Effects of an afternoon stroll under different light conditions on alertness, sleep quality and -perception

Published: 08-11-2017
Last updated: 12-04-2024

To investigate whether three hours of consecutive daylight and activity can affect alertness and improve night-time objective and subjective sleep.

Ethical review	Approved WMO
Status	Will not start
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON44189

Source
ToetsingOnline

Brief title
Improving sleep and alertness with daylight

Condition

- Other condition

Synonym
sleep

Health condition

slaap en alertheid

Research involving
Human

Sponsors and support

Primary sponsor: Rijksuniversiteit Groningen
Source(s) of monetary or material Support: Ministerie van OC&W,Philips Drachten

Intervention

Keyword: Alertness, Light, Sleep quality, Walking

Outcome measures

Primary outcome

The main study parameter is objective sleep quality, characterized by higher amounts of slow wave activity and fewer sleep arousals and awakenings. This will be measured throughout the night using EEG loggers on both intervention days.

Secondary outcome

Secondary output parameters are subjective alertness, measured with the Karolinska Sleepiness Scale and perceived sleep quality, quantified by the Groninger Sleep Quality Questionnaire.

Study description

Background summary

Sunlight is considered to be one of the primary zeitgebers in humans for entraining the circadian clock. Light can phase-shift endogenous oscillator in the Suprachiasmatic Nucleus and in this way synchronize internal rhythms with environmental day-night cycles.
The activity of the SCN changes over the course of the day and night. During the day, when ipRGCs are activated by different amounts and wavelengths of light, SCN activity is high, coinciding with relatively high levels of alertness and suppression of the nocturnal hormone melatonin occurs. During the night, in absence of light, there is less SCN activity, coinciding with a decrease in alertness and an increase in melatonin concentrations.
Sleep is regulated by an interaction of homeostatic and circadian processes.

This is commonly described by the two process model, which states that sleep is regulated by a homeostatic component, which tracks how much sleep is needed, and a circadian process, which determines when to sleep. The two processes together influence sleep architecture, timing, duration and quality. EEG is often used as a measurement to determine sleep, as brain frequencies measured reflect different stages of sleep. Sleep can be devided in four phases, three stages of non-REM and one stage of REM.
Nowadays, many experiments have been conducted to investigate the clock shifting properties of light, resulting in either a phase advance or delay, depending on subjective time of the individiual. However, less is known about the influence of light on the homeostatic sleep pressure. Previous research suggest a positive effect of sunlight exposure on alertness and subjective sleep duration and sleep quality. Other experiments conducted by the Chronobiology unit of the University of Groningen also suggest a link between light exposure and sleep architecture, indicating a modulation of light on the homeostatic sleep drive. Activity has also been determined to have positive effects on sleep. A general assumption is that an evening constitution has a positive effect on sleep.

Study objective

To investigate whether three hours of consecutive daylight and activity can affect alertness and improve night-time objective and subjective sleep.

Study design

The study has a within the individual design and will be performed in the field.
Participants will spent the first evening at home under dim light conditions (curtains closed while wearing some blue light blocking orange glasses) to determine dim light melatonin onset. This is necessary to determine phase angle of entrainment, to make sure that the light exposure does not cause a change in phase and therewith affects sleep. DLMO will be determined with the help of 5 saliva samples, taking every hour, starting 6 hours before habitual sleep time (determined by the Münich Chronotype Questionnaire).
There is a strong correlation between DLMO and core body temperature. The relation between core body temperature minimum and DLMO was derived from previous work and is found to be CBT¬min=(DLMO-20)*1,25+317. From each CBTmin can the individual deadzone of each participant be calculated. As a true deadzone does not exist for humans, the afternoon constitution will be centered around this deadzone, with 1.5 hour in the phase advance portion and 1.5 hour while being exposed to light while causing a phase delay. On the day of DLMO determination, subjects are asked to refrain themselves from cafeine,banana's and chocolate.

Thereafter, subjects will take part in this experiment two times, separated by

exactly one week. Both times, they will walk for three consecutive hours while being exposed to natural light. One time they will wear neutral density filtered glasses (for the whole duration of the stroll), the other time not. Which treatment is allocated at which time will be randomized.
Participants will come to the university of Groningen 30 minutes before they have to start their afternoon stroll. They will receive actiwatches on the non-dominant wrist to check whether they indeed walked for the allocated amount of time and to gain insight about the intensities of light that they have been exposed to. In addition, they will wear light watchers on a cord around their neck to determine the spectral composition of the light that they*ve been exposed to.
After the three hour walk, which can be on a self-selected route, participants will come back to the university of Groningen (which has to be the start and end point of the walk, so data can be checked immediatly by the investigator). Here they will hand in their actiwatch and light watcher. Actiwatch data will be checked immediately, to ensure that participants followed protocol.
If this is the case, subjects are allowed to go home. 6 hours before habitual sleep onset, they again have to sit in de dim light, to perform another DLMO determination. This is done to check whether the intervention indeed has not shifted the clock. During this DLMO determination, the investigator will visit, to attach electrodes to the participants, which will be placed on the following positions: EOGL, EOGR, EMG, Cz, C3, C4, Fpz and Oz. A reference electrode will be placed at the left mastoid. After DLMO determination, subjects are allowed to go to sleep while wearing Camtech Actiwave loggers to determine EEG activity. Upon awakening, they will fill in a questionnaire concerning sleep quality and alertness. Thereafter, the investigator will come by again to remove the electrodes and loggers. One week later the same protocol will be repeated with the other intervention.

Study burden and risks

There are no risks associated with participation, as light conditions used are conditions that we are regularly exposed to in every day life.
A possible burden for participants might be that they have to walk for 3 consecutive hours independent of the weather. This can be experienced as unpleasant. Also, subject have to refrain themselves from caffeine, banana's and chocolate on days on which they have to perform a DLMO (three times in total). This can be experienced as unpleasant.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

- Age between 20-30
- Healthy
- Dutch speaking
- Early chronotypes

Exclusion criteria

- Diagnosed color blindness (Ishihara's color blindness test)
- Use of photosensitizing medication or sleep medication
- Drug use
- Moderate to high levels of caffeine intake during a day (5 or more cups)
- Smokers
- Diabetic disease
- Shift work schedule in the 3 months prior to participation
- Travel over 2 or more time zones in 1 month prior to participation
- Epworth Sleepiness Scale <18
- PSQI < 6

- Usage of oral melatonin
- Daily exposure to high amounts of light (outside work)
- Lack of access to a refridgerator
- Females: if not on hormonal birthcontrol

Study design

Design

Study type:	Observational non invasive
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Will not start
Enrollment:	18
Type:	Anticipated

Ethics review

Approved WMO Date:	08-11-2017
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Groningen (Groningen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL62482.042.17