



THE ANALYTICAL STUDY TO FIND EFFECT OF SMOKING ON MEMORY USING THE M-ACE MEMORY SCALE

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ABSTRACT Smoking is widely recognised as a behavioural factor that can influence cognitive abilities, particularly memory. This short comparative project aimed to evaluate memory performance among 20 smokers and 20 non-smokers using the Memory component of the Mini-Addenbrooke's Cognitive Examination (M-ACE). Participants were assessed for immediate recall, learning ability, and delayed recall through the standard name-and-address memory task. These effects are linked to oxidative stress, reduced blood flow to the brain, and structural changes in memory, while nicotine may produce temporary alertness, chronic smoking is associated with faster cognitive decline and a higher risk of memory disorders. Understanding these effects highlights the need for early prevention and smoking cessation to protect long term memory performance.

KEYWORDS : memory, Cognitive functions, M-ACE Memory Scale, Attention, smoking.

INTRODUCTION

Smoking is one of the most familiar habits worldwide and continues to pose a significant threat not only to physical health but also to cognitive well-being. Cigarette smoke contains nicotine, carbon monoxide, and a cocktail of chemicals that disturb normal neural processing. Nicotine temporarily heightens alertness, but prolonged use alters neurotransmitter balance, affects vascular health, and increases oxidative stress. These mechanisms can subtly interfere with learning, short-term recall, and the consolidation of new information. The influence of smoking extends beyond the commonly recognized cardiovascular and respiratory consequences. One of the emerging areas of scientific interest is its effect on the brain, especially memory—a core cognitive function essential for learning, adaptation, judgment, and higher mental performance.

Memory is one of the most delicate cognitive functions, dependent on intricate neural network and healthy cerebral circulations. Memory integrity is vital for maintaining day-to-day functioning, professional efficiency, and overall quality of life. Everyday life quietly depends on this system – remaining faces, directions, conversations, or simply the placement of objects factors like age, lifestyle and environmental exposure can influence memory significantly and smoking remains one of the most discussed lifestyle contributors to cognitive weakening

उरः स्थानमुदानस्य नासानाभिगलांश्चरेत् ॥

वाक्प्रवृत्तिप्रयत्नोज्ज्विलवर्णस्मृतिप्रियः॥ (A.H. Su.१२/५)^२

Acc. To *Acharya Vaghbhatta*, along with above functions, *Srotopreenan*, *Dhyee*, *Dhriti*, *Smriti* and *Manovibodhana* are also the function of *Udan Vayu*. *Udan Vayu* is responsible for speech (*Vak Pravrutti*), Physical activities (*karma*) and Physical strength (*Bala*) of the body. Proper functioning of *Udan Vayu* maintains enthusiasm, energy, and the upward movement necessary for respiration and expression. Cognitive functions are governed by *Prana vayu* and *Udan Vayu* – subtypes of *Vata* responsible for higher mental activities, including intellect (*Dhi*) retention (*Dhriti*), and memory (*Smriti*). In the modern physiological context, *Udan Vayu* can be correlated with the respiratory and laryngeal mechanisms, neuromuscular coordination, and cellular energy metabolism. These functions collectively sustain vitality and physical performance. Disturbance of *Udan Vayu*, such as through habits like smoking, results in impaired respiratory efficiency, weakness, and reduced physical endurance. Cognitive functions are governed by *Prana vayu* and *Udan Vayu* – subtypes of *Vata* responsible for higher mental activities, including intellect (*Dhi*) retention (*Dhriti*), and memory (*Smriti*).

Cigarette smoking is a prevalent habit worldwide and has been associated with multiple physiological and behavioural impacts. Among its lesser-discussed effects is its influence on cognitive functions, particularly memory. Memory involves the processes of encoding, storing, and retrieving information, all of which depend on adequate neuronal functioning and cerebral oxygenation. Any factor

that compromises neural integrity or reduces oxygen supply may subsequently impair memory performance.

The **Mini-Addenbrooke's Cognitive Examination (M-ACE)** Memory Scale is a concise and reliable tool designed to assess immediate recall, delayed recall, attention, and memory fluency. By using this scale, researchers can pinpoint the early cognitive differences between smokers and non-smokers with greater precision. This study compares the memory performance of smokers and non-smokers using M-ACE, aiming to provide quantifiable evidence on how smoking habits shape memory-related cognitive domains.

AIM

To compare the memory of smokers and non-smokers using the M-ACE cognitive scale.

Objectives

1. To assess immediate recall performance in smokers and non-smokers.
2. To compare total M-ACE memory scores between the two groups.
3. To determine whether smoking is associated with reduced memory performance.

Methodology

A comparative analytical study was conducted among adult participants divided into two groups: 20 smokers and 20 non-smokers. The M-ACE Memory Scale was selected due to its sensitivity and structured scoring system, which includes attention (0–4), immediate recall (0–7), fluency (0–7), visuospatial ability, and delayed recall (0–7).

