

## **Evidence of the effect of mindfulness training in college students through complex analysis of autonomic regulation**

In today's fast-paced world, chronic stress has become a serious problem with often severe consequences for physical and mental health. The concept of mindfulness and the Mindfulness-Based Stress Reduction (MBSR) program derived from it are considered an effective stress management technique for patients as well as healthy people.

In a first study, we evaluated a mindfulness-based training program for students (MBST) developed at the EAH Jena using methods of biosignal analysis to investigate its effects on the autonomic regulation of the training participants. As biosignals, the electrocardiogram, finger pulse curve, and respiratory activity of students belonging to either the intervention group (IGR, N=38) or a passive control group (N= 35) were continuously recorded and analyzed over 20 min before and after the eight-week MBST intervention. From these, various measures of heart rate variability (HRV), pulse wave variability (PWV), and respiratory activity that characterize autonomic function could be extracted and statistically analyzed. On this basis, we found a significant effect in this study in terms of reduced vascular regulation (vascular regulation based on specific PWV parameters). This improvement was observed exclusively in MBST participants.

In a second study, we were able to show that this positive effect lasted up to three months after the end of the 12-week intervention phase. Moreover, the results of observations up to one year after the end of MBST indicate a long-lasting effect among participants.

In perspective, these results may provide evidence for future applications of monitoring individual stress levels and intervention progress through wearables with pulse wave analysis. Due to the positive physiological effect, the MBST intervention can make a meaningful and, above all, lasting contribution to stress reduction and thus to health prevention in students.



### **Biography**

Andreas Voss was since 1997 Full Professor in Biosignal Processing and Medical Informatics at the Ernst-Abbe-Hochschule (EAH) in Jena, Germany. Before that, he worked as leader of the Biosignal Processing research group at the Max-Delbrueck-Centre for Molecular Medicine in Berlin. In 2015, he founded the Institute of Innovative Health Technologies IGHT at the EAH where he acts up to 2020 as the director and coordinated the research between five different departments. After his retirement, Professor Voss focuses on research in two main areas, autonomic regulation, and electronic senses (electronic nose). Here he works as a Guest Professor at two renowned German universities, the Institute of Biomedical Engineering and Informatics (BMTI) at the Technical University of Ilmenau and the

Department of Pediatric Oncology and Hematology at Charité Berlin. He also led the medical evaluation in the Thuringian model of mindful universities.

His research interest are linear and non-linear analysis of multivariate and multiscale data and systems analysis (e.g., risk stratification in different diseases), characterizing autonomic regulation (heart diseases, schizophrenia, depression, stress...), time-frequency analyses, knowledge-based interpretation of physiological and pathophysiological regulations, and electronic senses (electronic nose). Prof. Voss (h-index 44, RG score 43.84) published more than 330 papers in peer reviewed journals. He is member of scientific societies (DGBMT, European Society of Cardiology, and IEEE), organizer, co-organizer, and associated editor of various national and international conferences as well as member of scientific boards of various other academic events and scientific journals. He acts as reviewer and for many international journals, conferences, and grant agencies.