

The Impact of An Innovative Summer Camp for Community Older Adults

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Research Article

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Abstract

Background

Healthy aging with dignity and aging in place are important concepts for most Taiwanese individuals, which can hopefully affect health policies. However, many elders have been encouraged to stay at home during the COVID-19 pandemic since January 2020. Consequently, most elders limited their social participation in a previous regular activity in the community center, which undermined the strategies for healthy aging. Few studies have explored how to promote or maintain holistic health and physical fitness for community elders during the COVID-19 worldwide. Therefore, this study aimed to establish and evaluate the impact of an innovative summer camp program for older adults in the rural community.

Methods

A quasi-experimental pre-post-test design was used. The innovative summer camp (ISC) was based on a standardized protocol of modified Baduanjin exercise combined with three recreation breathing games. Participants were recruited from three community centers around the western coastal Yunlin County between June and August 2020. ISC program was designed and demonstrated by the research team and conducted by each community care worker for 90 minutes per day, five days per week, for 12 weeks. The paired t-test was used to measure the physical biomarkers, pulmonary lung function, and health-related fitness changes.

Results

Sixty-eight participants completed this study. The findings indicated that the ISC program significantly improved elderly individuals' physiological biomarkers and health-related fitness, including reduced body weight, waistline, systolic blood pressure, and increased forced vital capacity, biceps arm flexion, sit and stand from a chair, step with a knee up in situ, and stand on one foot with eyes open. Besides wearing a facemask during the activity, almost all participants reported that they felt happy, satisfied and hoped that this program can be continued in their community center.

Conclusion

This pilot study supported the finding that a three-month ISC program can improve physical biomarkers and health-related fitness. The results strongly suggested that community care workers can employ the proposed ISC program as routine activity for community elders.

Background

According to the report of the World Health Organization [1], there are currently 1 billion people aged 60 years and above, which will increase to 1.4 billion and 2.1 billion by 2030 and 2050, respectively. This historically significant change in the global population requires adaptations to the way societies are structured across all sectors (e.g., health and social care) [1]. In Taiwan, the recent average life expectancy at birth was 81 years (male: 77.7; female: 84.2); however, the healthy life expectancy at birth was 71 years [2, 3]. This means nearly 10 years of life were spent disabled and of less quality before death. There is a huge gap between life expectancy and healthy life expectancy. Healthy life expectancy is a useful indicator of a population's overall health, reflecting the length of life as well as the quality of life. It also refers to an individual's length of life lived without limitations in conducting daily activities [4, 5]. Furthermore, in an aging society, as greater age puts increased pressure on social systems, extending a healthy life expectancy and shortening life expectancy with disability are becoming global priorities [6].

The ideal concepts of healthy aging with dignity and aging in their living place are gradually becoming a common ideology for most Taiwanese people and are included in all health policies [2]. Since 2010, the government in response to the WHO's initiative began the promotion of "age-friendly cities" suitable for the elders to live and work in peace. Through the 8 domains highlighted by the WHO, including social participation, community support, and health services, assisting county and city governments to inspect favorable and unfavorable living conditions for aging, and propose effective improvement programs are currently implemented [2]. Taiwan is a free marketing country wherein any adult who receives a certificate for long-term care training hours can be a community care worker (CCW), and the budget provided by the local government would assist them to establish access for elders in villages to bring them together in community activity centers for social participation via physical activity or providing free lunch meals.

Taiwan has implemented national health insurance, covering 99% of the population for more than 20 years now, and most of its citizens are highly satisfied with the program. However, non-communicable diseases, cancers, and cardiometabolic and lung diseases are collectively responsible for almost all deaths in the country. The increasing cost burden of the national health insurance program is becoming a challenge to the government. Some evidence supports that low pulmonary function is associated with low muscle mass or sarcopenia [7]. Several studies have indicated that adopting regular exercise has health benefits to the lungs and reducing the above-mentioned noncommunicable diseases, especially in the aging population [2, 8]. Therefore, some sports experts have coined the term "health fitness" to emphasize the importance of preserving the body's health-related aspects and components of fitness targeted at sustaining the body's well-being, which is especially important for the elders. There are four factors of health-related fitness: cardiopulmonary endurance, muscle strength, body flexibility, and body fat percentage [2, 3, 9].

