CORE-SKIN GRADIENT OF BODY TEMPERATURE RELATED TO NON-SHIVERING THERMOGENESIS 3 IN HUMANS AT A LOWERED AMBIENT TEMPERATURE

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Energy expenditure (EE) is related to body temperature, and vice versa, while EE is related to ambient temperature as well. In a study in women, EE was higher at 22°C than at 27°C, 9.9 MJ/d versus 8.9 MJ/d ($p<.001$), respectively (Westerterp-Plantenga *et al.*, 2002a). The difference was the result of an increase in diet induced energy expenditure (DEE, $p<.01$) and of an increase in activity induced energy expenditure (AEE, $p<.01$). At the same time, core ($p<.05$), proximal (forehead, infra-clavicular zone) and distal (hand, foot, thigh) skin ($p<.001$) temperatures had decreased. In a study in men, the increase in EE at 16°C compared to at 22°C, 12.9 MJ/d versus 12.2 MJ/d ($p<.001$), consisted of increases in DEE ($p<.01$) and in Sleeping Metabolic Rate (SMR, $p<.05$), together with decreases in core, proximal and distal skin temperatures ($p<.01$) (Westerterp-Plantenga *et al.*, 2002b). Here, we addressed the effect of lowered ambient temperatures i.e. 22°C (72°F) *vs* 27°C (81°F) and 16°C (61°F) *vs* 22°C (72°F) on a part of 24h non shivering thermogenesis, named NST3, in the two referred studies. We define NST as the sum of NST1 (part of SMR), NST2 (part of DEE), and NST3 (part of resting EE or REE). In both studies, EE measured as DEE is in fact REE consisting of DEE and NST3. DEE is the acute effect of food ingestion on EE, which accounts for about 10 percent of EE. Relative DEE -as percentage of energy intake- normally should remain the same in comparable situations with respect to energy balance and macronutrient composition of the diet. Since the relative DEE appeared to be significantly different between the two different ambient temperatures within both groups of subjects, we considered this difference as being part of NST, named NST3. We hypothesized that NST3 contributes to the regulation of body temperature. NST3 was determined as total EE minus (SMR + DEE + AEE). Thus, NST3 was 248±208 kJ/d at 22°C and 714±505 kJ/d at 16°C, and was related to the core-skin body temperature gradient ($r= -.95$, $p<.001$; and $r= -.7$, $p<.05$; respectively). NST3 limited the increase in core-skin temperature gradient at a lower ambient temperature. NST1 was increased as well in the men at 16°C. We conclude that at a lower ambient temperature, the larger NST3, the smaller the core-skin body temperature gradient, i.e. the larger the area in which the decrease of body temperature is limited. Thus NST3 contributed indeed to the maintenance of body temperature under circumstances with decreased ambient temperature.

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