The Brief-Odor Detection Test: is it able to detect very early cognitive impairment in community dweller older adults

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Outline

1. Background
2. Materials and Methods
3. Results
4. Conclusions

1. Olfactory loss in normal aging

- Increasing prevalence with age
- Age range 80–97 years had a prevalence of olfactory dysfunction of 62.5% (Murphy et al., 2002)

Factors involved in age-related olfactory dysfunction include

1. changes in non-olfactory elements of the nose (e.g., airflow patterns and mucous composition),
2. olfactory neuroepithelium
3. olfactory bulb, and neurochemical changes in the brain

Alves et al., 2014

1. Olfactory Dysfunction

Olfactory dysfunction is present in neurodegenerative diseases (Alzheimer's disease, vascular dementia, Parkinson and Frontotemporal Dementia)

AD and amnestic MCI patients display significant deficits in olfactory identification tests when compared to healthy elderly people (Bahar-Fuchs et al., 2011).

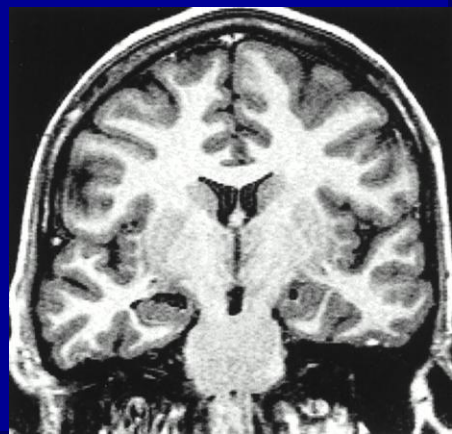
2-year study showed that 47% of MCI patients with olfactory impairment and 11% of MCI patients with a normal sense of smell eventually developed AD (Conti et al., 2013)

Early-stage AD has been shown to result in lower-level deficits in odor detection as well as higher-order deficits in odor quality perception, such as discrimination and identification (Li et al., 2010).

Odor characteristics

Impairment in AD patients is greater in odor identification compared to odor detection (Kovacs 2004)

Odor identification deficit in aMCI and AD patients is associated with ***hippocampal atrophy*** (Hagemeier et al., 2016)



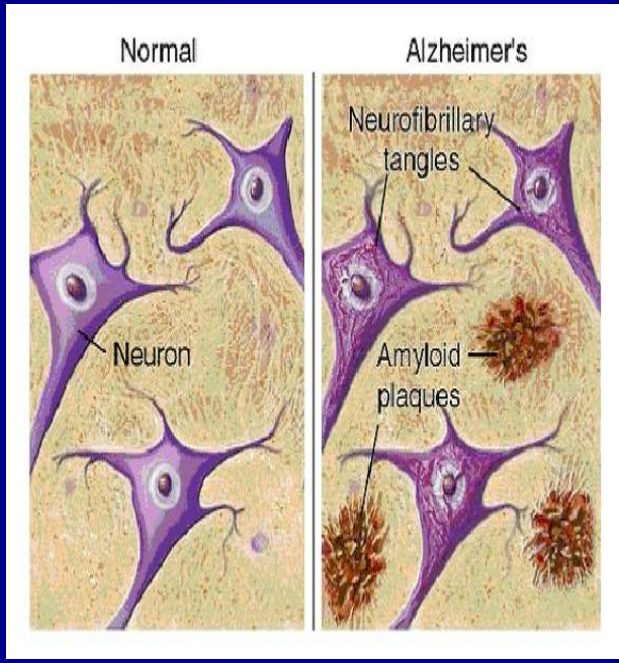
1. Olfactory Dysfunction-2

Post mortem studies have demonstrated the presence of amyloid-beta (Aβ) and hyperphosphorylated tau in the olfactory system. (Attems et al., 2014)

ApoE4 may be involved in olfactory function, as **apoE mice demonstrated reduced olfactory performance when compared to control mice** (Nathan et al., 2004)

