

# **Diabetics and Insulin Resistant Patients, Especially Post COVID-19, Have an Increased Biologic Age From Analysis of Brain FDG PET**

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**Background:** Diabetics and Insulin Resistant (R) patients have greater risk of cognitive impairment, often exacerbated by COVID-19.

**Objective:** Report brain biologic age (AB) in diabetics and IR patients, particularly post long COVID-19.

**Methods:** Brain biologic age (AB) was determined from the Nuclear Brain Functional index (BFI) as:  $AB = 121.22 - (0.9634)(BFI)$ . This simple relation follows from the Gompertz-like nature of BFI we reported previously from brain FDG PET analysis. Cognition was also monitored with Montreal Cognitive Assessment (MOCA).

**Results:** BFI predicts maximal AB of 121.22 years, near the oldest human chronologic age. In eight near-normal, educated people, including a physician and a veterinarian, BFI was  $86.9 \pm 9.1$  years, indicating AB  $37.5 \pm 8.8$  years despite their chronologic age  $62.6 \pm 9.8$  years. In contrast 17 IR or diabetic patients had BFI  $45.7 \pm 9.6$  and AB  $77.2 \pm 9.3$  years ( $p < 0.00000004$ ) with chronologic age  $60.1 \pm 14.6$  years, similar ( $p = 0.6$ ) to the near-normals. Of eight patients (47%) with COVID-19, BFI was  $41.2 \pm 6.2$  vs. BFI  $49.8 \pm 10.4$  ( $p < 0.05$ ) for those without COVID-19. At least two of the long COVID-19 patients had growth hormone deficiency. One patient had Cushing's disease, two had prostate cancer, one thyroid cancer, and nearly all had hepatic steatosis and hyperlipidemia. The MOCA results of  $23.5 \pm 2.1$  in abnormal patients vs.  $26.8 \pm 2.1$  in near-normals, though significant ( $p < 0.005$ ), were much less sensitive than the larger differences in AB.

**Conclusion:** Biologic brain age of diabetics and IR patients with multiple comorbidities, including COVID-19, is remarkably compromised in comparison to near-normal patients.