機能的スポーツウェア設計のための基礎研究
―人体加圧の生体影響―

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A Basic Study for designing Functional Sports Wear
― Effects of Clothing Pressure on the Human Body ―

by

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ABSTRACT

In order to determine the effects of clothing pressure on physiological responses, especially on the autonomic nervous system of the human body, two different types of experiment were conducted.

In experiment A, heart rate variability of ten female subjects were examined when the clothing pressure was applied with a non-stretch belt to the subject around the breast, waist, and hip, respectively. As a result, HF（0.15-0.40Hz of HRV）increased significantly, while LF（0.04-0.15Hz）/HF decreased in the cases of clothing pressure around the waist and hip.

In experiment B conducted to determine the basis of designing stretch fabric sports wear, the blood flow rate and skin temperature of the finger and toe, as well as HRV of seven female subjects were measured when the clothing pressure was applied by a stretch fabric around the hip and lower extremity of the subject under the standing and lying postures, respectively. The effects of the clothing pressure on the metabolic rate were also evaluated in both standing and running conditions at $\dot{V}O_{2max}$ 70%. The results showed an increase of HF and a decrease of LF/HF as the effect of clothing

pressure. The effects were more apparent in the standing than in the lying posture and on the lower extremity than in the hip. Neither the blood flow rate nor the skin temperature were affected by the clothing pressure, while the clothing pressure caused the metabolic rate to increase significantly both in standing and running conditions. The results suggested that clothing pressure around the lower body applied by stretch garments such as a girdle or sport spats increases the blood flow rate and blood pressure in the upper body, which affect the autonomic nervous system, especially the increase of activity level of the parasympathetic nervous system.

要　旨

衣服による人体加圧が自律神経活動を中心とする生理反応に及ぼす影響を明らかにする目的で，二つの実験を実施した．実験Aでは，非ストレッチ性ベルトによる胸部・胴部・腰部の加圧を行った結果，心拍変動のHF成分の有意な増大とLF/HF成分の低下が胴部と腰部で観察された．実験Bでは，ストレッチファブリックを用い，立位・仰臥位の各姿勢において，腰部または下肢（大腿と下腿）加圧時の心電図・血流量・皮膚温を測定した．また，安静時と，各被験者の$\dot{V}O_{2max}$70％運動負荷時のエネルギー代謝に及ぼす加圧の影響も検討した．結果，下半身の加圧はHFの有意な増大，LF/HFの有意な低下を示し，仰臥位より立位で，腰部より下肢加圧で反応がより顕著であった．手足の血流・皮膚温には加圧による差が観察されなかった．エネルギー代謝は，安静時・運動時ともに加圧によって有意に増加した．以上により，スポーツウェアによる短時間下半身加圧は，血流の上半身への還流・血圧上昇を促し，心臓迷走神経活動の亢進をもたらすことが考察された．