CA1 is very severely affected by NFTs

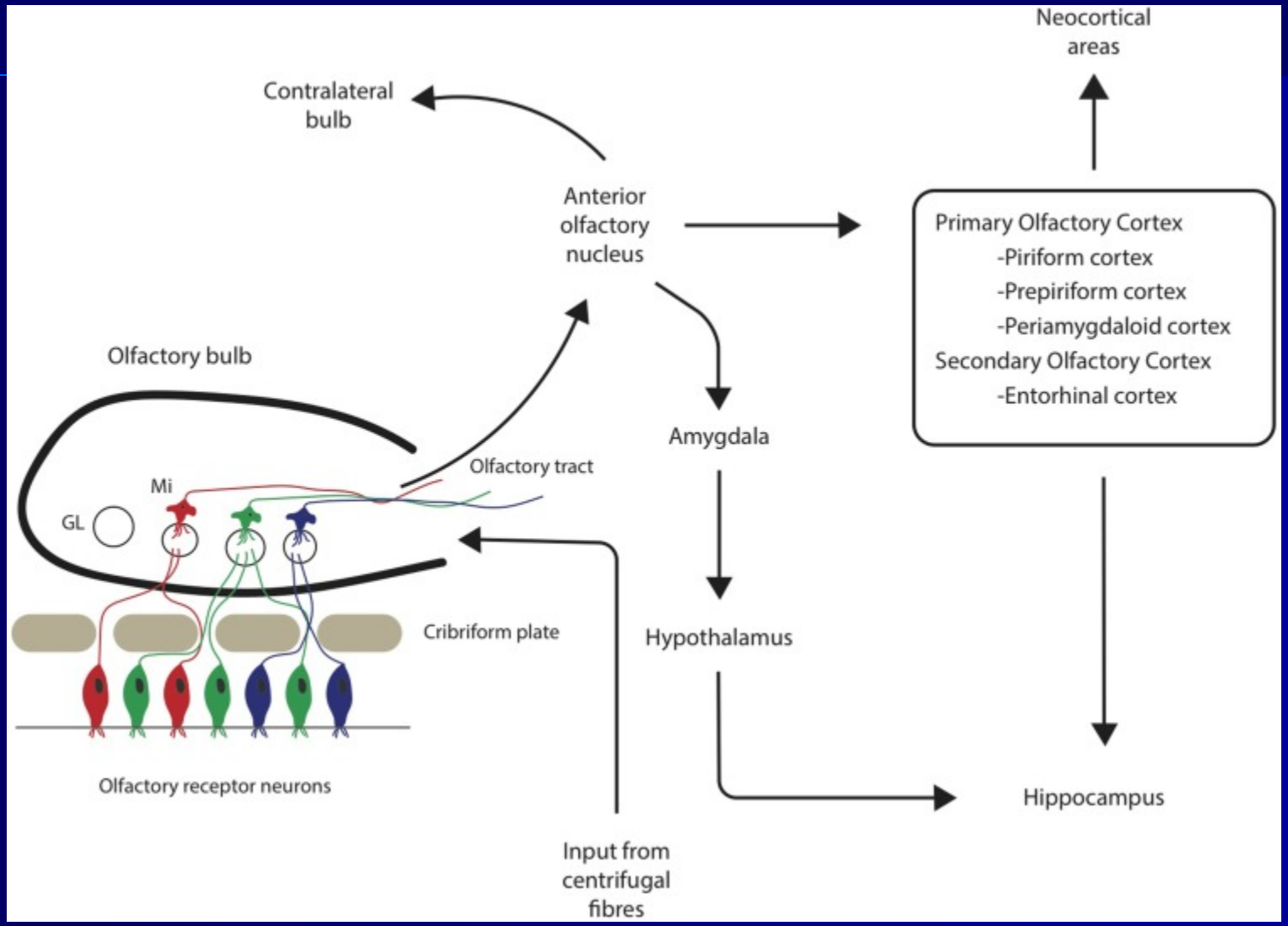
Olfactory Bulb is affected in early AD stages (Kovács et al., 2001).



