# Thermophysiological comfort of three different cycling backpack systems

## (Close to the body, spacer fabric, 3D-knitting spacer)

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Even though a backpack covers only part of your body, wearing one when doing sports or activities that make you sweat, has a significant impact on thermoregulation. The overall feeling of comfort is often affected in a negative way by extreme perceptions of local temperature or moisture. For example, a damp back as a result of wearing a backpack can result in a thermophysiological feeling of discomfort, even though the clothing as such would be optimal and there is no actual increase in the core temperature.

## Backpack samples used

**Sample A:** Spacer fabric

**Sample U:** Close to the body

**Sample T:** 3D-knitting

During a complex series of tests on test subjects, three different types of backpacks with different designs were examined on a bicycle ergometer in a climatic chamber.

## Subject Tests / Data Logger MSR 147WD

In the process, innovative wireless data loggers with plug-in sensors (MSR 147WD) were used to measure the temperature and relative humidity, both in the microclimate (between skin and shirt) and on the backpack.

**Underwear:**
72% PES
28% Lyocell,
loose fit

**Clima room:**
Temperature:
20°C
Relative
Humidity:
35%
Wind:
9 km/h

**Activity level:**
100W

Fig.1: Fitting of the microclimate temperature and humidity sensors

Fig. 2: Subject with Backpack on Bicycle Ergometer

Fig. 3: Data Logger MSR147WD

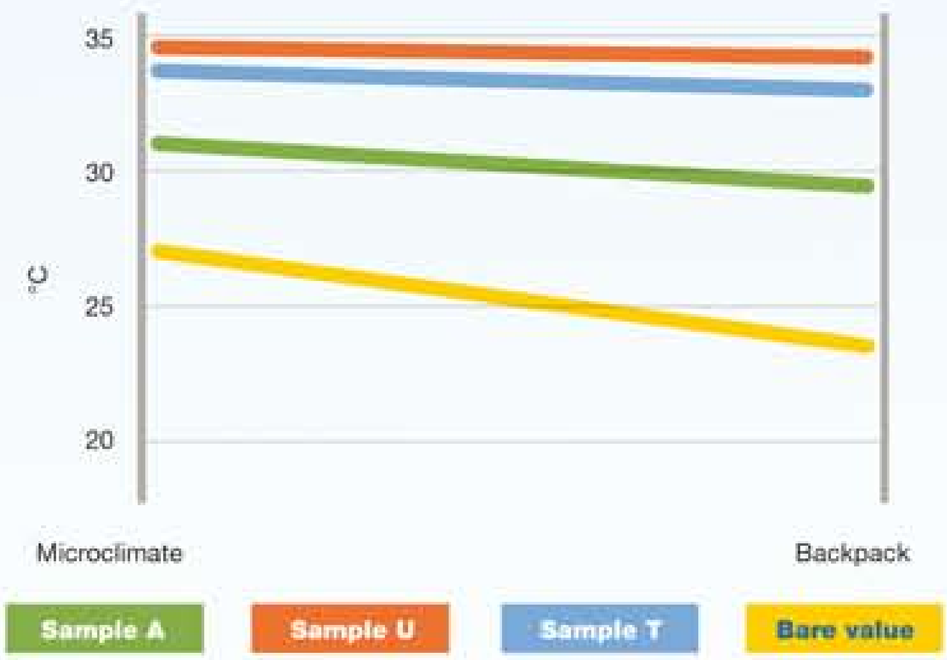
## Conclusion

Depending on the application, a better performance may be preferable to a less damp back. Where and during which stress phases, and in which temperature and weather conditions the backpack is used, plays an important role in this. Based on the measurements, the different design features and materials of the individual layers can be better optimised with respect to the desired requirements. The wearer therefore obtains the best possible backpack for his/her planned activity.

## Results

As a general rule, a lower microclimate humidity and a slightly higher backpack humidity would be beneficial. The results clearly indicate a better thermal comfort of the ventilated backpack compared to the body contact system. The differences in temperature at the end of the stress phase are relatively large, both in the microclimate and on the backpack, measuring 3° to 4 °C. Humans can perceive differences in temperature of as little as 1°C. Accordingly, the thermoregulation of a backpack, resulting in a lower increase in temperature on the back, is more beneficial. This leads to an increase in the evaporative cooling, therefore to an improved heat dissipation and, accordingly, also to a better performance.

### Temperature at the end of the activity phase




### Relative Humidity at the end of the activity phase