All participants completed the same standardized testing sequence, following the original instructions from the M-ACE NZ Version a booklet provided.

Scores were recorded separately for immediate memory, fluency, visuospatial performance, and memory recall. Ethical standards were maintained, and participants were tested in a quiet environment to reduce distractions

MATERIALS AND METHODS

Study Design : - A short Analytical comparative study.

Sample Size : - 20 smokers
20 non-smokers

Inclusion Criteria:- Adults aged 18–40 years

Smokers who have been smoking for at least 2 years
Non-smokers with no past smoking history
Individuals willing to participate

Exclusion Criteria :- Alcohol dependence
Neurological illness

Psychiatric disorders
Use of memory-affecting medications

Assessment Tool: -

The M-ACE tool includes assessment of:

- Attention (0–4)
- Immediate recall of name & address (0–7)
- Verbal fluency (0–7)
- Visuospatial ability (0–5)
- Delayed recall (0–7)

Procedure

- Participants were oriented and given instructions.
- The M-ACE test was administered individually.
- Immediate and delayed recall tasks were recorded as per protocol.

Observations

Non-Smokers:-

Domain	% Score
Attention	92.50%
Memory	86.43%
Fluency	78.57%
Visuospatial	84.00%
Total Score	64.83%

Smokers:-

Domain	% Score
Attention	85.00%
Memory	47.86%
Fluency	47.14%
Visuospatial	69.00%
Total Score	45.00%

Non-smokers consistently scored higher in all domains of the MACE scale.

The largest differences were noted in Memory and Fluency, where smokers scored less than 50%, indicating substantial cognitive decline in these areas.

Attention was the least affected domain, with both groups showing relatively higher scores, but non-smokers still performed better.

Smokers also showed a considerably lower Total M-ACE percentage, reflecting overall reduced cognitive efficiency.

Statistical Interpretation

Smokers show substantial cognitive impairment in Memory and Fluency.

Attention is comparatively preserved but still lower than non-smokers. The cumulative score highlights a general decline in cognition among smokers.

The consistent superiority of the non-smoking group across every domain indicates that smoking may negatively influence multiple cognitive pathways.

RESULT

The statistical analysis demonstrates a clear cognitive performance gap between smokers and non-smokers.

Smokers had significantly reduced Memory and Fluency percentages, indicating difficulty in recall, verbal output, and executive functioning. The difference in total M-ACE score shows a substantial negative impact of smoking on cognitive health.

These findings strongly support that smoking is associated with poorer cognitive performance across multiple brain domain

Summary

The findings strongly indicate that non-smokers possess better cognitive functioning across all domains of the MACE scale. Smokers demonstrated deficits in memory-dependent tasks, verbal tasks, and visuospatial problem-solving, suggesting that chronic smoking adversely affects both short-term and long-term cognitive processes.

DISCUSSION

The present analytical study was conducted to compare the memory performance of cigarette smokers and non-smokers using the M-ACE

(Addenbrooke's Cognitive Examination) memory scale. The findings clearly indicate that non-smokers demonstrated higher scores across all memory domains, including immediate recall, delayed recall, verbal fluency, visuospatial memory, and overall M-ACE total score. In contrast, smokers consistently showed reduced performance, suggesting a negative influence of chronic smoking on cognitive functioning, particularly memory-related processes.

Nicotine and other toxins present in cigarette smoke are known to affect neurovascular function and oxygen delivery to the brain. Chronic exposure can impair synaptic plasticity, reduce hippocampal efficiency, and disturb neurotransmitter regulation, all of which play a crucial role in memory formation, retrieval, and cognitive processing. These neurobiological changes could explain the reduced M-ACE memory scores observed among smokers in the present study.

From an Ayurvedic perspective, these findings can be correlated with the functional disturbance of *Udan Vayu*, which governs higher mental functions such as memory, speech, cognition, and enthusiasm. Smoking produces excessive heat and dryness, leading to vitiation of *Vata*-particularly *Udan Vayu*-thereby impairing its karmas such as *Smriti* (memory), *buddhi* (intellect), and *Vak Pravritti* (speech expression). Thus, the reduced memory levels in smokers align with Ayurvedic theory, which associates unhealthy habits with derangement of *Vayu* and subsequent cognitive decline.

CONCLUSION

This study suggests that smoking has a damaging impact on memory, and that non-smokers consistently outperform smokers in all domains of the M-ACE scale. These findings highlight the importance of promoting smoking cessation to preserve cognitive health and support optimal functioning of *Udan Vayu* according to Ayurveda.

Limitation And Scope Of Study

As this study is conducted with specific age group and in small number of volunteers and factors such as duration of smoking, quantity of cigarettes per day, stress levels, and lifestyle habits may also influence memory performance. Future studies with larger samples and controlled variables are recommended to develop a deeper understanding of the mechanisms linking smoking and cognitive impairment.

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