The Indoor climate: towards comfort ánd health - Building and occupant energetics

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Saving energy in buildings: increasing energy expenditure in occupants.

Standards and guidelines related to the indoor environment are related to avoiding discomfort and reducing health related risks. Fixed criteria and targets are often proposed for that. However, (thermal) comfort and health are often treated as synonyms, which is not necessary correct.
The hypothesis therefore is that changing indoor conditions (focus on thermal conditions inside and outside the comfort limits in time and/or building zones) will positively influence health. This is especially evident for healthy ageing and for obesity.

With respect to ageing, health benefits of variable temperature conditions are important to study. Especially in houses for older people the indoor climate is very tightly controlled and for instance in wintertime fixed at a high level. On the other hand physiological studies clearly show that heat and cold acclimatization does take place when regularly exposed to warm or cold environments, and that acclimatized subjects are less vulnerable during heat and cold waves. Such knowledge is apparently important for deciding whether or not ageing people should be exposed to (mild) temperature variations.

The health benefit related to obesity is complex, since the development of obesity and related disorders is a very slow process. Functional parameters are desperately needed. Fortunately recent physiological studies indicate that the development of such parameters is within reach.

For example, with respect to body heat production in the cold the most well-known and very effective response to cold is shivering. This however is a response to extreme cold, uncomfortable, and thus beyond the scope of the indoor environment. Interestingly, we and others have shown that in adults mild cold induced thermogenesis (i.e. non-shivering thermogenesis - NST) occurs. That means that in mild cold conditions the human energy balance can be influenced without much discomfort. The mild cold temperatures are within the temperature ranges as indicated by the adaptive model of DeDear (1998).
NST is individual specific and blunted in obese subjects. In rodents brown adipose tissue (BAT) is responsible for NST. In adult humans it was for long believed that adults do not have significant amounts of BAT. We recently showed with advanced techniques that BAT is present and active in adult humans and is negatively related to body mass index or body fat percentage. We also showed that other tissues such as skeletal muscle are involved in NST. Finally we just revealed that cold acclimatization goes hand in hand with increased themal comfort. This information provides us with tools to measure health benefits of exposure to environmental temperature variations and to develop functional tests. This can lead to develop ideas for indoor climate with drifting temperatures, that are healthy (less obesogenic; temperature training during ageing), reasonable comfortable, and can save energy in buildings in the mean time.

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