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# ABSTRACTS

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## Alzheimer's disease detection combining novel radiogenomics of ApoE, structural and function MRI

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**Introduction:** The most common type of dementia in neurodegenerative diseases is Alzheimer's disease (AD), is a progressive neurological illness that causes memory loss. Neurophysiological tests including the Montreal cognitive assessment (MoCA), mini-mental state examination (MMSE), and clinical dementia rating (CDR) Scores are used to identify AD. Neuroimaging studies T1-weighted MRI scans assessed brain structural abnormalities. AD patients had grey matter volume (GMV) loss in brain structures when structural MRI data were analyzed using voxel-based morphometry (VBM). Neuroimaging studies resting state functional MRI (rs-fMRI) -blood oxygen level dependent (BOLD) sequence for brain imaging was process using the seed-based analysis (SBA) method to analyse functional connectivity (FC) in Default mode network (DMN), Sensorimotor network (SEN), Executive control network (ECN), Language network (LN), Visuospatial network (VN) and Salience network (SAN). Late onset AD can be studied utilising the apolipoprotein E gene (ApoE). ApoE has four alleles: ApoE 1, 2, 3, and 4, with LOAD patients having either a homozygous or heterozygous genotype of these alleles. The genotypes, particularly ApoE ε4, are associated with a more significant risk for AD pathogenesis. The combination of genotyping and MRI neuroimaging is a promising avenue for research that starts with protocol optimisation. Objective: to differentiate changes in structural brain volumetric and rs-fMRI functional connectivity strength with the diagnosis of AD and HC by combining APOE Ɛ4 genetic variations.

**Methods:** Thirty participants with AD, n = 15, and healthy control (HC), n = 15, for MRI study and six participants (n=6) with AD, n = 3, and HC, n = 3 for APOE genotyping. In this study we categorised the participants using neuropsychological tests i.e., MoCA, MMSE and CDR. Structural and functional MRI brain imaging was performed to identify network areas affected by AD. Structural voxel-based morphometry (VBM) models, and CONN Toolbox, which analysed functional MRI using seed-based analysis (SBA) were performed. Genotyping was done by extracting the DNA from the participants' blood samples. The isolated DNA underwent PCR-RFLP. Then, the restricted enzyme RE AFIII for rs429358 and the HAEII for rs7412 were performed.

**Results:** There was decreased grey matter volume (GMV) and reduced functional connectivity among AD participants involving the frontal lobe and anterior cingulate gyrus in DMN, SEN, ECN, LN, VN and SAN. We detected three participants with homozygous ApoE ε4 negative genotype (non-carriers), which was consistent with HC genotype. We also detected heterozygous genotype ApoE ε4 positive carriers, which indicated LOAD.

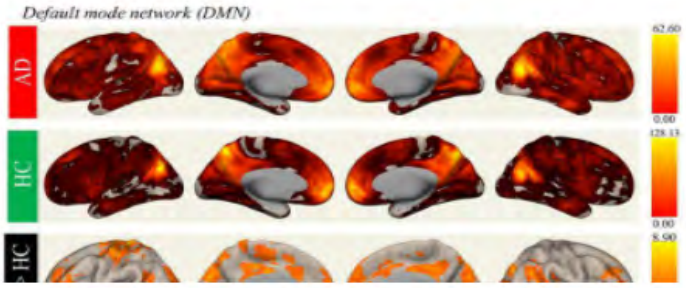

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Table 1: Comparison of sociodemographic and neuropsychological profile of AD with HC.

| Variable n=30 | | AD n=15 Freq. (%) | HC n=15 Freq. (%) | $X^2$ statistic[a] (df) P Value[a] |
|---|---|---|---|---|
| Demographic Data | Gender | | | 0.001 (1) 1.0 |
| | Male | 5 (33.3%) | 5 (33.3%) | |
| | Female | 10 (66.7%) | 10 (66.7%) | |
| | Education Level | | | 1.15 (1) 0.28 |
| | <6 years | 3 (20.00%) | 1 (6.67%) | |
| | >6 years | 12 (80.00%) | 14 (93.33%) | |
| | Marital Status | | | 0.37 (1) 0.54 |
| | Single | 1 (6.67%) | 2 (13.33%) | |
| | Married | 14 (93.33%) | 13 (26.67%) | |
| | | Min-max (mean ± SD) | Min-max (mean ± SD) | t statistic[b] (df) P Value[b] |
| | n=30 | n=15 | n=15 | |
| | Age Neuroimaging | 59-83 (70.6 ±8.55) | 60-82 (69.27 ±6.81) | -0.47 (28) 0.64 |
| | n=6 | n=3 | n=3 | |
| | Age Genotyping | 61-83 (73.67 ±12.7) | 60-79 (68±9.85) | -0.83 (3.77) 0.46 |
| Neuropsychological test scores. | MoCA | 0-22 (14.13± 6.82) | 23-30 (28.13± 2.20) | 7.36 (16.88) 0.001 |
| | MMSE | 0-29 (14.40±8.33) | 24-30 (28.09±2.17) | -13.26 (14.00) 0.001 |
| | CDR | 1-3 (2.13±0.92) | 0 (0.001±0.001) | 6.12 (15.89) 0.001 |

Note: AD: Alzheimer's disease group, HC: healthy control group, MoCA: Montreal Cognitive Assessment, MMSE: Mini-Mental State Examination, CDR: Clinical Dementia Rating Score.

[a] Chi-square test for independence *n*= Frequency *df*= Degree of Freedom with participant categories AD and HC

[b] independent *t* test for independence *n*= Frequency *df*= Degree of Freedom with participant categories AD and HC

**Conclusions:** There is altered GMV in VBM, decrease in brain activation and increase spatial activation size in rs-fMRI neuronal FC in some area of the brain with APOE ε4 carrier of AD Participants. Thus the imaging features of the AD participants are mapped well with their ApoE ε4 carrier status. Thus, we propose our radiogenomics techniques as a useful biomarker for the characterisation of AD patients.

**References**

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