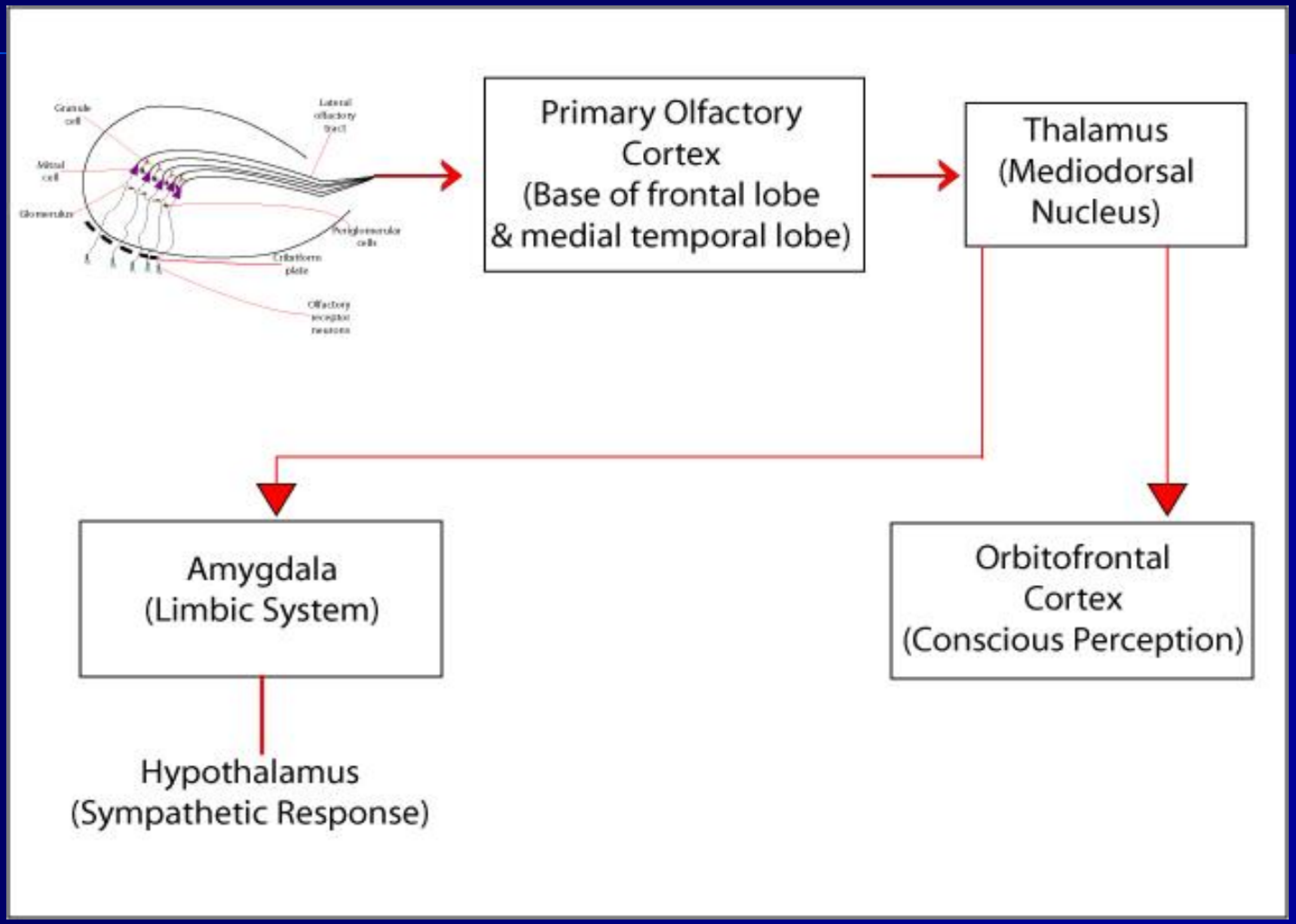
Olfactory Dysfunction-3

- The primary olfactory cortex has connections to brain regions, such as **the hippocampus** (Haberly, 2001), which are also involved in AD.
- In later stages of the disease, NFTs are abundant in almost all components of the hippocampal formation, despite relatively few Aβ deposits (Braak and Braak, 1991).

