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Can nighttime scents affect walking, cognition and sleep in middle-aged adults?

Submission date
14/11/2026

Recruitment status
No longer recruiting

Registration date
18/11/2026

Overall study status
Completed

Last Edited
18/11/2026

Condition category
Other

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
During middle age, changes in sleep, thinking abilities, and walking performance may begin to emerge. Previous research suggests that exposure to different smells during sleep may influence brain function, but its effects on walking and cognitive performance in middle-aged adults remain unclear.
This study aimed to investigate whether nighttime exposure to pleasant smells could improve walking performance, cognitive function, and sleep quality in adults aged 45–60 years.

Who can participate?
Community-dwelling adults aged 45–60 years

What does the study involve?
Following a 1-week baseline period, participants completed two 3-week intervention periods in random order: one involving nighttime exposure to fragrances and the other involving an odorless control condition. There was no break between the two periods.
A programmable scent-diffusion device (Kimba Scent Device, model V4) was installed near each participant's bed. During the active intervention, three fragrances (lavender, bergamot, and sandalwood) were delivered in random order. Participants activated the device when going to bed. Diffusion began 40 minutes later and continued for about 3 hours and 45 minutes, using brief pulses that were more frequent at the beginning of the night. During the control period, the same device operated without releasing fragrances.
Participants underwent assessments of walking speed, walking while performing a mental arithmetic task, and cognitive abilities, including verbal fluency. These assessments were performed at baseline and after each intervention period.
Sleep was monitored using Garmin wrist-worn devices, daily sleep diaries, and questionnaires. Participants also completed morning attention tests.

What are the possible benefits and risks of participating?
The findings are intended to improve understanding of whether nighttime olfactory stimulation may offer a practical approach to supporting cognitive and physical functioning during middle age.

Where is the study run from?
University of Haifa (Israel)

When is the study starting and how long is it expected to run for?
March 2025 to December 2025

Who is funding the study?
The study was funded by Kimba AI, the company that developed the scent-diffusion device

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Additional identifiers

Study information

Scientific Title
Nocturnal olfactory stimulation and dual-task gait in midlife: a randomized crossover

Study objectives
To investigate the effects of nocturnal olfactory stimulation on cognitive function, gait performance, and sleep quality in community-dwelling middle-aged adults aged 45–60 years, compared with an odorless control condition, using a randomized, single-blind crossover design.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 05/03/2025, Faculty Ethics Committee for Research Involving Human Participants, Faculty of Social Welfare and Health Sciences, University of Haifa (199 Abba Khoushy Avenue, Mount Carmel, Haifa, 3103301, Israel; +972 (0)4 8240257; Ethics-health@univ.haifa.ac.il), ref: 086 /25

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Placebo

Assignment
Crossover

Purpose
Basic science

Study type(s)

Health condition(s) or problem(s) studied
Sleep quality, cognitive function, and gait performance

Interventions
Participants were randomly allocated using a lottery method to one of two intervention sequences:
Sequence A: Three weeks of nocturnal olfactory stimulation followed by three weeks of odorless control.
Sequence B: Three weeks of odorless control followed by three weeks of nocturnal olfactory stimulation.
Both sequences were preceded by a one-week baseline period. There was no washout period between the two intervention periods.

A 1-week baseline period preceded the intervention. Olfactory stimulation was delivered using the Kimba Scent Device (model V4, developed by Kimba AI), installed by a trained technician on a bedside table within 80 cm of the center of the participant's pillow. Three fragrances were used: lavender, bergamot, and sandalwood, selected from different fragrance families. The fragrances were delivered in random order without a fixed repeating sequence. Participants activated the device when getting into bed with the intention of sleeping. Odor diffusion began 40 minutes after activation and continued for 3 hours and 45 minutes each night. Each diffusion pulse lasted 40 seconds. Pulses were delivered every 7 minutes during the first 45 minutes and every 10 minutes during the subsequent 3 hours. During the odorless control condition, the same device operated according to an identical schedule without odor delivery. Both intervention periods lasted 21 nights. Outcomes were assessed at baseline and after each intervention period. Device activity was monitored through system logs to assess adherence to the intervention protocol.

