

Article

Impact of Aerobic and Strengthening Exercise on Quality of Life (QOL), Mental Health and Physical Performance of Elderly People Residing at Old Age Homes

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Abstract: Background: The COVID-19 infection spread rapidly in Malaysia, and elderly people with underlying comorbidities were affected most. The study aimed to determine the effect of exercise on QOL and mental health among elderly people residing in old age homes during the COVID-19 pandemic. Methods: Out of 178 older adults from old age homes in Kedah and Penang States, 39 respondents undertook aerobic and strengthening exercises. A single group pre-test and post-test study was conducted in one government home and nine private homes in the northern region of Malaysia. The DASS-21 scale was used to assess mental health, and the WHOQOL-BREF questionnaire was used to evaluate QOL. Results: After 12 weeks of the exercise programme, scores for the physical domain increased from 53.1 to 61.8, for the psychological domain from 51.8 to 59.3, for the social domain from 53.2 to 60.5 and for the environmental domain from 67.2 to 72.1. Moreover, there was a significant reduction in the depression score from 6.2 to 4.4, the anxiety score from 3.5 to 2.2 and the stress score, from 4.6 to 2.8. Conclusion: Performing aerobic and strengthening exercises for a minimum of 12 weeks may have helped to improve mental health among the elderly during the COVID-19 pandemic, and it may also improve the quality of life for those who are residing in old age homes.

Keywords: exercise; elderly; quality of life; mental health

1. Introduction

Coronavirus disease 2019 (COVID-19) affected millions of people worldwide, and was officially declared a pandemic by the World Health Organization on 11 March 2020 [1,2]. The first case of COVID-19 was detected in Malaysia on 25 January 2020, and the government implemented the Movement Control Order (MCO) from 18 March 2020 to 31 December 2021 in order to reduce disease transmission [3].

During the MCO period, the movement of people was restricted, and this caused a strong impact on the economy, sport and tourism. The COVID-19 infection spread rapidly, and people with underlying comorbidities and the elderly were affected most [4–6]. Fear and worry related to COVID-19, as well as social isolation because of nationwide lockdown, caused negative emotions among people [7–9]. Different countries adopted quarantine successfully in order to contain the rapid spread of the coronavirus. Separation from family or friends, disturbances in sleeping and eating, worsening chronic conditions, increased alcohol consumption and substance use, worry and stress over the coronavirus, and fear of

uncertainty were associated with poor mental health and well-being for patients as well as the general population [10,11].

QOL can be subjectively considered as a measure of happiness; however, a multidimensional view of the quality of life was proven to be important, especially in health [12,13]. According to the WHO, quality of life can be defined as an individual's perception of their position in life based on culture and value systems, and it is related to their goals, expectations, standards and concerns [14]. Physical health, psychological state, personal beliefs, social relationships and relationship with the environment were identified as important determinants for QOL in [15]. Changes in lifestyle, inadequate physical activity, consuming insufficient fruit and vegetables, wearing a face mask, delay in obtaining medical care and social isolation were shown to have huge effects on QOL for older adults during the pandemic [16]. Many elderly people were not able to access adequate food due to functional limitations, transportation issues, fear of COVID-19 exposure and poor knowledge relating to technology [17]. One study found that elderly individuals in nursing homes and care homes had a higher risk of COVID-19 infection, as these homes acted as incubators of infection [18]. Moreover, many homes were faced with financial difficulties during the pandemic, causing an increased burden on elderly care [19–21].