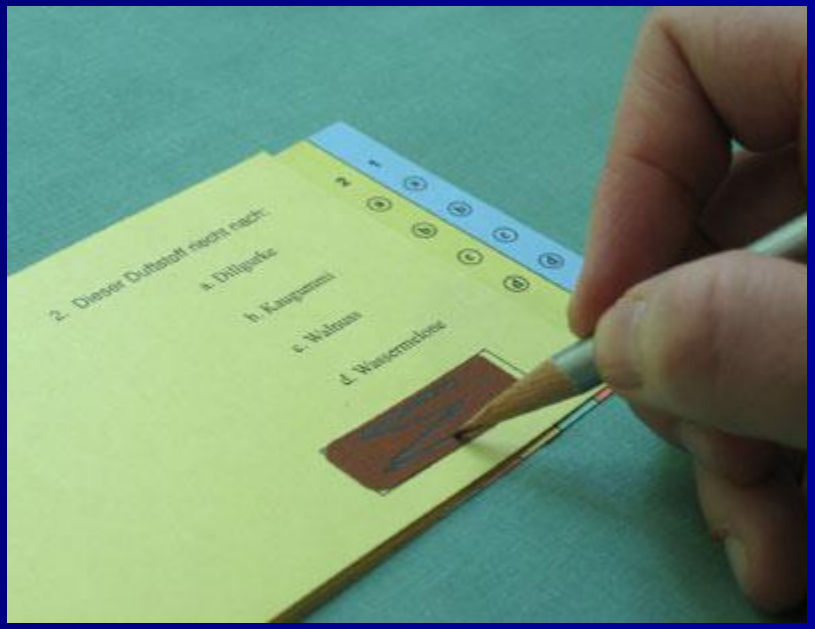
Olfactory Connections



Olfactory connections



UPSIT test (Smell identification test)



UPSIT test (Smell identification test)

Review Article

Is The University Of Pennsylvania Smell Identification Test (UPSIT) Valid for the UK Population?

Most patients are not aware of their problems in smell!!!!

6% complained of decline in cognitive function during the early stage of the disease

90% had significant impairment of olfactory function in an olfactory test

Zou et al., 2016

Aim

This study describes the development of a brief odor detection test, and its pilot administration in older adults.

The study aimed at examining whether the test could differentiate older adults with very mild cognitive impairment from their cognitively healthy counterparts.

Materials and Methods

The sample consisted of 34 older adults (22 women), age range 65- 87 years. Participants were divided into two groups according to their general cognitive functioning (as assessed by MOCA).

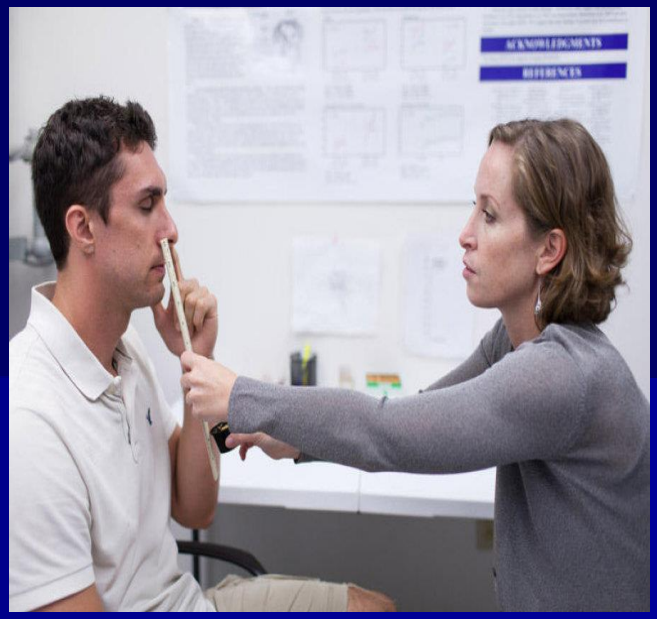
Group 1 Adults with probable mild cognitive impairment (pMCI group), consisted of 16 older adults who achieved a MoCA total score from 24 to 26

