

**Oral Exercise with Lay Health Advisor Strategy on Oral Self-care  
Behaviors, Oral Hygiene, Oral Function and Quality of Life among  
Older Adults in Aboriginal Communities in Taiwan: A Randomized  
Controlled Trial**

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## BACKGROUND

According to United Nations statistics, the global population has reached 7.7 billion in 2019, and the population over 65 has reached 700 million, accounting for 9.3% of the world's total population [1]. Taiwan turned into an elderly society in 2018, with 3.31 million people over 65 years old, accounting for 14.1% of the country's total population. It is estimated that it will enter a super-aged society in 2025 [2]. Oral function will gradually degenerate with age; dental diseases, decreased chewing and swallowing functions, and decreased salivary gland function can also affect food intake, cause malnutrition and other problems, and the higher risk of chronic diseases. Elderly people with swallowing dysfunction and poor oral health are 2.6 times more likely to die than those with better oral health [3]. The number of teeth is a crucial factor affecting masticatory function. Several studies have also indicated that older people with fewer posterior teeth and fewer teeth overall are more likely to experience difficulty chewing [4, 5]. Dysphagia and masticatory performance may serve as pathways through which xerostomia affects quality of life [6]. A community-based educational program targeting oral function improvements in older people may be a promising strategy for improving OHRQoL.

Previous studies have highlighted a health disparity between aboriginal and general population[7-9]. The uneven distribution of access to medical resources and insufficient health professional manpower in remote aboriginal villages has led to such health disparities. The aborigines have poor oral hygiene habits and lower level of oral health-related knowledge than those in urban areas [10]. The aborigines living in remote areas have unique cultures, languages, and values. Betel nut is an indispensable item in the traditional society of Taiwan's aborigines. Betel nut chewers usually suffer from severe oral lesions and alveolar bone loss [11,12]. In addition, aboriginal people's dependence on alcohol and smoking rates are also higher than those of ordinary people.

Therefore, the incidence of oral diseases (such as dental caries, periodontal disease, missing teeth, etc.) is higher than that of the general population [13-15]. Lay Health Advisors (LHAs) are chosen from the community; they share similar values, ethnic background, and socioeconomic status, and speak the same language as the people they serve. They are also known as natural helpers and are recommended to provide emotional and social services to local health institutions and communities [16-18]. Its advantages are to save manpower, money and reduce language and cultural barriers. LHA intervention strategies have been widely used in the community-based program, such as cancer screening, smoking cessation, risk behaviors, and the delivery of health information [19-23]. A recent study using an LHA strategy in aboriginal communities in Taiwan has proved more effective than reading leaflets alone for reducing barriers toward oral cancer screening and increasing self-efficacy for oral cancer self-examination [24]. Another study [25] conducting a community-level LHA program that addressed oral health disparities in the access and utilization of dental caries preventive services for immigrant children in Taiwan. A 4-week LHA intervention with one-on-one lessons and experience-sharing proved more effective in improving immigrant children's decay teeth, immigrant mothers' dental caries-related knowledge and maternal preventive behaviors than reading only the brochure.

Employing LHAs strategy can be effective in improving access to care and delivery of health care services for groups that have traditionally lacked access to adequate health care. Oral exercise (i.e., neck exercises, salivary gland massages, and vocal exercises) can effectively improve the oral diadochokinesis (DDK) rate and reduces xerostomia, dysphagia, and poor masticatory performance [9]. Early oral function intervention may be a valuable and actionable target for older adults to maintain quality of life. This is the first study to use the Lay Health Advisor (LHA) strategy to improve the oral function of the older adults in aboriginal communities. In

the present study, we aimed to evaluate the effectiveness of community-based oral exercise with LHA intervention on the oral health-related quality of life, oral function and oral self-care behaviors.

## **METHODS**

### *2.1 Design*

A randomized controlled trial (RCT) was conducted. The participants recruited from aboriginal communities in Eastern Taiwan. Data collecting time was from 2019 to 2020. Participants from the identified communities were randomly assigned to EG or CG using random table.