Due to the effects of aging on the central nervous system, there exists an imbalance in the body's coordination capacity. Hence, the prevention of falls is an important issue among the elders. Moreover, aging is accompanied by changes in lung function due to factors such as loss of lung elasticity, weakened respiratory muscles, and decreased surface area for alveolar gas exchange. Thus, lung function parameters such as FVC (forced vital capacity) and FEV1 (forced expiratory volume in 1 second)

decline with age [10, 11]. Some previous studies and systematic reviews have indicated that the traditional Chinese exercise, Baduanjin (also called the eight-section brocade), significantly improved the physical and mental health of the elderly (e.g., reducing lower back pain, symptoms of knee osteoarthritis, obesity, depression, blood pressure, waistline, frailty, static and homeostasis, cardiopulmonary endurance) [12–15]. Baduanjin is a very popular Chinese exercise, characterized by low-intensity aerobic exercise that consists of eight simple, safe, slow, coordinative, and sequential movements [16, 17].

Furthermore, the literature has indicated that singing can affect health and well-being [18, 19, 20]. For instance, in Japan, Miyazaki and Mori have found that frequent karaoke training improves respiratory function in elderly people [18], and singing has also shown widespread beneficial effects on health and well-being [19, 20]. This was confirmed by a longitudinal study conducted by Batt-Rawden and Stedje [19] in older people in Norway. They observed that singing interventions could be a vital component for the enhancement of health, well-being, and quality of life for elderly adults; its effects include reduced uneasiness; increased comfort, well-being, and joy; and improved sleep. Moreover, they believe that singing potentially reduced the need for medications and prevented accidents among their nursing home residents. According to them, singing in groups as a way of social connection enhanced the elders' sense of identity and belonging and thereby increased their self-esteem and promoted social inclusion [20].

Social participation through engaging in community physical activities is an important routine for the older adults, and the proportion of individuals aged 65 years old in Yunlin county is 19.1%, which is the second-highest in Taiwan [3]. Additionally, this figure is over 25% in many townships in the western coastal area. Many elders have been encouraged to stay at home due to the COVID-19 pandemic since January 2020. Consequently, most elders had to cut down on their previously regular physical exercise in the community center. As part of measures to prevent COVID-19 infection since January 2020, all citizens were mandated to wear facemasks in public and practice frequent hand washing [19]. Taiwan is one of the few countries where the societies are functioning normally due to the low infection rate on June 2020 [20, 21]. Therefore, this study aimed to establish an innovative summer camp (ISC) program and evaluate its effects on physiological biomarkers and health fitness in the community older adults.

Methods

Study design and participants

A one-group, quasi-experimental, pre-post-test study design was applied in three rural villages in Yunlin County. Participants were recruited from three community activity centers between June and August 2020. The research team designed the ISC program 12 weeks before conducting this summer camp, with a standardized protocol of modified Baduanjin exercise combined with three recreational breathing games. Each week, the ISC program conducted by the research team took approximately 90 minutes, including 30 minutes of the modified Baduanjin exercise, 30 minutes of table tennis blowing games and elephant-trunk paper flute (a similar pulmonary rehabilitation game that was designed by the research team), and 30 minutes of karaoke competition (a type of interactive entertainment developed in Japan in

which participants sing along to recorded music using a microphone). Furthermore, we also video recorded and shared the activities via YouTube and used this to train the CCWs for the other four days' activities weekly.

The three CCWs had received certification from the local government following 90 hours of long-term care training on the prevention of disability or slowing aging. The inclusion criteria were as follows: (1) fully independent in daily activities and able to walk to the community center, (2) age > 65 years and able to communicate in Mandarin or Taiwanese, and (3) agreed to participate in this study and signed the informed consent form. The exclusion criterion was attending less than 70% of the ISC program.

Measurements

(1) *Demographic characteristics*: These included age, sex, education level, and living arrangement. We also assessed the health condition, including blood pressure and pulse rate, before the study.

(2) *Lung function test*: This was performed by a certified respiratory therapist and experienced technician (MH, first author) using an automated flow-sensing spirometer (Pony Fx-EN13485 is the new generation of desktop lung function tester developed by COSMED) based on the American Thoracic Society recommendations [10]. Three indices were frequently used by the clinicians to identify airway diseases: (1) forced expiratory vital capacity (FVC), which refers to the total amount of air that an individual can exhale in one breath, (2) predicted FVC value (%), and (3) forced expiratory volume in one second (FEV1)/FVC ratio (%) [11].

