計上にて40秒間の静的立位課題を行った。若年者は、左手示指をビーカー内の水中(20°C, 30°C, 40°C)へ浸すWT条件と、固定点に示指で軽く触れるライトタッチ(LT)条件、何も触れないコントロール(CON)条件の5条件、高齢者はWT30°C, LT, CONの3条件で測定を実施した。その結果、若年者群ではLT条件に加え、至適温度でのWT条件において、足圧中心位置(CoP)軌跡長が、CON条件に比べて有意に減少した($P<0.05$)。高齢者ではLT条件、WT条件ともにCoP揺らぎの低周波成分(1Hz以下)が有意に減少した($P<0.05$)。以上より、水からの体性感覚フィードバック情報により、立位バランス制御機能が向上することが示された。本研究の結果は、水中運動の立位バランスに対する神経生理学的効果を期待させるものである。