### *2.2 Participants*

Participants who were 55 years old or above and indigenous people were recruited in the present study. Participants who were disability, have had oral cancer, impaired facial appearance and impaired cognitive function were excluded. Impaired cognitive function was screening by Short Portable Mental Status Questionnaire (SPMSQ). Participants were recruited according to the predetermined minimal sample size estimated based on a type I error = 0.05, power = 0.95, and effect size (ES)  $f = 0.25$  (medium effect in Cohen's  $f$ ) [26]. The number of samples in each group was expected 66 participants. An additional 30% drop out rate was added. The final number of samples for each group were required at least 86 participants. The total sample size was 122 and 118 in EG and CG, respectively.

### *2.3 Instrument*

A structured questionnaire was developed to collect data on demographics (i.e., age, sex, education level), oral function (i.e. swallowing, oral DDK, masticatory performance, saliva flow rate and perceived dysphagia), oral hygiene (i.e. plaque control record, plaque index and Winkel tongue coating index), oral self-care behaviors

(i.e. dental visit, tooth-brushing, and interdental brush) and OHRQoL. Items were reviewed by a panel of experts to assess content validity. The content validity index was 0.89–1.00. To ensure that the study participants understood the content, the questionnaires were pilot tested on 10 indigenous old adults. The reliability of each scale was assessed in terms of internal consistency. Swallowing was assessed with repetitive saliva swallowing test (RSST), masticatory performance was assessed using color-changeable chewing gum (Xylitol, 3.0 g; Lotte, Saitama, Japan) and /pa/, /ta/, and /ka/ syllables was assessed with oral diadochokinesis (DDK) test using KENKOU-KUN (Produced by TAKEI, japan dental supply).

#### *2.4 Outcomes*

##### *2.4.1 Oral health-related quality of life*

OHRQoL was measured using the Geriatric Oral Health Assessment Index (GOHAI), which was translated into Chinese for the participants (GOHAI-T) [27]. For example, “Are you satisfied or happy with the appearance of your teeth, gums or dentures?” Possible responses were range from 1 (always) to 5 (never). The total score ranged from 12 to 60 points. The higher the score, the better the quality of life. Cronbach’s alpha was 0.75 for the scale.

##### *2.4.2 Oral function index*

The Repetitive Saliva-Swallowing Test (RSST) was used to evaluate swallowing. Participants were asked to swallow saliva as many times as possible in 30 seconds [28]. For oral DDK, the participants were asked to repeat the /pa/, /ta/, and /ka/ syllables as quickly as possible, and the number of articulations was counted [29]. Using a digital counter, we separately counted the number of articulations of the /pa/, /ta/, and /ka/ syllables within 10 seconds. Masticatory performance was evaluated using the color-changeable chewing gum (Xylitol, 3.0 g Lotte, Saitama, Japan). This chewing gum contains xylitol, citric acid, and red, yellow, and blue dyes that change color when

subjected to masticatory forces from chewing. The red dye is pH sensitive and changes color under neutral or alkaline conditions. Citric acid maintains a low internal pH of the yellowish-green gum before chewing commences. The gum changes to red when chewed because the yellow and blue dyes seep into saliva, and citric acid elution produces the red color [30]. Participants were asked to chew for 2 minutes. Two minutes later, the observer checked the color of the gum by using a color chart of five color gradations ranging from 1 (very poor) to 5 (very good). Saliva flow rate was measured the saliva flow rate in one minute (ml/min). Participants were asked to chew the gauze for two minutes and spited out the gauze and saliva back into the test tube. After centrifuging the saliva of the gauze, pour the saliva into a measuring tube to measure the volume of the saliva. Perceived dysphagia, which was defined as a subjective perception of problems swallowing, was measured using the swallowing screening scale developed by Ohkuma [31] and has an internal consistency Cronbachα's alpha coefficient of 0.85. Examples of questions included “Do you ever have difficulty swallowing?” “Do you ever have difficulty as a result of cough up phlegm during or after a meal?” “Does it take you longer to eat a meal than it used to?” “Do you feel that it is becoming difficult to eat solid foods?” and “Do you ever have difficulty sleeping because of coughing during the night?” Possible responses were “obviously” (frequently), “slightly” (sometimes), or “no” (never). Respondents with at least one severe symptom were classified as having dysphagia.

