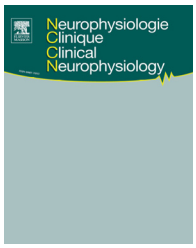
Neurophysiologie Clinique/Clinical Neurophysiology (2013) 43, 161—169

Disponible en ligne sur
SciVerse ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en



ORIGINAL ARTICLE/ARTICLE ORIGINAL

Combined caffeine and bright light reduces dangerous driving in sleep-deprived healthy volunteers: A Pilot Cross-Over Randomised Controlled Trial

L'association caféine et photothérapie avec lumière blanche réduit la conduite dangereuse sur simulateur chez des volontaires sains privés de sommeil : étude pilote contrôlée, randomisée, en cross-over

S.L. Hartley[a,*], F. Barbot[b], M. Machou[a], M. Lejaille[b], B. Moreau[c], I. Vaugier[b], F. Lofaso[a], M.A. Quera-Salva[a]

[a] *Unité du sommeil, service d'explorations fonctionnelles, hôpital Raymond-Poincaré, université de Versailles-St Quentin, AP—HP, 92380 Garches, France*
[b] *Hôpital Raymond-Poincaré, centre d'investigation clinique, innovation technologique 805, CIC-IT 805, Inserm/AP—HP, 92380 Garches, France*
[c] *Fondation Vinci pour une conduite responsable, 92310 Sèvres, France*

Received 2 October 2011; accepted 4 April 2013
Available online 26 April 2013

KEYWORDS
Caffeine;
Sleep deprivation;
Vigilance;
Bright light;
Driving simulator

Summary
Aim of the study. — To explore the effects of caffeine and bright light therapy on simulated nighttime driving in sleep-deprived healthy volunteers.
Participants and methods. — Twelve male healthy volunteers aged 20 to 50 years participated in a randomized cross-over study of simulated nighttime driving at a sleep laboratory, followed by recovery sleep with polysomnography at home. The volunteers received variable combinations of caffeine 200 mg (C+), caffeine placebo (C—), bright light 10,000 lux (L+), and bright light placebo < 50 lux (L—), in four sessions (C+L+, C+L—, C—L+, C—L—), in random order with a wash-out period of 7 days. Treatments were given at 1 a.m. and testing was performed at 1:30 a.m., 3 a.m., 4 a.m., and 6 a.m. Lane drifting was the primary outcome measure. Other measures were reaction times, self-rated fatigue, sleepiness and recovery sleep.
Results. — Without treatment, lane drifting increased throughout the night, and objective and subjective vigilance declined. Paired comparisons showed that lane drifting was significantly

* Corresponding author.
E-mail address: sarah.hartley@rpc.aphp.fr (S.L. Hartley).

0987-7053/$ - see front matter © 2013 Elsevier Masson SAS. All rights reserved.
http://dx.doi.org/10.1016/j.neucli.2013.04.001

worse at 6 a.m. and at 4 a.m. than at 1:30 a.m. There was a global treatment effect on lane drifting. Lane drifting at 6 a.m. was significantly decreased with C+L+ compared to C−L−.
Conclusions. — Bright light therapy combined with caffeine administered at 1 a.m. decreased lane drifting by healthy volunteers during simulated nighttime driving.
© 2013 Elsevier Masson SAS. All rights reserved.

MOTS CLÉS
Lumière blanche ;
Privation de sommeil ;
Simulateur de conduite ;
Caféine ;
Vigilance