Group 2 18 Healthy controls The two groups did not differ significantly in age, gender, and educational level

Materials and Methods-2

1. The first condition was based on the study of Djordjevic et al. (2008), and their procedure of a scale solution administration which they used to determine the threshold of detection. For the administration of the concentrations of vanillin in this condition 300mg / L, 30mg / L, 3mg / L, 0.03mg / L. , five pairs of transparent glass bottles are used.

2. Condition 2 examines the change in air odor and it requires vanillin solution of 30mg/L and a 30 cm metric ruler. The solution is initially placed 30 cm below participant's nostril. The examiner had to place the solution at a specific distance point from each nostril.



the Brief Odor Detection Test (B-ODT).

Odor detection was measured via vanillin solutions which were created and renewed for each administration in the laboratory of the Department of Chemistry of the Aristotle University of Thessaloniki.

WHY VANILLIN????

- it is a widely used, pure odorant substance which activates mainly the olfactory nerve.
- it is common in the Greek population.

Results

A statistically significant difference in odor detection ($p<0.05$) between the group with probable MCI (pMCI) patients and the group of cognitively healthy older adults (CH) was observed

The control group presented a statistically significant higher performance in odor identification

However, older adult participants with probable MCI and control subjects did not differ in odor detection or identification measured as threshold distance from the right nostril.