#### *2.4.3 Oral hygiene index*

Plaque control record (PCR) was measured the percentage of tooth surface with plaque. PCR range from 0 to 100% [32]. Plaque index (PI) was measured the six indicator teeth 12, 16, 24, 32, 36, 44 and the score for each tooth is range from 0 to 3 (0 = no plaque, 1 = a film of plaque adhering to the free gingival margin and adjacent area of the tooth, 2 = moderate accumulation of soft deposit s within the gingival pocket,

or the tooth and gingival margin which can be seen with the naked eye, 3 = abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin). Then summing the average of 6 indicators teeth. Winkel tongue coating index (WTCI) [33] was measured the accumulation of coating on the surface of the tongue. The tongue was divided into six areas (three posterior and three anterior), and the coating was scored as 0 = *no coating*, 1 = *light coating*, or 2 = *severe coating*; scores ranged from 0 to 12 points.

#### *2.4.4 Oral self-care behaviors*

The question of dental visit, “Do you see a dentist every six months?” Possible responses were “Yes”, “No”. The question of tooth-brushing, “How many times do you brush your teeth a day?” Possible responses were “None”, “One time”, “Two times” and “More than 3 times”. The question of interdental brush, “Do you use an interdental brush every day?” Possible responses were “Yes”, “No” and “Never heard”. The question of flossing, “Do you use dental floss every day?” Possible responses were “Yes”, “No” and “Never heard”.

#### *2.4.5 Covariates*

This study examined age, gender and educational level as covariates.

#### *2.5 LHA recruitment and training*

A total of 30 people was recruited for LHA training. LHAs are recommended by public health center and tribal community building coordinator as a priority. Selection of LHAs were over 25 years old, indigenous people from the same community, communicated in indigenous language and had a driver license of motorcycle or car. Subsequently, all LHAs received 4-week 15-hour curriculums of training. The training manual was developed to educate the LHAs about association of common oral diseases and systemic diseases in older people, oral care for the older people, teaching principles and methods, working log and practice and final is communication skill. After 4 weeks

of training, 28 trainee LHAs passed the qualification exam and became certified LHAs.

### *2.6 Intervention*

Oral exercise intervention is designed to increase the range of movement in tongue, lips, and jaw as well as salivary gland massages, which will help speech and/or swallow functioning. All participants performed oral exercise before three meals a day, whereas the participants in the EG also received 4 lessons from a LHA over 4 weeks. Four lessons were taught one-on-one once a week by a certified LHA at the participants' homes. The lessons including understand oral structure, learn oral self-care skills and oral function promotion, understand the status of oral self-care and the relationship between oral diseases and systemic diseases, understand swallowing dysfunction and safe eating skills and review. Teaching tool including oral health leaflets, oral exercise video, dental model, magnets, stickers and oral care logbook. The participants in the CG received leaflets only.