(3) *Health-related fitness assessment tool*: Based on measures for the implementation of National Fitness Testing by the Ministry of Sports Education for the elders, the checklist was mainly focused on the assessment of participants' cardiopulmonary function and physical fitness: (a) upper limb muscle strength and endurance (duration times of biceps arm flexion for 30 seconds); (b) leg muscle strength and endurance (duration times of sitting and standing for 30 seconds); (c) cardiorespiratory endurance (duration times of raising the knee and stepping on the spot for 2 minutes); (d) shoulder softness (back grasp test); (e) lower limb softness (sitting on the chair and bending forward); (f) static balance ability (stand on single foot with the eyes open); (g) physical agility and dynamic balance ability (standing from a chair, moving around objects, and returning to the chair). According to the standardized test by the Ministry of Sports Education [9], points were based on the participant's sex, and age, wherein values from 1 to 5 were "very weak, weak, normal, good, very good," respectively.

Procedure and ethical consideration

This study was approved by the institutional review board (IRB 201900222A3). Before conducting the study, the research team (e.g., one family physician, two nursing staff, one respiratory technician, one physical therapist, and five senior nursing students) conducted a general health assessment via a checklist (e.g., How are you feeling today? Did you have breakfast? Measuring the participant's blood pressure, temperature) to determine whether he/she was eligible to participate in this program. The checklist was recorded and followed up by a CCW for another four days per week. The study's purpose

and procedures were explained to all participants and three village leaders and CCWs. The village leader sent messages regarding the information and invited individuals to participate in this study. Upon agreeing, one-to-one measurement was conducted at each community activity center before and after this study.

The research team described the study procedures to all participants, including opening the windows, wearing surgical facemasks except when drinking water or participating in recreational breathing games, keep social distance, the procedure of the lung function test, and health-related fitness [22, 23]. The ISC program was 90 minutes per day, five days a week for 12 weeks. As long as the elderly are willing to participate in interpersonal interaction, they are positively encouraged. On day 1, after the research team demonstrated the procedures, and each CCW followed the ISC protocol with the recorded video material for the other four days. Besides, the three CCWs were taught how to assist the elders in checking their blood pressure via the automated oscillometric monitor (Omega 1400; Orlando, Florida, USA) every morning, temperature, frequent hand hygiene, drinking water, and using the toilet during each session. During the post-test, we asked a general question to all participants “how do you feel/are you satisfied with this program?” The answer was descriptively recorded.

Datal analysis

Based on a two-tailed t-test (Cohen, 1992), the sample size was set at 55, which was calculated by the G^{*} power 3.1.9.2 version, when the effect size = 0.4, α = 0.05, and power = 0.90. Considering the 20% retraction rate, 82 participants were recruited for this study. The paired t-test was used for the mean difference on physiological biomarkers (e.g., blood pressure, waistline, body mass index, three lung function parameters, and health-related fitness changes). Data analyses were conducted using SPSS 20 (IBM SPSS, Armonk, NY: IBM Corp).

Results

Demographic characteristics

The criteria were met by 85 elderly individuals at the beginning of the study, of which 13 were excluded due to attending < 70% of the program and four moved to a different county. Finally, 68 participants completed the study. The mean age of the participants was 74.7 years (standard deviation, 9.8). Most participants were women (68.2%), 43.5% were illiterate, and 38.8% were living alone (Table 1). We further compared the differences between incompletely and completed (17/68) participants based on their demographic characteristics (age, sex, and educational level), pretest physiological biomarkers, lung function test, and health-related fitness between. There was no significant difference between both groups, except the SKU. The mean steps were higher in the incompletely group than those in the completed group (t = 2.71, p < .01).

Table 1
Demographic characteristics and health-related behaviors (N = 85).

| Variables | N (%) |
|-------------------------|--------------------------------------|
| Gender | |
| Female | 58 (68.2) |
| Male | 27 (31.8) |
| Age (years) | Mean = 74.8; SD = 9.4; Range 65 ~ 90 |
| Education level (years) | |
| Illiterate | 37(43.5) |
| ≤ Middle school | 37 (33.5) |
| ≥ High school | 11 (13.0) |
| Living arrangement | |
| Alone | 33 (38.8) |
| Lived with others | 61 (61.2) |

Changes in physiological biomarkers and health-related fitness before and after the ISC program

Table 2 presents the participants' physiological biomarkers after the three-month intervention. The body weight ($t = 2.19, p < .05$), waist circumference ($t = 3.97, p < .001$), systolic blood pressure ($t = 4.01, p < .001$), forced vital capacity ($t = -4.44, p < .001$); forced vital capacity predicted ($t = -4.09, p < .001$), and forced expiratory volume in 1 second predicted ($t = -4.51, p < .001$) were significantly improved. As shown in Table 3, participant's biceps arm flexion ($t = -3.01, p < .01$), sit and standing from a chair ($t = -4.99, p < .001$), stepping with a knee up in situ ($t = -4.31, p < .001$), and standing on one foot with the eyes open ($t = -2.57, p < .05$) were significantly increased after the three-month intervention.