Physical activity is important for maintaining fitness, and exercise plays an essential role in promoting health-related quality of life for the elderly. Exercise was shown to improve emotional functioning and mental wellbeing in [22]. A study conducted by Hu et al., 2020, found a reduction in anxiety and depression even after a single session of exercise, and significant improvement was reported after engaging in rhythmic aerobic exercise of low-to-moderate intensity. Exercising for 15 to 30 min, at least three times a week for 10 weeks was also recommended [23]. Those who engaged in exercise showed better QOL than those who did not engage. A study conducted in Korea reported that those who performed resistance, flexibility and walking exercises attained better QOL scores than non-exercisers; it was noted that older people preferred to engage in walking exercise, followed by flexibility and resistance exercise [24]. Another study in Romania found that participants who engaged in aerobic exercise displayed positive effects in aspects of both physical and mental health, such as weight loss, higher self-esteem, improved sleep quality and higher confidence [25].

Aerobic and strength exercises are recommended to reduce the risk of falling for older people, according to the WHO [26]. Nonetheless, older adults with comorbid diseases considered themselves handicapped, and became physically inactive and more dependent on caregivers during the COVID-19 pandemic [27]. Based on data from previous studies, the quality of life of the elderly in old age homes was significantly poorer than that of the elderly living with family. A study carried out in Indonesia reported that the elderly living in the community displayed higher QOL scores than those in nursing homes, showing significant differences in mobility and daily activities [28]. Fiorelli De Almeida et al. reported that the QOL of the elderly who attended day care centres attained better QOL scores than those in nursing homes [29]. Many elderly individuals felt left alone unsatisfied with life in old age homes [30]. Malaysia may be transformed into an 'aged nation' in the near future, and the government is faced with special needs and challenges for the ageing population [31].

The psychological impact of COVID-19 was reported as significantly high in respondents with depression and anxiety [23]. Comprehensive care, which includes lifestyle modifications by engaging in regular exercise, should be considered for elderly individuals with mental health problems, especially during a pandemic. In this study we aimed to determine whether exercise can improve mental wellbeing and QOL among the elderly during the COVID-19 pandemic. Developing exercise which is easy to administer in residential settings may help to improve the wellbeing of elderly residents in old age homes. The mental-health-related information in this study may help to improve public awareness of the emotional needs of elderly people who are either from an underprivileged category or are unfortunate enough to be living apart from their families. Moreover, findings may

provide useful information for the Malaysian Government in developing programmes for the special needs of citizens aged 60 years and above. This exercise protocol can also be used as an easily accessible measure for individuals with mental disorders during the COVID-19 pandemic. There is limited scientific evidence of the experiences of the elderly to date, and of the QOL of the elderly residing in old age homes in Malaysia. Results may help to fill the research gap by providing information on QOL among depressed elderly individuals residing in old age homes.

2. Materials and Methods

Older adults above the age of 60 years residing in old age homes in northern Malaysia from Penang and Kedah States were selected as participants in this study. A total of 39 respondents with depression undertook exercise. This research used a single-group pre-test and post-test design, and respondents were recruited by convenience sampling from one government home and nine private homes in the northern region, from December 2020 to April 2022. Those who were younger than 60, ill, or mentally unstable, as well as terminally ill respondents, were excluded from the current study. QOL and mental health were assessed among the participants before and after the exercise programme. Participants were screened by a psychiatrist, and were included in the study after obtaining a green light to participate in the study. Informed consent information was distributed and explained in detail to the participants. Approval was obtained from all respondents before beginning the study. Two researchers had undergone training in administering questionnaires to avoid observer bias. The study was conducted in accordance with the standards of the Declaration of Helsinki and the AIMST University Human and Animal Ethics Committee (Ref: AUHEC/FOM/2020/03).

Exercise was introduced to 39 depressed elderly people from old age homes. The majority of respondents were females (53.8%), unmarried and single/divorced/widowed (61.8%), with primary education (30.8%), living alone (66.7%), without disability (51.3%), unable to receive visits from friends or relatives (61.5%), with no role in family decisions (69.2%), without a caretaker (59%), from a private home (71%) and with a comorbidity (94.9%). The age of the respondents ranged from 60 to 90, with a mean age of 70.5 years \pm 8.3. while BMI ranged from 16 to 28, showing an average BMI as 22.9 \pm 3.1). Those with mild and moderate depression accounted for 61.5% and 38.5% of participants, respectively; 41% and 5.1% reported mild and moderate anxiety, respectively; and 20.5% of respondents reported experiencing mild stress. The detailed characteristics of depressed respondents are shown in Table 1.