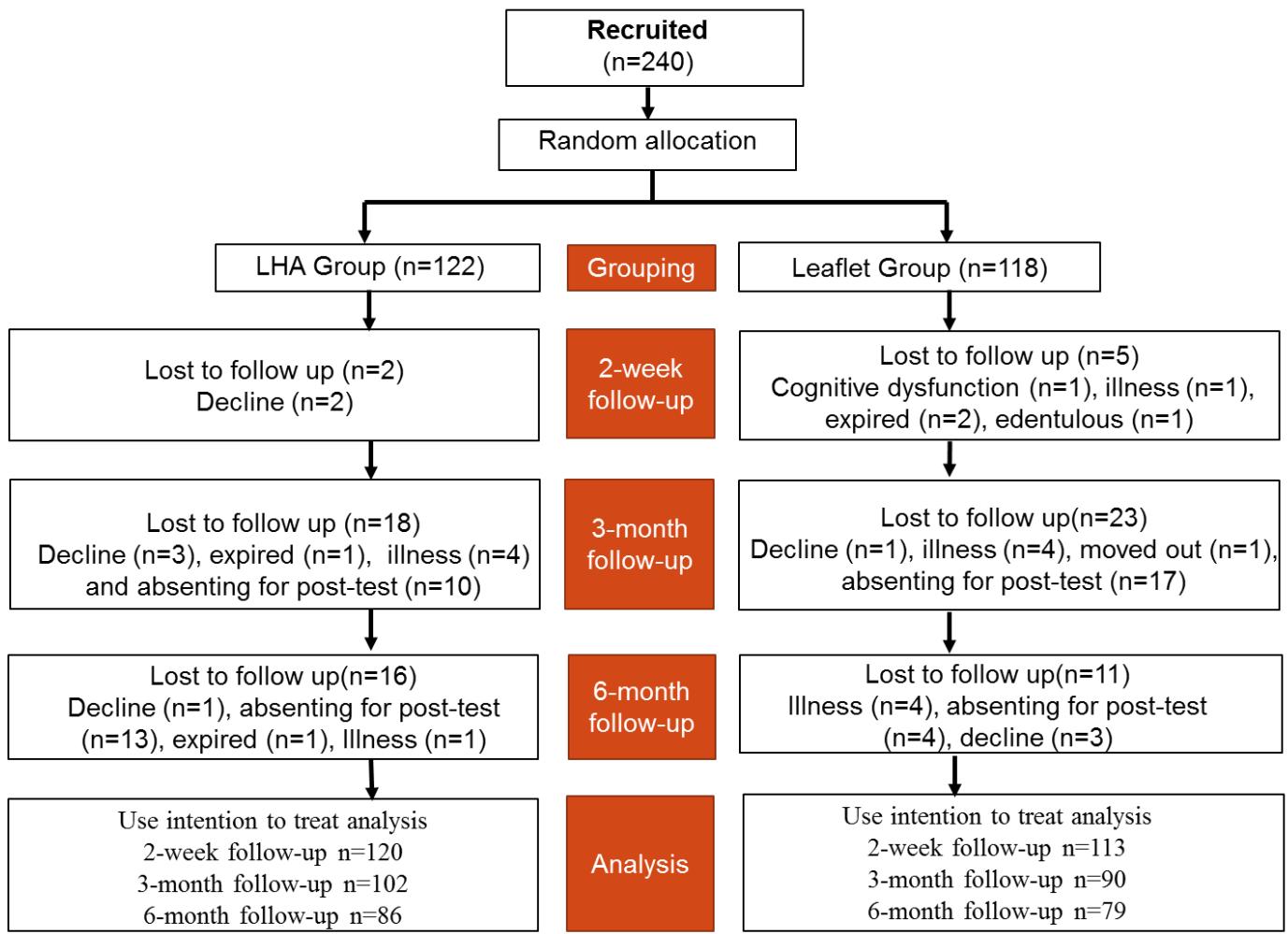
### *2.7 Data collection*

Data were collected by thoroughly trained interviewers during face-to-face interviews in accordance with standard protocol. Each interviewer attended a 1-hour training course on the standard process and data collection criteria before data collection. The data collection process comprised three steps. First, a dental hygienist recorded the PCR score, PI score, and tongue coating score. Second, a structured questionnaire was administered by an interviewer. The entire interview process took approximately 30 minutes. Finally, the research staff collected data on masticatory performance, assessed according to the results of participants chewing color-changing gum, and on /pa/, /ta/, and /ka/ syllables and swallowing. The inter-rater reliability for two dental hygienists was kappa=0.89.

### *2.8 Statistical analysis*

Stata 13.1 (StataCorp LP, College Station, TX, USA) was used for statistical

analysis. A chi-square test and two sample t test were used to compare the demographic variables of the EG and CG. A logistic regression model using generalized estimating equations (GEEs) analyzed the change in oral self-care behaviors between baseline and the follow-ups. Comparisons of OHQoL, oral function index, and dental hygiene index between the EG and CG were analyzed with a linear regression model using GEEs. The effect size (Cohen's  $d$ ) of continuous variables were calculated from the mean difference between baseline and the follow-ups within the EG and CG. An effect of 0.20 is small, 0.50 is medium, and 0.80 is large [26].



The CONSORT flow chart of participant recruitment

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## *Approval of Clinical Trial/Research*

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*Principal Investigator(s): Hsiao-Ling Huang*

*Co\_Investigator(s): Pei-Shan Ho 、 Ying-Chu Lin*

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*See the back of this page for the procedures for reporting unanticipated problems, or drug serious adverse reactions, or interim, and other important notes.*

*Hsueh-Wei Yen*

*Hsueh-Wei Yen, MD*

*Chairman*

*Institutional Review Board- I*

*Kaohsiung Medical University*

*Chung-Ho Memorial Hospital*

