

毛管現象を付与した自己発汗式冷却下着の開発と検証

岐阜医療科学大学 田中邦彦
(共同研究者) 日本福祉大学 西村直紀

Development and Evaluation of Self-Perspiration with Evaporative Cooling Garment Added Capillary Function

by

Kunihiko Tanaka
*Graduate School of Health and Medicine,
Gifu University of Medical Science*

Naoki Nishimura
*Faculty of Sport Sciences,
Nihon Fukushi University*

ABSTRACT

As a body temperature lowering mechanism, we have a perspiration function. Recently, we have developed and demonstrated “self-perspiration with evaporative cooling garment” that lowers body temperature by spontaneous “perspiration” and evaporation. The system is cooling the body with both the “water cooling” in which the cooling water flows through the tube on the clothing surface and the “evaporation” in which water is leached from the pores in the tube and evaporated to cool.

In the present study, we developed the leaching by capillary action (capillary type) rather than the leaching by pore water pressure (pore type), and compared the body cooling function. Six healthy subjects were volunteered to exercise 30W, 60W, 90W, and 120W for 3 minutes each using a cycle ergometer, and changes in skin

temperature and humidity in clothing were measured and analyzed simultaneously. The skin temperature decreased with time in both the pore type and capillary type, but the decrease was significantly larger in the capillary type. There was no significant difference in the humidity change in the garment. The capillary type obtained a higher cooling effect without further increasing the humidity in the garment.

要 旨

体温低下機構として人体は発汗機能を有している。これまでに我々は、衣服が自発的に「発汗」し蒸散することで体温を下げる「自己発汗式冷却下着」を作成、有用性を証明した。これは衣服表面のチューブ内を冷却水が還流する「水冷式」と、そのチューブ内の細孔から水を浸出、蒸散させて冷却する「蒸散式」双方で身体を冷却する方式である。

今回、細孔からの水圧による浸出（細孔式）ではなく、毛管現象でによる浸出（毛管式）を実現し身体冷却機能を比較した。6名の健康被検者にサイクルエルゴメーターで30W, 60W, 90W, 120Wそれぞれ3分間の運動を行わせ、皮膚温と衣服内湿度の変化を同時に計測、解析した。細孔式、毛管式両者ともに時間経過とともに皮膚温は低下したが、毛管式の方が、有意に低下した。衣服内湿度変化は両者に有意差を認めなかった。毛管式の方が、衣服内湿度をより上げることなく高い冷却効果を得られることがわかった。