Mental health and QOL were assessed among residents of old age homes using the Depression, Anxiety and Stress Scale (DASS-21) and the WHOQOL-BREF questionnaire, respectively. Post-test data were collected at weeks 1, 6, 9 and 12 of exercise.

Table 1. Characteristics of the depressed respondents.

Variables	Frequency (n = 39)	Percent
Gender		
Females	21	53.8
Males	18	46.2
Marital status		
Unmarried	14	35.9
Married	11	28.2
Single/Divorced/Widowed	14	35.9
Education		
Primary	12	30.8
Secondary	9	23.1
Tertiary	3	7.7
No formal education	15	28.5

Table 1. *Cont.*

Variables	Frequency (n = 39)	Percent
Living condition		
Alone	26	66.7
With family	13	33.3
Disability		
Present	19	48.7
Absent	20	51.3
Visit by friends and relatives		
Present	15	38.5
Absent	24	61.5
Role in family decision		
Present	12	30.8
Absent	27	69.2
Caretaker		
Present	16	41
Absent	23	59
Type of home for aged		
Government	11	28.2
Private	28	71.8
Comorbidity		
Present	37	94.9
Absent	2	5.1
Depression		
Mild	24	61.5
Moderate	15	38.5
Anxiety		
Normal	21	53.8
Mild	16	41
Moderate	2	5.1
Stress		
Normal	31	79.5
Mild	8	20.5

By considering the confidence interval ((Z) as 95%, effect size (Δ) as 1.5, and standard deviation (σ) as 3, the minimal sample requirement was 32 depressed patients [32]. The formula used is given below:

$$n = (Z_{1-\alpha/2} + Z_{1-\beta})^2 \sigma^2 / \Delta^2$$

In this study, 42 respondents were screened by DASS-21 for depression. Three individuals dropped out of the study, and exercise was ultimately introduced to 39 elderly people with depression.

Depression, Anxiety and Stress Scale (DASS-21): Respondents were asked to complete 21 questions on the DASS-21 scale based on their last two weeks' experience [33]. The respondents who scored marked evidence of depression were recorded for introduced exercises and follow-up. DASS-21 is a reliable screening tool for mental health, especially for depression among the elderly [34]. It uses a 4-point Likert scale from 0 to 3 based on the severity of depression, anxiety and stress. The cut-off scores are presented in Table 2 [35]. Cronbach's alpha of 0.926 for the overall score of DASS-21 showed excellent reliability for its use as a screening tool in [36].

Table 2. Score criteria for DASS-21.

	Depression	Anxiety	Stress
Normal	0–5	0–4	0–7
Mild	6–7	5–6	8–9
Moderate	8–10	7–8	10–13
Severe	11–14	9–10	14–17
Very Severe	15+	11+	18+

WHOQOL-BREF Questionnaire: To assess quality of life, the WHOQOL-BREF questionnaire was used, and respondents answered questions related to four domains (physical, psychological, social and environmental) [37]. There were seven questions for the physical domain, six questions for the psychological domain, three questions for the social domain and eight questions for the environmental domain. The WHOQOL-BREF questionnaire exhibited acceptable evidence of internal consistency, showing a Cronbach’s alpha coefficient of 0.896 in [38]. Both English and Malay versions of the questionnaire were used in this study, based on respondent preference. The respondents were categorized into poor and satisfactory QOL, based on a 60% cut-off point [39,40]. Those with a total score of less than 60 percent were considered as unsatisfactory QOL, whereas those with a score of 60 or more were considered as satisfactory QOL.

