early stages OHS (1-2) thanks to the use of capnography, and the clinical and environmental predictive factors within this obese population.
Materials and Methods: In this prospective multi-centric observational study, inclusion criteria were adults patients with obesity without past or current non-invasive ventilation or continuous positive pressure treatment and no recent hospitalization. In this intermediate analysis, OHS prevalence and staging, BMI and associated factors (gender, age, mean peripheral saturation, night-time desaturation < 90% (min and % of total sleep time), arterial blood gases values, SF-36 quality of life measurement, Ricci & Gagnon physical activity assessment, Epworth) were examined from the first 100 patients (67% women).
Results: In these patients, the prevalence of early stage OHS was 6% that is not routinely assessed. Stage 0 were 68% and stage 3-4 17%. Early stage OHS was associated with elevated level and duration of night-time hypercapnia (PtCO2 = 51.62mmHg ±6.88, $P<0.001$; Time PtCO2 > 50 mmHg = 144min ±166, $P<0.001$), hypoxemia (PaO2 = 82.55mmHg ± 14.32, $P=0.015$), lower pH (7.4 ± 0.03, $P=0.0086$) and elevated bicarbonate (HCO3- = 26.05mmol/L ± 0.92, $P<0.001$). No difference on BMI, apnea-hypopnea index, physical activity or Epworth score was found among groups.
Conclusions: These results suggest that the use of capnography recording allowed to determine the existence of early stage OHS which may be of clinical relevance and independent from BMI.
Acknowledgements:

ONE-NIGHT TOTAL SLEEP DEPRIVATION DID NOT ALTER THE EFFECTS OF PAVLOVIAN CUES ON INSTRUMENTAL RESPONSES FOR HIGHLY PALATABLE FOOD REWARDS

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Introduction: Inadequate sleep is a risk factor for obesity. Prior studies suggest that sleep-deprived individuals may consume more calorie-dense food. The mechanisms underlying such change is unclear. The present study aimed to evaluate if sleep deprivation altered the effects of cues on one's instrumental responses for highly palatable food rewards using the Pavlovian-Instrumental Transfer (PIT) paradigm. The PIT paradigm allowed for the evaluation of specific transfer effects, i.e., increased instrumental responding for a food reward in the presence of a conditioned cue associated with that specific food reward, and general transfer effects, i.e., increased instrumental responding for a food reward in the presence of a conditioned cue associated with other food rewards. It was hypothesized that one-night total sleep deprivation would elevate specific and general transfer effects.
Materials and Methods: A within-individual randomized crossover design was used. A sample of 96 healthy adults (mean age = 25.41 years, SD = 8.01, range = 18-51; BMI = 21.41, SD = 3.52, range = 16.61-40.16) were randomized to undergo either one-night total sleep deprivation (TSD) or the normal sleep control (NSD) condition first, followed by a 3-day washout period and the other condition. The PIT paradigm consisted of an instrumental training phase, a Pavlovian conditioning phase, and a testing phase. In the instrumental training phase, participants acquired the associations between pressing two keys on the keyboard (M and N) and two respective food rewards (i.e., instrumental conditioning). Then, in the Pavlovian conditioning phase, they were presented with five neutral graphical pattern cues pairing with the two food rewards used in instrumental conditioning, two other food rewards not previously presented, and a "no food reward" control respectively. In the PIT testing phase, they were told to press either M or N as many times as they can to get the food they wanted, in the presence and in the absence of the five Pavlovian cues. Participants completed the PIT training phases between 20:00 and 22:00 prior to sleep manipulation and the PIT testing phase between 0800 and 10:00 in the following day for both TSD and NSD conditions to control for circadian influences.
Results: Repeated-measure ANOVA showed that there was a main effect of satiation, indicating that instrumental responses decreased after satiation. Significant specific transfer effects were observed regardless of sleep conditions or satiation but not for the general transfer effect, indicating that the presence of cues associated with the key increased instrumental responses on that key. However, there was not a main effect of sleep on the specific transfer effects nor general transfer effects.
Conclusions: This finding did not support the hypothesis. Sleep deprivation did not alter the effect of Pavlovian cues on instrumental responses for highly palatable food rewards. It is possible that one-night TSD might not be sufficient to induce changes in habitual control of behavior. Future research directions will be discussed.
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PERSONALIZED EEG/FNIRS: A PROMISING TOOL TO STUDY WHOLE-NIGHT SLEEP IN HEALTHY AND PATHOLOGICAL CONDITIONS