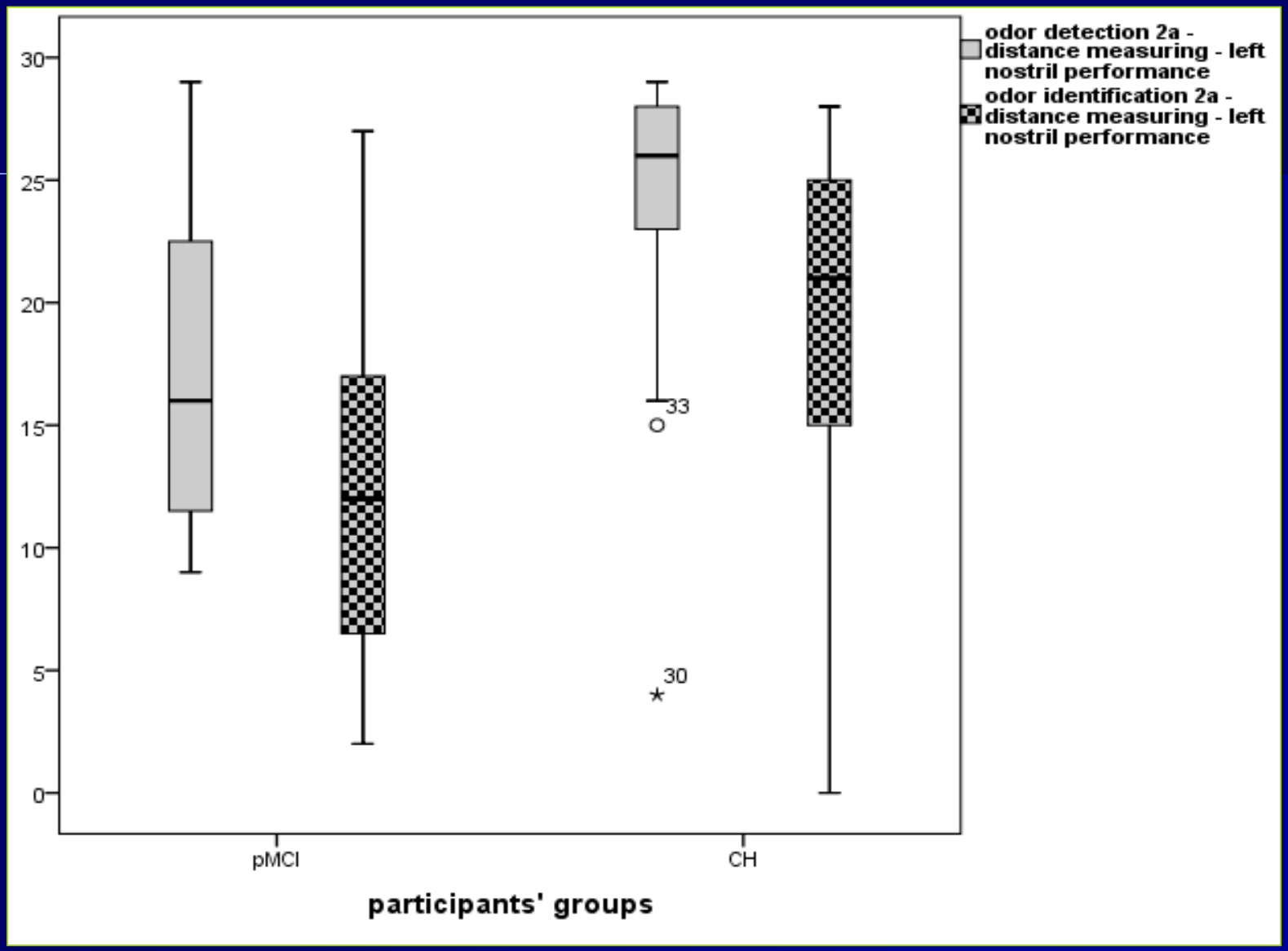
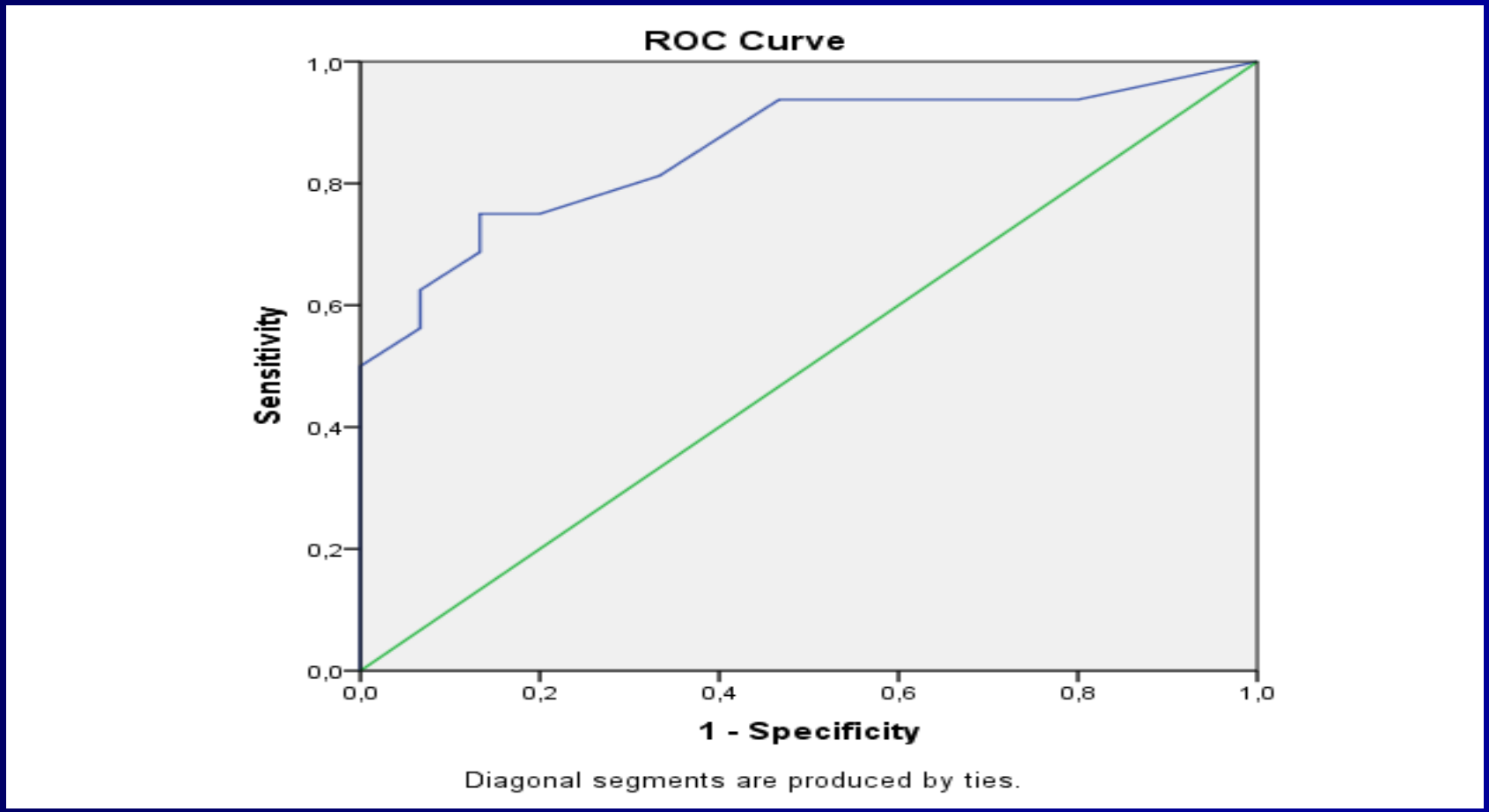