Exercise Protocol: Strengthening and aerobic exercises were introduced to 39 respondents with mild to moderate depression. The exercise protocol was developed by an experienced geriatric physiotherapist, and is shown in Table 3. The exercise protocol was developed based on the earlier literature [41–43]. It was developed for the following reasons: (1) It was easy to administer in any residential and clinical settings without the need of resistance bands/dead weights, (2) minimal supervision was needed during exercise training and (3) this exercise can be performed by the elderly people themselves without supervision once they have mastered. In addition, two researchers from the team were trained by a geriatric physiotherapist for a period of two weeks to assess the mental health and implementation of exercise training among study participants. The assessors were competent in data collection and the implementation of the exercise training.

Table 3. Exercise protocol for elderly respondents.

	Exercise	Protocol	Duration
	Warm up		
1	Marching and brisk walking for 2 min at very low intensity on Borg scale (7–8 on scale).	Strengthening exercise Four sets per day, each set consisting of 10 repetitions; 1 min rest between each set; 3 days per week.	12 weeks
	Strengthening exercise Stepping on a stool (14 inch stool) in forward and sideways directions. Basic chair squat.	Aerobic exercise Intensity of exercise: somewhat hard on Borg scale (13 in scale); 3 days per week.	
2	Heel raising by holding a stable object. Heel walking. Aerobic exercise. Brisk walking.	Progression of exercise Strengthening and aerobic exercise will be progressed every 2 weeks by varying the intensity of exercise.	
	Cool down		
3	Marching and brisk walking for 2 min at very low intensity on Borg scale (7–8 on scale).		

Statistical Analysis: Data obtained from the study were analyzed using SPSS version 23. Descriptive statistics were used to identify the prevalence of DASS among

study participants. The normality distribution of obtained data was analysed using the Shapiro–Wilk test. A Wilcoxon signed-rank test was carried out to compare mental health status and QOL before and after the exercise programme. A p -value < 0.05 was considered a significant difference.

3. Results

Among the respondents, 62.9% expressed their QOL as unsatisfactory and 30.8% expressed it as satisfactory (Table 4).

Table 4. Overall quality of life among depressed elderly participants.

QOL	Frequency (n = 39)	Percent (95% CI)
Unsatisfactory	27	69.2 (57.1, 84.8)
Satisfactory	12	30.8 (15.2, 42.9)

The average QOL score was 62.1 (SD = 11.2) among the elderly respondents in old age homes, ranging from a minimum of 34.3 to a maximum of 89.3. The physical domain showed a high score of 94 and a low score of 36, with a mean of 65.2 (SD = 14.1). The psychological domain showed a high of 82 and a low of 31, with a mean of 58.3 (SD = 11.8). The score ranged from 0 to 100 for the social domain, showing an average of 53.3 (SD = 24.1). The environmental domain a high score of 94 and a low of 31, with a mean of 71.6 (SD = 13.5). In this study, the environmental domain showed the highest score, and Social domain showed the lowest score (71.6 vs. 53.3) among all four domains of QOL (Table 5).

Table 5. Frequency distribution of QOL score among different domains.

	Physical	Psychological	Social	Environmental	Overall QOL
Mean	65.2	58.3	53.3	71.6	62.1
Median	63.0	56.0	56.0	75.0	61.8
Mode	63.0	56.0	56.0	75.0	59.5
Std. Deviation	14.1	11.8	24.1	13.5	11.2
Minimum	36.0	31.0	0.0	31.0	34.3
Maximum	94.0	82.0	100.0	94.0	89.3

Domain 1—physical health; Domain 2—psychological; Domain 3—social relationships; Domain 4—environmental.

