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The effect of the indoor environmental quality on cognition and health

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Introduction

With global warming, average outdoor temperatures experienced during spring and summer are rising along with humidity levels. Previous studies have shown that there was an increase in detrimental effect on cognitive performance and memory at high relative humidity (RH) levels >70% than low RH levels of <30% (1-3). However, these studies only examined short term exposure (<3 hours) to high humidity levels or only examined older adults, outdoor environmental exposure, or field studies. Higher temperatures (>30˚C) and relative humidity levels (>60%) are associated with greater sleepiness and fatigue (4-5) and affecting memory and cognitive performance. Moreover, increase in thermal discomfort and humid sensitivity has been observed with higher humidity levels when temperatures were >30ºC (6-7).

The effects of heat on cognitive performance depends on multiple personal factors – such as the level of motivation, expertise, sex, hydration status, and heat acclimation (HA) (8-9). Motivation to complete cognitive tasks improved when individuals were in more thermoneutral conditions (10). Many studies thus far that have investigated the effects of higher temperatures (>35ºC) on cognition have been conducted in hotter and more humid geolocations like China. However, little have focused on the effects of higher humidity in more temperate landscapes (<35ºC) temperate geolocations like Central Europe.

Figure 1: Graphical representation of study design

Figure 2: Depiction of Respiration Chambers at Maastricht University, allows for respiration analysis in a free-living environment

Results

Data collection is ongoing at the moment. We are actively recruiting participants. If you are interested in the study, please scan the QR code for more information.

Objective

The primary objective of this study is to investigate the isolated effect of a warm and humid indoor environment for the duration of 8 hours on cognitive function compared with a lower humidity level at the same ambient temperature and at a neutral temperature.

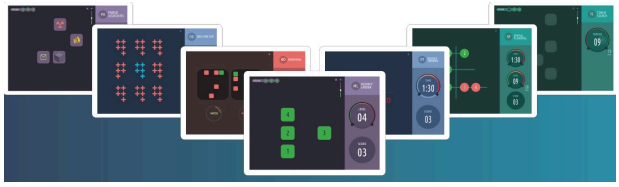

Figure 3: Cognitive test battery (Cambridge Brain Science, London, Ontario, Canada) is a web-based neurocognitive assessment battery consisting of 12 tests that encompass a broad range of cognitive processes.

Methods

Study population: 25 healthy participants – European descent with ages between 20 and 40 years and a BMI between >18.5 and <26 kg/m^2 will be included.

Each participant will be exposed to the four conditions in randomized order. The difference between the conditions are the level of humidity in the chamber, which is either 30% of RH (LOW) or 70% of RH (HIGH) and temperature, which is either 25ºC (NEUTRAL) or 32ºC (WARM).

In all conditions, participants will spend **8** hours in a Respiration Chamber. Throughout the test day the participant will conduct tablet-based cognition tests (Cambridge Brain Science) once in the morning and once in the afternoon (am/pm) along with a small stepping task (am/pm). While the secondary parameters are physiological measures including metabolic rates, skin temperature, skin blood flow, heart rate, core temperature, blood pressure, urine for hydration, sweat rate and salivary cortisol.

Light, Noise, Airflow and air composition are maintained at the same level throughout all experiments, but also continuously measured. Lastly, subjective perceptions will be assessed through hourly perceptual questionnaires with evaluations of the environment (thermal, air quality and wetness sensation, comfort, acceptance, preference, pleasure) assessed at the start and end of exposure.

Figure 4: Physiological parameter and associated wearables and equipment used for data collection – Blood pressure cuff, Core temp Pill, Laser Doppler Flow (LDF), Qsweat, Accelerometer (MOX), Heart Rate Belt, Skin temp (iButtons)

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