odor detection 2a - distance measuring - left nostril performance
odor identification 2a - distance measuring - left nostril performance
30
25
20
15
10
5
0
33
30
pMCI
CH
participants' groups

Figure 3. ROC curves computed to assess the ability of the score in the B-ODT condition of 'odor detection from the left nostril' to discriminate between CH and pMCI

AUC = 0.86, *p* = 0.001, 95%CI: 0.72-0.99; sensitivity: 75%, specificity: 87%, cut-off score: 22

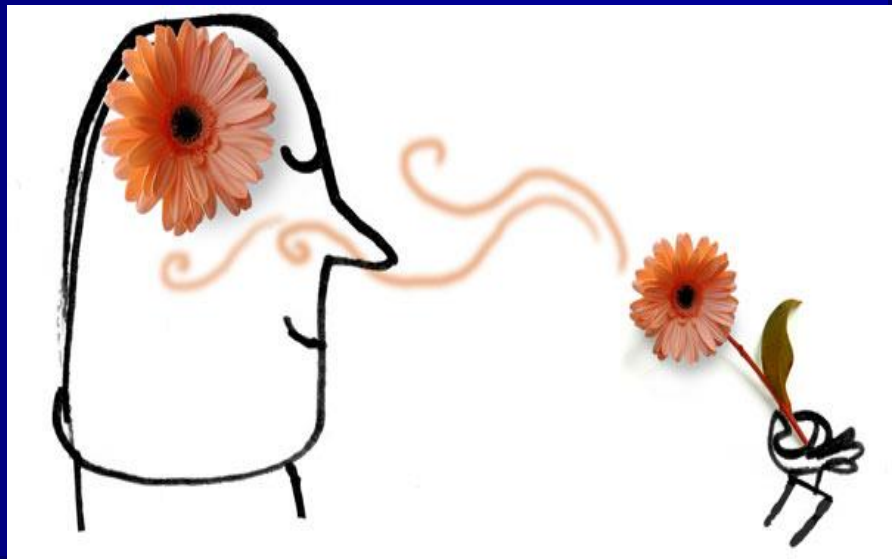


Conclusions

B-ODT can differentiate older adults with MCI and healthy controls ***(sensitivity 75%, specificity 87%),*** , in terms of odor detection sensitivity measured as odor detection distance from the left nostril while **odor identification distance from the left nostril appeared to be a simultaneous and highly interconnected to detection process**.

Early indicator

of medial temporal lobe degeneration (Kjelvik et al., 2014)



Thank you very much for your attention