Exercise was introduced to 39 respondents with mild to moderate depression. Scores related to QOL and mental health were considered non-normal distributions, since the p -values of the Shapiro–Wilk test were less than 0.05. Skewness z -values were 0.086, -0.230 , -0.147 and -0.871 respectively for the physical, psychological, social, environmental domains of QOL, and were 0.710, 0.467 and 1.323 respectively for depression, anxiety and stress scores. Kurtosis z -values were -0.518 , -0.082 , -0.611 and 1.588 for the physical, psychological, social and environmental domains respectively and -0.715 , -1.024 and 0.825 respectively for scores related to depression, anxiety and stress. Visual inspection of the normal Q–Q plots showed data which deviated from the reference lines and non-normal distributions of QOL scores, as well as mental health scores.

The Wilcoxon signed-rank test was performed to test any significant differences in the scores related to four domains of QOL and mental health before and after the exercises [44].

The score for Domain 1 (physical) was statistically improved after exercise (Mdn = 58), as compared to the score before exercise (Mdn = 56) in 36 out of 39 respondents: $T = 678.5$, $Z = -4.937$, $p = 0.000$. For Domain 2 (psychological), the score after exercise (Mdn = 60) was statistically higher than the score before exercise (Mdn = 54) in 31 out of 39 respondents, showing $T = 547$, $Z = -4.764$, $p = 0.000$. Similarly, for Domain 3 (social), 32 out of 39 depressed elderly people had a higher post-exercise (Mdn = 65) score than pre-exercise

score (Mdn = 56); $T = 581$, $Z = -4.360$, $p = 0.000$. Regarding Domain 4 (environmental), a higher post-exercise score (Mdn = 74) was noticed among 27 respondents, compared to the pre-exercise score (Mdn = 69); $T = 425.5$, $Z = -4.505$, $p = 0.000$.

Out of 39 respondents, 36 showed a lower depression score (Mdn = 4) after exercise, as compared to the score before exercise (Mdn = 6). The Wilcoxon signed-rank test indicated that this difference was statistically significant ($T = 666$, $Z = -5.372$, $p = 0.000$). For the scores related to anxiety, 29 out of 39 were lower after exercise (Mdn = 2) compared to before exercise (Mdn = 3), and the difference was statistically significant ($T = 480$, $Z = -4.632$, $p = 0.000$). Similar findings were noted for stress: 31 out of 39 respondents indicated a statistically lower score (Mdn = 3) after exercise, compared to the score before exercise (Mdn = 4; $T = 546$, $Z = -4.799$, $p = 0.000$).

Based on these results, exercise can be considered an effective tool to improve QOL and mental wellbeing in the current study.

4. Discussion

The sociodemographic background of the depressed respondents in the current study indicated that the majority were women; without family support; were unmarried, single, divorced, or widowed; lived alone; did not receive visits from families and friends; had attained a primary education; and had comorbidities. A previous study reported that the risk of developing depression was 80% higher in individuals who lived alone, compared to those who lived with families or friends. Loneliness could increase the production of cortisol, which is also known as the stress hormone, and depression is associated with long-term loneliness and loss of social support. A study done by Kemal, 2012, indicated that poor education was a common risk factor for depression, especially in females [45,46]. Kang et al., 2015, and Nguyen et al., 2021, reported that a high risk of depression and anxiety was noticed in patients with underlying health conditions [47,48]. However, severe and very severe cases were not detected in our homes, as most residents already received regular treatment from doctors. The majority of nursing homes in the current study were run by private companies or individuals, and they offered medical and nursing care as well as recreational activities based on payment. Medical care can be provided by the respondents' GPs or a doctor from the nearest health centre, so that they can receive early treatment [49].

