

Cognition: Smell Identification and the risk of Alzheimer's Disease

It is estimated that there are currently over 750,000 people in the UK suffering from dementia (source - the Alzheimer's Society), with Alzheimer's Disease (AD) being the most common form of dementia amongst older people.

AD is a progressive, incurable illness, with the structure and chemistry of the brain becoming increasingly damaged over time. It begins slowly and at first, the only symptom may be mild forgetfulness, which can easily be confused with age-related memory change. For example, a person suffering from the early stages of AD may have trouble remembering recent events, activities, or the names of familiar people or things. With such a mild onset, most people are not alarmed by such changes and simply put them down to getting older. Indeed, for most people such changes are just that – a sign that they are getting older and they do not have AD. AD is not part of the normal aging process and gradually the sufferer's ability to remember, understand, communicate and reason will decline. Eventually, they require total care.

Unfortunately, scientists do not yet fully understand what causes AD. There probably is not one single cause, but several factors, including age, genetic background and lifestyle, that may lead to the disease developing. Of these factors, age is known to be the greatest risk. The disease does not usually manifest itself until after the age of 60 and the risk increases with age. The number of people with the disease doubles every 5 years beyond age 65 to the extent that nearly half of those people aged 85 years and over have AD (source - Alzheimer's Disease Education and Referral Center).

Although AD is incurable, an early, accurate diagnosis helps patients and their families plan for the future, allowing the patient to take an active part in such discussions before they become incapable of doing so. Also, there are some drug therapies available that can help alleviate the symptoms of AD, and an early diagnosis may offer the best chance to treat such symptoms.

However, the only definite way to diagnose AD is to find out whether there are plaques and tangles in brain tissue and such an examination can only be performed once the patient has died. Therefore, doctors can only make a diagnosis of "possible" or "probable" AD while the person is still alive.

There are a number of tools currently available to doctors to enable them to make a diagnosis including testing memory, problem solving, attention and language; brain scans and blood and urine tests.

It has been known for sometime that odour identification and detection problems occur early in the course of AD (Doty *et al.* (1987)). Neurofibrillary tangles appear in the olfactory regions of the brain leading to the concomitant effect of an impaired sense of smell. However, as Doty noted "surprisingly few (of the) patients were aware of their disorder, despite its appearance early in the disease process" (Doty *et al.* (1987)).

Tabert *et al.* (2005) from Columbia University, undertook a study in which the researchers aimed to develop an optimal subset of items from the University of Pennsylvania Smell Identification Test (UPSIT) related to the risk for AD. Data from UPSIT results in respect of 310 subjects (control = 63, patients with mild cognitive impairment = 147, patients with AD = 100) were analysed in order to derive a 10 item optimal subset. The items were found to be:-

- Lemon
- Lilac
- Leather
- Clove
- Smoke
- Strawberry
- Menthol
- Pineapple
- Soap
- Egg-like odour added to natural gas

The researchers found an incorrect response to each of these items was consistently associated with the risk for AD. As they noted "olfactory deficits, consistently observed in AD, occur early, are predictive of a future diagnosis and increase with disease severity". An odour identification test based on these 10 smells, that is simple to administer and can be repeated over a number of years can, therefore, be "a very useful tool in diagnosing AD and should be considered an important addition to the existing diagnostic test batteries" (Morgan *et al.* (1995)).

Doty RL, Reyes PF, Gregor T. Presence of both odor identification and detection deficits in Alzheimer's disease. *Brain Res Bull.* 1987 May;18(5):597-600

Tabert MH, Liu X, Doty RL, Serby M, Zamora D, Pelton GH, Marder K, Albers MW, Stern Y, Devanand DP. A 10-item smell identification scale related to risk for Alzheimer's disease. *Ann Neurol.* 2005 Jul;58(1):155-60

Morgan CD, Nordin S, Murphy C. Odor identification as an early marker for Alzheimer's disease: impact of lexical functioning and detection sensitivity. *J Clin Exp Neuropsychol.* 1995 Oct; 17(5):793-803