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Introduction: Sleep is a crucial period during which neuronal and hemodynamic activities interact to support healthy brain functions. Simultaneous Electro-Encephalography and functional Magnetic Resonance Imaging (EEG-fMRI) remain the reference to study the hemodynamic responses associated with neuronal activity (Dang-Vu et al., 2010; Gotman et al., 2011). However, fMRI, only sensitive to fluctuations in deoxygenated hemoglobin, is limited by the difficulty to perform long-duration recordings. To overcome this issue, functional Near-Infrared Spectroscopy (fNIRS), a wearable technique sensitive to both cortical hemodynamic fluctuations of oxyhemoglobin (HbO) and deoxyhemoglobin (HbR), has been considered as an emerging technique for sleep monitoring (Ren et al.,2020). However, most fNIRS sleep studies relied only on a few optical sensors on the forehead, therefore not allowing accurate localization of the sleep-specific hemodynamic fluctuations. Although, it is well known that there are strong interactions between sleep and epilepsy with an increase of epileptic activity during non-rapid eye movement sleep (Frauscher et al., 2019, Lambert et al., 2018), the influence of sleep stage on the hemodynamic response to epileptic discharges remain unknown. In this preliminary work, we are proposing personalized EEG/fNIRS whole night monitoring as a promising tool to study sleep, where personalized fNIRS maximizes signal sensitivity to targeted cortical regions and allows an accurate localization of the hemodynamic responses (Cai et al., 2021).
Materials and Method: We performed whole-night personalized EEG-fNIRS monitoring on 4 healthy (20-35 years old) subjects and 3 focal epilepsy patients (21-42 years old). EEG electrodes were glued in the 10-20 layout using clinical adhesive (collodion) along with EOGs, EMG, and ECG. For the healthy subjects, we installed 54 fNIRS channels covering bilateral auditory cortices. For the epileptic patients, we installed 52 fNIRS channels targeting the epileptogenic focus and its homologous contralateral region (Pellegrino et al., 2016, Machado et al., 2018). The focus was estimated using EEG and Magnetoencephalography source localization of epileptic discharges. Using EEG, sleep stages and epileptiform discharges (bursts of spikes, spike, and waves and seizures) were marked and scored by sleep and epilepsy experts. We used a multi-taper approach to estimate HbO/HbR oscillatory characteristics during each sleep stage (Scheeringa et al., 2011).
Results: Average total bedtime was 7hours 11minutes (SD: 55minutes). Sleep efficiency was above 90% for all healthy subjects and was ranging from 70 to 80% in epilepsy patients. We found a gradual decrease of HbO oscillations power from awake to N3 followed by an increase in REM within endothelial (0.005-0.02Hz), neurogenic (0.02- 0.04Hz), and myogenic (0.04-0.15Hz) frequency bands in both healthy and epileptic subjects, in agreement with the existing literature (Näsi *et al.*,2011). In the epilepsy patients, we observed an HbO decrease and a HbR increase at the time of interictal epileptiform discharges (IEDs) and seizures. In one patient, fNIRS response to the IEDs differed between N2 and N3, suggesting a

possible modulation of the hemodynamic response to IEDs by the respective sleep stage.
Conclusion: Our preliminary results suggest that personalized EEG-fNIRS monitoring is a promising approach to assess the cortical hemodynamic fluctuations during sleep in healthy and epilepsy conditions.

PRELIMINARY VALIDATION OF IN-EAR EEG AGAINST PSG SYSTEM FOR SLEEP STAGING

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Introduction: Conventional sleep staging methods based on electrophysiological signals involve time-consuming setup procedures and maintenance of devices. Conventional recording devices are bulky and expensive making long-term electroencephalography (EEG) monitoringimpractical except forcontrolled clinical environments. The mobile IDUN GUARDIAN system offers a lightweight 2-channel in-ear EEG system, optimised for wearer's comfort and long-term use. One intriguing application is daytime sleep monitoring of patients suffering from narcolepsy, which is characterised by severe drowsiness or sudden periods of sleep. The GUARDIAN may facilitate the narcolepsy patient journey by identifying sleep onset and narcolepsy attacks throughout the day and potentially offer to support treatment decisions regarding medications and lifestyle. Here, we present preliminary findings for the validation of the GUARDIAN for sleep marker detection in comparison to gold-standard polysomnography (PSG).
Materials and Methods: In order to compare the GUARDIAN to a gold-standard sleep staging device, we recorded 1 h daytime naps of a total of 10 datasets from 8 healthy participants (2 females; age range: 23-37). Sleep staging was based on the AASM (Version 2.6; Berry et al., 2020) criteria. The recordings were divided into 30 s periods, which were scored as wakefulness (W), non-REM 1 (N1), non-REM 2 (N2), deep non-REM 3 (N3), or REM sleep (R). PSG data (SOMNOscreen plus, Randersacker, Germany), involving 5 EEG channels (F3, F4, C3, C4, O1; referenced to contralateral mastoid), 2 EMG channels placed on the chin, 2 EOG channels placed around the eyes, and ECG channels (Lead II placement) on the torso. The GUARDIAN was connected directly to the PSG amplifier and referenced to contralateral mastoid in order to ensure time-synchronisation and identical preprocessing of all channels.
Results: Visual comparison between in-ear and scalp-EEG channels reveal a clear correlation in regards to neural activity differentiating sleep stages. Such sleep markers include alpha and beta activity during W, alpha-to-theta shift during sleep onset (W-N1), sleep spindles and K complexes during N2, slow wave activity in N3, and short bursts of arousal during different sleep stages. In addition, the GUARDIAN revealed - similar to frontal scalp-EEG electrodes - onset of slow rhythmic eye movements, characteristic for the transition between wakefulness and sleep in some participants. Sleep scoring was first performed on PSG channels (F3, C3, O1, EMG, EOG, and ECG), and in a second step, data of the in-ear EEG channel were scored. Pearson's correlation coefficients between scorings of PSG and the GUARDIAN revealed moderate to high correlations across all datasets (average: $r = 0.78$).
Conclusions: The IDUN in-ear EEG solution is able to accurately detect sleep markers, while ensuring wearer's comfort, enabling long-term mobile use. Themonitoring of narcolepsy patients with in-ear EEG is a possible application. By measuring sleepiness as well as onset and duration of narcoleptic attacks during the day in an unobtrusive and comfortable way, while only minimally interfering with everyday life activities, in-ear EEG-based biomarkers could be used for symptom monitoring and as surrogate endpoints in future clinical trials.

