The interrelationship between locally applied heat, ageing and skin blood flow on heat transfer into and from the skin

Abstract

In response to a thermal stress, skin blood flow (BF) increases to protect the skin from damage. When a very warm, noxious, heat source (44°C) is applied to the skin, the BF increases disproportionately faster than the heat stress that was applied, creating a safety mechanism for protecting the skin. In the present investigation, the rate of rise of BF in response to applied heat at temperatures between 32°C and 40°C was examined as well as the thermal transfer to and from the skin with and without BF in younger and older subjects to see how the skin responds to a non-noxious heat source. Twenty male and female subjects (10 – 20–35 years, 10 – 40–70 years) were examined. The arms of the subjects were passively heated for 6 min with and without vascular occlusion by a thermode at temperatures of 32, 36, 38 or 40°C. When occlusion was not used during the 6 min exposure to heat, there was an exponential rise in skin temperature and BF in both groups of subjects over the 6-min period. However, the older subjects achieved similar skin temperatures but with the expenditure of fewer calories from the thermode than was seen for the younger subjects (p<0.05). BF was significantly less in the older group than the younger group at rest and after exposure to each of the three warmest thermode temperatures (p<0.05). As was seen for noxious temperatures, after a delay, the rate of rise of BF at the three warmest thermode temperatures was faster than the rise in skin temperature in the younger group but less in the older group of subjects. Thus, a consequence of ageing is reduced excess BF in response to thermal stress increasing susceptibility to thermal damage. This must be considered in modelling of BF.