

HEALTHY LONGEVITY GLOBAL COMPETITION

2024 Catalyst Awardees

Sponsor: Ministry of Health of Singapore

Harmonising Health: Investigating the Impact of Community-Based Group Aural Rehabilitation on Hearing Loss and Cognitive Preservation in Elderly Individuals

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PROJECT DESCRIPTION

Hearing loss is known to increase the risk of cognitive decline, however many older adults with hearing loss struggle to adopt hearing aids due to concerns about sound quality and discomfort. Therefore, this study explores the potential benefits of a novel community-based group intervention for elderly individuals with hearing loss. By involving elderly individuals who have recently been fitted with hearing aids in scenario-based communication exercises set in a simulated home environment, we aim to deepen their understanding of the link between hearing loss and communication difficulties. This understanding may motivate them to prioritise their hearing health, leading to increased hearing aid usage, improved communication skills, and a reduction in perceived hearing difficulties. Ultimately, this could lower barriers to social participation and promote longer-term engagement in community activities. To evaluate the intervention's effectiveness, we will administer surveys before and after the programme and track changes in participants' hearing outcomes. If successful, this innovative intervention model could be easily replicated and tailored for different communities and settings in Singapore, contributing to the broader goal of supporting active and dignified aging among our aging population.

Potential of Artificial Intelligence to Track and Predict Cognitive Impairment in Stroke Rehabilitation

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PROJECT DESCRIPTION

This project aims to develop an automated system for early detection and longitudinal monitoring of cognitive impairment in stroke survivors using natural language processing (NLP) and machine learning techniques. The

system will analyze spontaneous speech samples collected through an intelligent virtual agent to predict Montreal Cognitive Assessment (MoCA) scores. Key components include advanced automatic speech recognition models using transfer learning and fine-tuned foundational models, multimodal feature extraction incorporating linguistic, acoustic, and clinical metadata, and machine learning models (random forests, SVMs, deep neural networks) for MoCA score prediction and cognitive impairment detection. The system will also incorporate longitudinal tracking capabilities to monitor cognitive decline over time. A pilot study with 20-30 stroke survivors will validate the system against standard cognitive assessments, with performance evaluated using correlation coefficients, ROC curves, and classification metrics. The project aims to achieve a minimum correlation of 0.7 between predicted and actual MoCA scores and an AUC of 0.8 for detecting cognitive impairment. If successful, this non-invasive, objective approach could enable earlier intervention and more efficient utilization of healthcare resources for managing cognitive decline in stroke survivors.

Softer Meals that Impact the Life of the Elderly (SMILE)

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PROJECT DESCRIPTION

BACKGROUND

Age-related changes such as taste alterations, xerostomia, reduced mastication, poor dentition, and swallowing difficulties (dysphagia) negatively impact food consumption among the elderly. Dysphagia, affecting 30-40% of those over 65, is linked to impaired nutritional intake. Textured modified diets (TMDs) are recommended to maintain oral nutrition and prevent aspiration, but they often have lower energy and protein content, are sensory unappealing and have altered taste.

AIMS AND HYPOTHESIS

This study aims to: 1) Understand food preferences and evaluate food intake among elderly individuals with chewing and swallowing difficulties on TMDs, 2) Develop visually appealing, tasty and nutritious TMD soft meals using a novel enzymatic method, and 3) Assess the food intake and acceptability of these meals.

METHODOLOGY

This project will be conducted in 3 phases. Phase 1 is the profiling of elderly individuals on TMDs to understand their food choices, taste preferences and food intake. Phase 2 involves developing TMD soft meals based on elderly profiling, using an innovative enzymatic modification method. Phase 3 involves conducting a food intake study to evaluate the intake and acceptability of the developed TMD meals in phase 2.

FEASIBILITY AND IMPORTANCE TO SCIENCE

Collaborating with St. Luke's Eldercare (SLEC), this study will recruit elderly participants for all phases. The multidisciplinary approach, involving dietitians, speech therapists, geriatricians and kitchen chefs, aims to create TMD soft meals that are well-accepted, visually appealing, nutritious and safe for swallowing. The developed know-how can be adopted across various healthcare sectors.

Targeting tyrosine hydroxylase against alpha-synuclein relevant neurodegeneration in Parkinson's disease

Principal Investigator	Zhou Zhi Dong, MD & PhD
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PROJECT DESCRIPTION

Parkinson's disease (PD) is the second most common age-dependent neurodegenerative disease with progressive dopamine (DA) neurodegeneration in PD brains. PD results in high rates of disability and need for care, especially for elderly. α -synuclein (α -syn) is an established PD biomarker and therapeutic target. The α -syn protein is prone to form deleterious protein aggregates and is the primary structural component of Lewy bodies in PD patient brains, including sporadic and familial forms of PD. In preliminary study, we have shown that the neurotoxicity of wild type (WT) and mutant α -syn to DA neurons can be endogenous DA dependent and inhibition of Tyrosine hydroxylase (TH) by α -methyl-L-tyrosine (α -MT), a clinical grade competitive and reversible TH inhibitor, can rescue α -syn induced neurodegeneration of DA cells. α -MT is an orally TH inhibitor used for multiple human disorders, including hypertension-linked pheochromocytoma and Dystonia, Dyskinesia and Huntington's disease. The low dose α -MT treatment on human subjects has been shown to be safe with insignificant side effects even after prolonged time usage. Application of α -MT can protect against LRRK2 mutations and other PD factors induced DA neurodegeneration. We propose to test and validate whether early-stage application of TH inhibitor α -MT can protect DA neurons against WT and mutant α -syn induced DA neurodegeneration in our transgenic *Drosophila* and human midbrain organoid PD models. Successful execution of the current study and achievements from this project will help pave the way for future application of TH inhibition as a new therapeutic strategy against DA neurodegeneration in PD.