Table 2
Physiological biomarkers changed before and after the summer camp program (N = 68).

| Variables | Before After | | <i>t</i> | <i>P</i> | 95% CI* |
|----------------------------------|----------------|----------------|----------|----------|---------------|
| | Mean (SD) | | | | |
| Body weight | 63.91 (11.38) | 63.18 (10.94) | 2.19 | < .05 | 0.06 ~ 1.39 |
| Body mass index | 25.97 (3.86) | 25.98 (3.87) | -0.02 | 0.983 | -0.44 ~ 0.43 |
| WC ¹ | 90.51 (9.34) | 88.68 (8.42) | 3.97 | < .001 | 0.91 ~ 2.76 |
| SBP ² | 138.82 (16.97) | 128.65 (22.25) | 4.01 | < .001 | 5.11 ~ 15.24 |
| DBP ³ | 72.85 (12.86) | 73.69 (12.31) | -0.57 | 0.572 | -3.78 ~ 2.11 |
| Pulse rate | 78.34 (11.80) | 77.99 (12.11) | 0.36 | 0.720 | -1.61 ~ 2.31 |
| FVC (L) ⁴ | 1.98 (0.70) | 2.19 (0.76) | -4.44 | < .001 | -0.30~- 0.11 |
| FVC % predicted (L) ⁵ | 76.44 (18.05) | 83.38 (15.97) | -4.09 | < .001 | -10.33~- 3.55 |
| FEV1 predicted (%) ⁶ | 75.91 (18.15) | 84.19 (15.05) | -4.51 | < .001 | -11.94~- 4.62 |

*Confidence interval; ¹WC, waist circumference; ²SBP, systolic blood pressure; ³DBP, diastolic blood pressure; ⁴FVC, forced vital capacity; ⁵FVC%, forced vital capacity predicted; ⁶FEV1, forced expiratory volume in 1 second predicted.

Table 3
Health-related fitness changed before and after the summer camp program.

| Variables | Before | After | <i>t</i> | <i>P</i> | 95% CI* |
|-------------------------------------|----------------|----------------|----------|----------|----------------|
| | Mean (SD) | | | | |
| BAF (time/30 seconds) ¹ | 15.32 (5.79) | 16.54 (6.11) | -3.01 | .004 | -2.03 ~ -0.41 |
| SSC (time/30 seconds) ² | 12.88 (5.47) | 14.38 (5.79) | -4.99 | < .001 | -2.10 ~ -0.90 |
| SKU (time/120 seconds) ³ | 106.43 (48.25) | 122.40 (52.59) | -4.31 | < .001 | -23.36 ~ -8.58 |
| BST (cm) ⁴ | 14.32 (15.27) | 12.12 (16.56) | 1.57 | .121 | -4.99 ~ 0.60 |
| SFB (cm) ⁵ | 0.92 (11.41) | 0.79 (13.17) | 0.11 | .912 | -2.20 ~ 2.46 |
| SOF (seconds) ⁶ | 10.58 (10.94) | 11.86 (12.19) | -2.57 | .012 | -3.14 ~ -0.39 |
| GCB (seconds) ⁷ | 11.37 (6.20) | 12.46 (14.27) | -0.66 | .512 | -4.38 ~ 2.20 |

*Confidence interval; ¹BAF, biceps arm flexion (assess upper limbs muscle endurance); ²SSC, sit and stand from chair (assess leg muscle endurance); ³SKU, step with knee up in situ (assess cardiopulmonary function and aerobic fitness); ⁴BST, back scratch test (assess shoulder softness); ⁵SFB, sitting forward bending (assess lower limbs softness); ⁶SOF, stand on one foot with eyes open (access static balance); ⁷GCB, get up from the chair, and bypass items, then return back to seat (access physical agility and dynamic balance).

When we asked each participant the general question, “how do you feel/ are you satisfied with this program?”, 97.1% (*n* = 66) of participants responded positively that they were happy and satisfied with the program.

Discussion

This study explored the effectiveness of an ISC program that combined the modified Baduanjin exercise and three recreation breathing games for community elders. Owing to the small sample size and lack of a control group, this study could be considered as a pilot study to test regular yet important strategies in primary healthcare for the healthy aging population; therefore, further research using a larger sample is necessary.