PSYCHEDELIC COMPOUND 5-MEO-DMT INDUCES AN ALTERED WAKE STATE IN MICE

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Introduction: The traditional view that the serotonergic system plays an important role in subcortical control of global sleep-wake states is supported by observations that administration of serotonergic psychedelics suppresses rapid eye movement (REM) sleep and results in increased sleep fragmentation. However, the possibility that potentiating the serotonergic system through psychedelics results in an occurrence of altered states of vigilance has received less attention. We hypothesise that the serotonergic system plays a role in controlling the quality rather than the quantity of specific sleep-wake states, as reflected in the EEG. The aim of this study is to characterise the effects of a short-lasting psychedelic compound, 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT), on brain activity and sleep-wake states in laboratory mice.
Materials and Methods: 10 adult male C57BL6 mice were implanted with frontal and occipital EEG screws and nuchal muscle EMG wires. The animals were kept under a 12 – 12 hour light-dark cycle and recorded continuously for 8 days. In a crossover design, each animal received an IP injection of 5-MeO-DMT (5 mg/kg, in a solution at a concentration of 1 mg/mL) and vehicle solution at light onset, with 2 days between injections. Vigilance states were manually scored in 4s epochs using SleepSign, and EEG spectra were analysed with Matlab. So far, only a subset of these animals has been analysed ($n = 4$), thus the values presented below are preliminary.
Results: We found that in the first hour following the injection of 5-MeO-DMT, wake was increased in three out of four animals, by on average 15.17 min (-3.2 min – 32 min) and the first episode of REM sleep was delayed by on average 45.6 min (63 min – 131.4 min). During the initial wakefulness (0 – 20 min after injection) in all the animals, EEG theta-frequency activity (6 – 9 Hz) was markedly suppressed by 42.18 % (-0.06 % – -70.34 %), while EEG slow wave activity (0.5 – 4 Hz) was increased by 23.43 % (10.16 % – 41.91 %). These changes returned to baseline levels within 60 minutes, and no further changes in the total amount of vigilance states were observed beyond this point.
Conclusions: Our data support the notion that the effects of 5-MeO-DMT are short-lasting, as the changes in vigilance states and the EEG were primarily apparent within 1 hour from the injection. Importantly, this compound did not merely change the amount and distribution of vigilance states but had an observed effect on state-specific brain activity patterns. Reduced theta-activity and increased slow wave activity during waking after administration of 5-MeO-DMT reflect an occurrence of qualitatively different, "hybrid" or "dissociated" state, having features of both waking and sleep.
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RESTNET-AROUSALS: A END-TO-END DEEP LEARNING APPROACH TO AROUSAL DETECTION

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Introduction: Arousals are defined as abrupt shifts of electroencephalography (EEG) frequency that last at least 3 seconds, preceded with at least 10 seconds of stable sleep. The identification of arousals is important for the evaluation of sleep continuity and diagnosis of sleep disorders. Arousals are difficult for human experts to score and the low inter scorer agreement makes this a particularly challenging task for artificial intelligence (AI) models to learn. However, a well designed AI model might be helpful in improving scoring consistency, leading to more consistent clinical results.
Here we present an end-to-end deep learning approach to robustly identify arousals from standard polysomnogram recordings (PSG) and from Self Applied Somnography (SAS) studies. The SAS setup allows patients to self-administer frontal EEG and EOG leads in a home sleep study, which reduces cost and is more convenient for the patients.
Materials and Methods: The ResTNet-Arousals model structure was inspired by ResNet convolutional neural network architecture, which has been highly successful in image recognition tasks. The model has the characteristic residual blocks with an added Temporal component to increase the temporal receptive field of the model.
The model makes predictions from the raw EEG, EOG and EMG signals, in