Résumé
Objectif. — Évaluation de l'efficacité de la caféine et de la photothérapie sur simulateur de conduite chez des volontaires sains privés de sommeil.
Participants et méthodes. — Douze hommes, volontaires sains âgés de 20 à 50 ans ont été randomisés pour recevoir caféine 200 mg (C+), placebo de caféine (C−), lumière blanche 10 000 lux (L+) ou placebo de lumière inférieur à 50 lux (L−) de façon aléatoire en quatre sessions (C+L+, C+L−, C-L+, C−L−), séparées d'une période de *washout* de sept jours. Le traitement a été administré à 1 h 00 du matin et les évaluations réalisées à 1 h 30, 3 h 00, 4 h 00 et 6 h 00. Le critère principal était les franchissements de ligne (FL). Les autres critères étaient le temps de réaction, des échelles subjectives de fatigue et somnolence et le sommeil de récupération.
Résultats. — Sans traitement, les performances s'aggravent au cours de la nuit avec une augmentation des FL. Les comparaisons deux à deux montrent que les FL étaient plus importants à 6 h 00 et à 4 h 00 qu'à 1 h 30. Les FL présentent un effet traitement. Ils étaient inférieurs avec C+L+ qu'avec C−L− à 6 h 00.
Conclusions. — La photothérapie combinée à la caféine semble avoir un effet favorable sur les FL chez des volontaires privés de sommeil.
© 2013 Elsevier Masson SAS. Tous droits réservés.

Introduction

Sleepiness at the wheel is a major international public heath issue and causes 37% of all fatal accidents on French toll highways [2]. Accidents peak between 2 a.m. and 7 a.m. Night-time accidents may be related both to sleep deprivation and to a dip in performance due to normal circadian variations. The performance decline seen after 17 hours of wakefulness is equivalent to that produced by a blood alcohol level of 0.05% [10]. Driving at night should be avoided whenever possible but may be necessary for social or professional reasons.

Interventions known to diminish the effects of sleep deprivation include caffeine, napping, and bright light. Caffeine is a widely available and safe substance that increases vigilance. Caffeine has been proven to improve nighttime driving performance under simulated [11,15,23,24] and real-life conditions [20]. Napping reduces sleep propensity and sleepiness [15,17,20,23,34]. Bright light increases subjective [3,16] and objective vigilance as measured using the psychomotor vigilance test (PVT) [21], pupillary responses [29], and wakefulness maintenance [16]. Furthermore, bright light affects the circadian system by suppressing melatonin secretion [13,27] and by shifting the circadian rhythms depending on the time of administration [8].

Bright light has been used both continuously and in pulses, but the optimal dose and timing are not agreed on [6]. Continual exposure to intense bright light during nighttime driving is not feasible, but a pulse of white light can be delivered during a 30-minute rest period. Caffeine has been shown to potentiate the effects of bright light on both vigilance and circadian phase shifts [32,33]. A recent pilot study found that both bright light and napping improved vigilance in shift workers [17]. However, the effects on driving performance of light alone or combined with caffeine have not been fully investigated.

The aim of this pilot randomised cross-over study was to investigate the combined effects of caffeine and bright light on driving performance and vigilance in healthy males during simulated nighttime driving tasks. We hypothesised that combining bright light and caffeine would improve objective driving performance and subjective fatigue and sleepiness.

Methods

The study was approved by the local ethics committee and conducted in compliance with good clinical practice guidelines and the Declaration of Helsinki. All participants provided written informed consent.

Participants

We included 12 healthy male volunteers aged 20 to 50 years (mean age, 34.6 ± 8.7 years; range 24−49 years). Inclusion criteria were having a valid driving license and driving at least 10,000 km over the past year. Exclusion criteria included symptoms suggesting sleep disorders; irregular sleep-wake patterns or abnormal daytime sleepiness (defined as an Epworth Sleepiness Scale score > 10); neurological, cardiovascular, or endocrine disease; drug or alcohol abuse in the past 6 months; usual daily intake of more than two cups of coffee or more than three units of alcohol; heavy smoking defined as more than 10 cigarettes per day; treatment with drugs active on the central nervous system, betablockers, melatonin, or melatonin agonists; and retinopathy. All participants were interviewed and examined by a sleep physician to check the absence of exclusion criteria.

Download English Version:

https://daneshyari.com/en/article/3082429

Download Persian Version:

https://daneshyari.com/article/3082429

Daneshyari.com