For the assessment timepoints, baseline (week 0) refers to the assessment immediately after the one-week baseline monitoring period and before the first intervention period. Week 3 and week 6 refer to the end of the first and second intervention periods, respectively. Daily and nightly recordings are summarised separately for the corresponding study phase.

Intervention Type
Device

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Kimba Scent Device, Model V4

Primary outcome(s)
1. Gait dual-task effect (DTE, %) measured using one-minute single-task walking and dual-task walking assessments, with serial subtraction by sevens performed during dual-task walking. Gait speed is calculated as the distance walked divided by 60 seconds. DTE is calculated as [(dual-task gait speed – single-task gait speed) / single-task gait speed] × 100 at baseline (week 0), week 3 and week 6

2. Cognitive dual-task effect (DTE, %) measured using one-minute serial-subtraction-by-sevens tasks performed while seated and while walking. Performance is quantified as the number of

correct responses. DTE is calculated as [(dual-task correct responses – single-task correct responses) / single-task correct responses] × 100 at baseline (week 0), week 3 and week 6

Key secondary outcome(s)

1. Single-task gait speed (m/s) measured using a one-minute walking assessment along a marked indoor route divided by 60 seconds at baseline (week 0), week 3 and week 6

2. Dual-task gait speed (m/s) measured using a one-minute walking assessment while participants simultaneously perform serial subtraction by sevens divided by 60 seconds, at baseline (week 0), week 3 and week 6

3. Single-task serial-subtraction performance measured using the number of correct responses during a one-minute seated task involving repeated subtraction of seven from a randomly selected starting number at baseline (week 0), week 3 and week 6

4. Dual-task serial-subtraction performance measured using the number of correct responses during a one-minute task involving repeated subtraction of seven while walking at baseline (week 0), week 3 and week 6

5. Phonemic verbal fluency measured using the number of valid Hebrew words generated in one minute beginning with a designated letter at baseline (week 0), week 3 and week 6

6. Total sleep time (minutes) measured using a wrist-worn Garmin device nightly sleep recordings at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

7. Sleep-onset latency (minutes) measured using Garmin sleep recordings and participant-reported daily sleep diaries. The two data sources are summarised separately for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

8. Sleep efficiency (%) measured using nightly sleep recordings from a wrist-worn Garmin device. Nightly recordings are summarised for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

9. Wake after sleep onset (minutes) measured using using nightly sleep recordings from a wrist-worn Garmin device. Nightly recordings are summarised for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

10. Nocturnal awakenings measured using daily sleep diaries and expressed as the percentage of diary entries reporting an awakening during the night. Participant-level summaries are calculated for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

11. Sustained attention measured using the Psychomotor Vigilance Test (PVT), with mean reaction time, median reaction time (milliseconds) and the number of slow responses recorded. Morning assessments are performed daily during each intervention period and summarised separately at week 3 and week 6

12. Subjective sleep quality and perceived impact of the intervention on sleep measured using a study-specific questionnaire containing numerical ratings and open-ended questions about perceived changes in sleep at week 3 and week 6

13. Daytime napping measured using daily sleep diaries and expressed as the percentage of diary entries reporting a daytime nap. Participant-level summaries are calculated for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

14. Morning wake time measured using clock time (hh:mm) in daily sleep diaries. Recordings are summarised for the baseline phase at week 0, the first intervention phase at week 3 and the second intervention phase at week 6

Completion date
05/12/2025

Eligibility

Key inclusion criteria
1. Adults aged 45–60 years
2. Community-dwelling individuals
3. Independent in activities of daily living (ADL)
4. Native or near-native Hebrew proficiency
5. Regular use of an iPhone compatible with the study application
6. Willingness to participate and provide written informed consent

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
45 Years

Upper age limit
60 Years

Sex
All

Total final enrolment
54

Key exclusion criteria
1. Sleep apnea, insomnia, or other severe sleep disorders, based on self-report during initial telephone screening
2. Self-reported sensitivity to odors
3. Self-reported olfactory impairment
4. Neurological diseases or acute medical conditions, including orthopedic conditions

Date of first enrolment
05/03/2025

Date of final enrolment
10/07/2025

Locations

Countries of recruitment
Israel

Sponsor information

Organisation
University of Haifa

ROR
https://ror.org/02f009v59

Funder(s)

Funder type

Funder Name
Kimba AI

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Data sharing statement to be made available at a later date