

## EFFECT OF CERAMIC-COATED CLOTHING ON PHYSIOLOGICAL RESPONSES TO EXERCISE IN A COOL ENVIRONMENT

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In a previous study (ISE et al., 1987), we measured forearm blood flow (FBF) in nine resting subjects on whose left arms were placed nine ceramic disks before wrapping in a fabric ribbon (80 mm x 310 mm). A ribbon with nine plastic disks, and a ribbon without any disks were used as control experiments. FBF with ceramic disks was found to be significantly greater than either FBF with plastic disks or FBF without any disks. The purpose of the present study was to obtain preliminary information on the physiological responses of men wearing ceramic-coated clothing in a cool environment.

Seven healthy male students, ranging in age from 22 to 25, volunteered for this study. Their mean values of stature and body weight were 171.7 cm and 65.3 kg. They wore shirts and pants made of ceramic-coated aluminized cloth (CERAMIC-AL). The subjects were also made to wear shirts and pants made only of aluminized cloth (nonCERAMIC-AL) as a control. They sat on a chair in a semi-reclining position for 30 min at 15 °C in a climatic chamber. Then, they exercised with a bicycle ergometer in a semi-reclining position for 30 min in the same environment. The order in which the subjects wore the respective clothing was randomly assigned. FBF was measured every 5 min by venous occlusion plethysmography. Cardiac output ( $\dot{Q}$ ) and oxygen uptake ( $\dot{V}O_2$ ) were measured every 10 min. Skin temperature, rectal temperature ( $T_{re}$ ), temperature of clothing and heart rate (HR) were measured every minute.

Effect of ceramic coating clothing on  $\dot{V}O_2$ ,  $\dot{Q}$  and HR were small. Mean skin temperature with CERAMIC-AL was lower than that with nonCERAMIC-AL.  $T_{re}$  was not significantly different between CERAMIC-AL and nonCERAMIC-AL conditions. Mean value of total weight loss with CERAMIC-AL was 154.9 g/hr and the corresponding value with nonCERAMIC-AL was 128.2 g/hr, but the difference was not statistically significant. FBF with CERAMIC-AL was significantly higher than that with nonCERAMIC-AL. The regression equations of FBF on  $T_{re}$  were calculated for both types of clothes, and were compared by analysis of covariance. The elevation of the regression equation for CERAMIC-AL was found to be significantly higher than that for nonCERAMIC-AL. This indicates that blood flow with ceramic-coated clothing is higher at a given internal temperature than that without ceramic coating.

In conclusion, the results of this study indicate that ceramic-coated clothing increases blood flow during exercise in a cool environment. This result on blood flow is consistent with the local effect of ceramic disks (ISE et al., 1987).