Detailed information concerning study flow of the complete study:

The study was performed at the Institute of Aerospace Medicine of the German Aerospace Center in Cologne. The protocol described in this paper was a segment of a larger research project that investigated a range of related research goals.

Participants stayed in the sleep laboratory for 12 nights and days. The first three nights served as adaptation and baseline period, followed by three blocks consisting of three nights and days each (in total nine nights and days). The first night of each block was an experimental night in which the sleep duration was modified, the subsequent two nights served as wash-out and recovery period. The three blocks of the overall research project were administered in a cross-over design to control for sequence effects.The duration of sleep in non-experimental nights was eight hours (11:00 p.m. to 07:00 a.m.). In partial sleep deprivation nights the duration of sleep was four hours (00:00 a.m. to 04:00 a.m.).

To minimize sequence effects, the experimental conditions were presented in a cross-over design (Figure 5):

1:start	adaptation	baseline	TSD	Rec	Rec	PSD	Rec	Rec	PSD+Alc	Rec	Rec
2:start	adaptation	baseline	PSD	Rec	Rec	TSD	Rec	Rec	PSD+Alc	Rec	Rec
3:start	adaptation	baseline	PSD+Alc	Rec	Rec	TSD	Rec	Rec	PSD	Rec	Rec
4:start	adaptation	baseline	TSD	Rec	Rec	PSD+Alc	Rec	Rec	PSD	Rec	Rec
5:start	adaptation	baseline	PSD	Rec	Rec	PSD+Alc	Rec	Rec	TSD	Rec	Rec
6:start	adaptation	baseline	PSD+Alc	Rec	Rec	PSD	Rec	Rec	TSD	Rec	Rec

Figure 5: Study flow. Six study phases (1 to 6) with 8 participants each were conducted.
TSD = total sleep deprivation of 38 hours (not reported in this paper!); PSD = partial sleep deprivation: four hours of sleep (00:00 a.m. to 04:00 a.m.) either in normobaric or hypobaric conditions; +Alc = alcohol consumption prior going to bed; Rec = recovery night: eight hours of sleep (23:00 p.m. to 07:00 a.m.) except for recovery after TSD: 10 hours of sleep (21:00 p.m. to 07:00 a.m.)

In order to decrease the pressure in the altitude chamber to 753 hPa, participants had to be in the altitude chamber approximately 15 minutes before the scheduled bedtime.

Detailed information concerning participants, inclusion and exclusion criteria and study flow of the two experimental nights focused on in this paper:

Forty-eight participants in the age between 18 and 40 years were included and randomly assigned to two groups stratified by age, gender, and BMI. The Control Group slept two experimental nights under conditions of normobaric normoxia in the sleep lab (53 m altitude), whereas the InFlight Group spent two experimental nights in a simulated crew-rest compartment in the altitude chamber, where the pressure was decreased to 753 hPa, simulating the minimal pressure inside an airplane cabin at cruising altitude. In addition, realistic noise as inside a plane (70 dB(A), recorded during a flight from Cologne to Kairo) was generated.

Complete polysomnography datasets were available for 40 participants (22 men, 18 women; average age = 26.4 ± 0.8 years; average BMI = 24.0 ± 0.4 kg/m^2): 23 participants in the Control Group (9 women; average age = 26.4 ± 1.2 years; average BMI = 24.3 ± 0.6 kg/m^2) and 17 in the experimental group called InFlight Group (9 women; average age = 26.4 ± 1.2 years; average BMI = 23.5 ± 0.6 kg/m^2 (Figure 6).

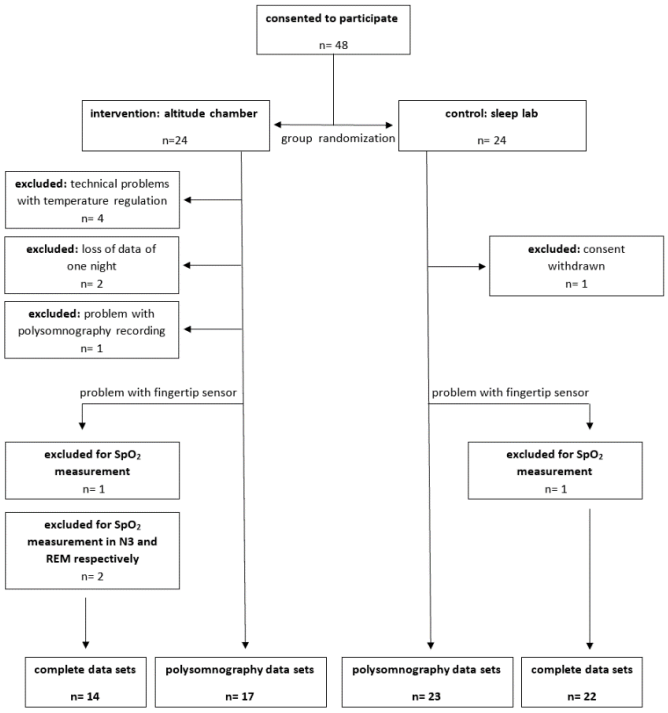

Figure 6: Availability of datasets

The following selection examinations were carried out in advance:

Resting ECG
Blood tests including: blood glucose, sedimentation rate of blood cells, liver enzymes (GGT, GOT, GPT), small blood count
Urine alysis
Medical history
Physical examination

The following exclusion criteria were applied:

Insufficient German language skills

Age: younger than 18 years, older than 40 years

Psychological unsuitability: FPI-R criteria catalogue, claustrophobia, psychological abnormalities, conspicuous social behavior

Sleep habits: Sleep duration regularly less than 6 hours or regularly more than 10 hours, sleeping times regularly before 09:00 p.m. or regularly after 01:00 a.m., waking times regularly before 05:00 a.m., daytime sleeper, sleep onset latency > one hour, getting up during the night > two times, regular use of sleep aids (intoxicants/addictive substances or medication), regular night work, apneas, snoring

Smoking

Severe visual impairment in at least one eye that cannot be corrected by visual aids

Severe physical disability

Infectious diseases (hepatitis, HIV, etc.)

Intoxication or drug addiction: Use of soft drugs or hard drugs in general

Allergies: Severe patch or electrode allergy (checked by means of an adhesive test at home), other allergies in extreme cases (requiring treatment)

Medication: Antihistamines with sedative effect, corticoids, beta-blockers, psychotropic drugs, sleeping pills, all other centrally depressant medications

Diseases: Neurodermatitis, clinically relevant lung diseases, clinically relevant kidney diseases, clinically relevant liver diseases, clinically relevant thyroid diseases, clinically relevant heart diseases, clinically relevant neurological diseases, clinically relevant anemia, clinically relevant leukocytosis/leukocytopenia, clinically relevant thrombocytosis/thrombocytopenia, diabetes (type I in general + type II, if requiring treatment with medication)

Blood values (reference values, further clarification may be required): Blood sugar (fasting > 120), erythrocyte sedimentation rate (2nd value > 100), liver values (γ-GT > 50 U/l, GOT > 40 U/l, GPT > 40 U/l)