Driving behavior of patients with mild Alzheimer’s Disease (AD) or amnestic Mild Cognitive Impairment (aMCI) carriers of the apolipoprotein e4 allele (APOE4)

Stathis E., Beratis I. , Kontaxopoulou D. , Fragkladiakis S. , Papageorgiou Technology, Papageorgiou C., Pavlopoulos V., Pavlopoulos T., Krougkis G., Tsoukias A., Papatriantafillou J., Stefanis L., Yannis G., Papageorgiou Technology, Kapodistrian University of Athens, Greece. Department of Transportation Planning and Engineering, School of Civil Engineering, National Technical University of Athens, Greece. Department of Transportation Planning and Engineering, School of Civil Engineering, National Technical University of Athens, Greece. Department of Psychology, National and Kapodistrian University of Athens, Greece.

BACKGROUND

• Although patients with AD maintain the ability to operate a vehicle, driving behavior is impaired and their driving profile is described as conservative (Papageorgiou et al., 2016).

• Previous research suggests that patients with MCI have also driving performance deficits, although generally considered safer drivers (Devlin et al., 2012).

• However, literature regarding the severity of driving impairments in MCI and mild AD has not yet reached a consensus.

• According to a recent meta-analysis, severity of cognitive decline appears to have important predictive utility over driving ability in patients with AD and patients with MCI (Hird et al., 2016).

• APOE e4 allele - a well documented genetic risk factor for AD - carriers have more severe cognitive impairments than non-carriers in MCI and AD.

AIM

Comparison of the driving behavior of patients with aMCI and mild AD carriers of the APOE4 with non-carriers.

METHODS

Participants

Table 1

Table 2

<table>
<thead>
<tr>
<th>Condition</th>
<th>Low Traffic</th>
<th>High Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOE4 carriers</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Average Speed</td>
<td>36.6 (7.4)</td>
<td>39.6 (6.3)</td>
</tr>
<tr>
<td>Speed Variation</td>
<td>9.9 (2.5)</td>
<td>11.7 (2.8)</td>
</tr>
<tr>
<td>Lateral Position</td>
<td>1.5 (0.2)</td>
<td>1.5 (0.1)</td>
</tr>
<tr>
<td>Lateral Position Variation</td>
<td>0.3 (0.04)</td>
<td>0.3 (0.04)</td>
</tr>
<tr>
<td>Heading Distance</td>
<td>548.0 (155.6)</td>
<td>542.8 (153.1)</td>
</tr>
<tr>
<td>Heading Distance Variation</td>
<td>244.9 (72.7)</td>
<td>227.9 (56.2)</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>2083.8 (757.5)</td>
<td>1997.7 (333.0)</td>
</tr>
<tr>
<td>Reaction Time Probability</td>
<td>0.3 (0.6)</td>
<td>0.3 (0.5)</td>
</tr>
</tbody>
</table>

Results

• Independent samples t-test indicated significant differences regarding driving behavior. After the Bonferroni application for multiple comparisons in low traffic volume no differences were depicted, however in high traffic volume APOE4 carriers indicated lower Speed Variation.

• Independent samples t-test indicated significant differences regarding cognitive functions only in episodic memory. No other significant differences were depicted between performances in neuropsychological measures. This result did not survive after the application of Bonferroni corrections.

CONCLUSION

• To our knowledge, this is the first study to investigate the possible effect of APOE4 to driving behavior.

• APOE4 carriers demonstrated lower speed variation in higher traffic volume, however, no differences were depicted in low traffic volume. APOE4 seems to challenge carriers in cognitively demanding conditions.

• Lower speed variation might be a compensatory mechanism utilized by carriers in order to avoid driving errors. More specifically, it is an indication of serialization of behavior in a multicomponent task which demands switching attention among various tasks.

• In conclusion, the driving simulator reported a difference which was not depicted through the thorough neuropsychological assessment.

• Future studies, should consider investigating the driving behavior of APOE4 carriers in preclinical stages.

Statistical Analysis

• Independent samples t-test indicated no significant differences regarding demographic characteristics, which allows performing comparisons between the two groups.

• Independent samples t-test indicated significant differences regarding neuropsychological assessment, specifically, it is an indication of serialization of behavior in a multicomponent task which demands switching attention among various tasks.

• In conclusion, the driving simulator reported a difference which was not depicted through the thorough neuropsychological assessment.

• Future studies, should consider investigating the driving behavior of APOE4 carriers in preclinical stages.

REFERENCES


• Papageorgiou C., Pavlopoulos V., Pavlopoulos T., Krougkis G., Tsoukias A., Papatriantafillou J., Stefanis L., Yannis G., Papageorgiou Technology, Kapodistrian University of Athens, Greece. Department of Transportation Planning and Engineering, School of Civil Engineering, National Technical University of Athens, Greece. Department of Psychology, National and Kapodistrian University of Athens, Greece.

Acknowledgements

This paper is based on two research projects implemented within the framework of the Operational Program Education and Lifelong Learning of the National Strategic Reference Framework (NSRF), under the Research Funding Project TRAÇÃO: Investing in knowledge society through the European Social Fund and the Greek National Funds, and the Framework Programme 7 (FP7) of the European Union (European Social Fund – ESF) and Greek national funds.