Life satisfaction has been positively related to socioeconomic status, adequacy of income, perceived health status, engagement in activities and social interaction [50–53]. The majority of respondents in the current study could not fulfil all these requirements, and this might have contributed to unsatisfactory quality of life. Compared to the studies done in Sabah and Sarawak, the average QOL score was lower in the current study. Elderly people in Sarawak were satisfied with their QOL, showing an average score of 90.17, whereas elderly people residing in rural areas of Sabah showed an average score of 65.2 [54,55]. The mean QOL score in the current study was 62.1, with the Environmental domain the highest and social domain the lowest among all four QOL domains. The higher QOL score in the other studies was probably due to time differences in study duration and the fact that findings were based on older people in the general population. The Sabah and Sarawak studies were carried out in 2015 and 2019, when COVID-19 was either nonexistent or not very prominent in Malaysia. Shrestha et al., 2018, reported that elderly people living with their families had better QOL than those who lived in care homes, especially because of low scores in the social domain [56]. The lowest score was in the social domain in our study, as many elderly people faced social isolation during the Movement Control Order (MCO) during the COVID-19 pandemic [57]. Our respondents were satisfied with their living conditions, showing higher scores in the Environmental domain. The greener and pollution-free environment in Kedah State might contribute to the favorable environmental conditions, as compared to urban areas. A similar finding was reported by a study done in rural populations [54].

All four domains of QOL were significantly improved after 12 weeks of aerobic and strengthening exercises in this study. Findings from this study supported findings from another study carried out in Brazil, in which people who engaged in exercise regularly for 16 weeks had higher QOL scores than a control group with sedentary lifestyles [58]. Active older people had greater self-efficacy, which was associated with better physical and mental health. In turn, they became more satisfied with life [59]. Regular exercise can improve outcomes beyond physical health. Greater social interaction and enjoyment in the performance of activities can enhance the quality of life [60]. Atad and Caspi, 2020, found that older adults who engaged in a minimum of 2.5 h exercise per week could achieve better physical health, and a higher level of physical activity was associated with increased quality of life [61,62].

Yao et al., 2021, suggested that low-frequency, long-term regular exercise was effective for those aged 60 year or older, in improving mental health [63]. Light physical activity such as walking, aerobic exercise, strength exercises and gardening was advised during the COVID-19 pandemic to reduce depressive symptoms among the elderly, by Callow et al., 2020 [64]. Regular exercise was found to protect against depression and to improve sleep quality among older people [65]. Exercise could reduce stress hormone levels as well as muscle tension, and could produce an anti-anxiety effect; anxiety scores were reduced after 12 weeks of the exercise programme, based on a meta-analysis. However, the score difference before and after exercise was greater in their findings (38.7 ± 5.6 and 33.7 ± 3.4) than in the current study (4.6 ± 2.9 and 2.8 ± 1.8) [66]. The nature of the homes, the age and sex of the residents, the availability of support, including caregivers, and the type and duration of the exercise programme may contribute to the differing results between the current and previous studies. Andréa et al., 2010, stated that stress coping capacity and daily activities were improved after exposure to aerobic, resistance, breathing and stretching exercises [67]. Scores related to depression, anxiety and stress were significantly reduced after a 12 week exercise programme in the current study.

5. Conclusions

The findings indicate that performing aerobic and strengthening exercises for a minimum of 12 weeks may help to improve mental health among the elderly, and may also improve the quality of life for those residing in old age homes. A regular exercise programme should be considered an essential component of healthy ageing, not only for those with depression, but also for every elderly person. A balanced diet, encouragement and attention should be provided for the elderly, along with exercise, for better outcomes. A similar study using a randomized controlled trial should be done in order to assess the effectiveness of the aerobic and strengthening exercises among the elderly living in care homes or living with their families, irrespective of mental health status.

6. Limitations of the Study

The lack of a control group presents a threat to research validity. However, a separate control group was not included in this research, as the study was conducted in an institutionalized setting; the elderly people were able to share their exercise protocol (social interaction) and start to introduce the exercise themselves, without our knowledge. Furthermore, a control group was not included in order to obtain an adequate sample size in the experimental group. It was difficult in practice to assemble a suitable control group, as many homes did not allow visitors during the COVID-19 pandemic. A future study will be conducted to explore the effect of exercise upon mental health and QOL among depressed elderly people, including a control group to support our conclusion.

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