The present findings showed that after the ISC program (90 minutes per day, five days a week, for 12 weeks in total), lung function parameters and health-related fitness were significantly improved in the older adults in the community. Previous studies showed that low pulmonary function was found to be associated with low muscle mass in community-dwelling older Korean adults. Moreover, forced expiratory volume in 1 second and forced vital capacity were positively correlated with appendicular skeletal muscle [7]. Although we did not measure sarcopenia or muscle mass change in this program, the short three-month intervention had significantly improved lung function parameters. The possible reasons might be

due to the ISC program which enhanced both upper and lower limb muscle endurance and maintained the cardiopulmonary function via the Baduanjin exercise and recreational breathing games. Further studies are needed to measure the change in muscle mass after the ISC program for both experimental and control groups.

The present findings also echoed those of a study in Japan by Miyazaki and Mori [18] which found that frequent karaoke training for elderly people significantly improved their Frontal Assessment Battery at the bedside compared with that in an active control group receiving scratch art training, improved tongue pressure, and pulmonary function, with a greater increase in FEV1. They also pointed out that frequent karaoke is beneficial for slowing cognitive decline and preventing dysphagia by sarcopenia. Although we did not measure cognitive function, almost all participants responded positively to this program (e.g., "I expect to come here again to see all of my friends... It is fun to play with friends... I love the interesting classes so much... I'm so happy when I sweat during exercise... I felt happy that I could sleep well every day after classes... I can learn much useful health education from all of you... I hope this class can be continued forever.") Only two participants complained, stating "I felt uncomfortable when wearing a facemask during exercise..." Furthermore, three CCWs also gave positive feedback, including "Thank you so much for teaching us how to handle the program... the recreational games are so funny and are not boring to the elder individuals... so... they love coming here... I felt they were happier than before... hope your team continues to support our village..."

Although some studies had challenged the safety and efficacy of wearing facemasks as a preventive measure for COVID-19, suggesting that both medical and non-medical facemasks are ineffective in blocking the human-to-human transmission of viral and infectious diseases, and wearing facemasks have been demonstrated to have substantial adverse physiological and psychological effects [23–25], in our present study, all participants followed the guidelines by wearing a surgical mask and maintaining social distance during the ISC program. This might be due to Taiwan's experience with SARS in 2003. With the simple and familiar songs played on the karaoke record machine or computer amplifier, many participants responded well to join this program. Hence, the research team strongly suggested that the ISC program be duplicated or selected as an activity in the community centers while following the COVID-19 prevention measures (e.g., maintaining a social distance of 1.5 meters to avoid droplet transmission). Further studies could explore what were the most favorite karaoke songs, the table tennis blowing and elephant-trunk paper flute with free chosen by each elder. Further studies should consider measuring the change in cognitive function after an ISC program.

Limitations

Despite the evidence to support the use of the proposed ISC program in improving elders' physiological biomarkers and health-related fitness changes and enhancing the subjective feeling of happiness and satisfaction with the program, some limitations were noted. First, the absence of a control group and the potential threats to the internal validity of the instrumentation must be considered, as these might limit the generalization of the findings. Thus, it is necessary for further studies to include a control group.

Second, the sample size was small. The population selection was not entirely random because all participants were from three communities and one county. Third, the potential for a social desirability response bias also needs to be taken into consideration.

Conclusions

The present study developed a standardized procedure for the implementation of an ISC as a 3-month intervention program that significantly improved body weight, systolic blood pressure, lung function, health-related fitness, and self-reported satisfaction, feeling of happiness among the elders in the rural community. The ISC program combined the modified Baduanjin exercise with three recreational breathing games and can be used to enhance social participation, physiological biomarkers, and health-related fitness. Indeed, this simple, low-cost program can be duplicated by other CCWs and elders at activity centers to improve their holistic health.

Abbreviations

ISC

innovative summer camp; WC:waist circumference; SBP:systolic blood pressure; DBP:diastolic blood pressure; FVC:forced vital capacity; FVC%:forced vital capacity predicted; FEV1:forced expiratory volume in 1 second predicted; BAF:biceps arm flexion; SSC:sit and stand from a chair; SKU:step with knee up in situ; BST:back scratch test; SFB:sitting forward bending; SOF:stand on one foot with eyes open; GCB:get up from the chair, and bypass items.

Declarations

Ethics approval and consent to participate

This study was approved by the institutional review board of the ethical committee of Chang Gung Memorial Hospital (IRB: 201900222A3). Participants who agreed to be interviewed completed and returned a consent form.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests

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The project did not receive any funding.

Authors' contributions

MY, MC, CH, YL and TH contributed in designing the project. MY, and CH collected data. MC and CH drafted the manuscript and performed the statistical analyses. YL and TH participated in interpretation of results and provided critical review of drafts. All authors read and approved the final manuscript.

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