

Modified Boxing Exercise for Improving the Balance and Gait Performance of Ageing Adults with Mental Disorders in Sheltered Workshop

Cyrus S H Lee

Physiotherapy Service
The Mental Health Association of Hong Kong

Abstract

Objective: To explore the feasibility of using modified boxing exercise for training to improve balance and gait performance in ageing adults receiving service in sheltered workshop with mild to moderate intellectual disability (ID) or mental illness.

Participants and Methods: Ten adults diagnosed with mild to moderate intellectual disability or mental illness, aged 40 or above and attending workshop were recruited to receive 36 sessions of 60-minute balance training through a set of modified boxing exercise which was designed by physiotherapist for 9 months. Outcome measures were Brief-BESTest total score and Timed "Up & Go" time. Paired Samples t-Test and Wilcoxon signed-rank Test of SPSS were adopted to analyze the data of pre- and post-test to compare the within-group differences.

Results: After training, significant within-group differences were found in both the pre- and post-intervention data for the total score of Brief-BESTest and Timed "Up & Go" time.

Conclusions: The results reveal that modified boxing exercise can have benefits on balance ability and improve gait performance in adults with mild to moderate intellectual disability (ID) or mental illness. More in-depth research is needed.

Keywords: Boxing exercise, Balance & Gait, Ageing, Intellectual disability, Mental Illness

Background

Individuals with intellectual disability (ID) would tend to have early onset of ageing. Dementia is more likely to develop by the age of 40 years for such population (Mimi et al., 2018). Studies shown that older people with dementia or ID have a higher chance of fall (Taylor et al., 2017; Axmon et al., 2019; Chen, 2006). Thus people with ID usually have earlier decline in balance and gait ability compared with normal population (Enkelaar et al., 2012).

Similar findings were observed in the mental illness cases. Studies illustrated that people with mental disorders in youth have tendency to speed up

ageing in middle age and a higher risk of developing other diseases and of dying earlier. (Richmond-Rakerd et al., 2021; Wertz et al., 2021). Gait, balance and posture disturbances commonly existed in mental illness cases who suffered from depression, anxiety and schizophrenia (Feldman et al., 2020). As a result, balance training is crucial to prevent fall and the related consequences such as fracture, functional decline, and decreased quality of life (Abraham, 2020).

Boxing can be used as a form of therapeutic exercise to bring various positive health effects for people with different diseases (Long & Robertson, 2020). Participants can improve the cardiovascular fitness, strength, body composition, eye-hand

Correspondence concerning this article should be addressed to Mr. Cyrus Lee, Physiotherapy Service, The Mental Health Association of Hong Kong, Unit 12C, 12/F, Harvest Moon House, 337-339 Nathan Road, Kowloon, HK.
Email: cyruslee@mhahk.org.hk

Modified Boxing Exercise for Improving the Balance and Gait Performance of Ageing Adults with Mental Disorders in Sheltered Workshop

coordination, agility, gait independence and gait speed through boxing training (Sánchez-Lastra et al., 2020; Shosha, 2020). Past studies examining the effect of using boxing therapy in balance training reveal that it is an effective tool on balance rehabilitation for patients with Parkinson disease (Combs et al., 2011; Morris et al., 2019) and Stroke (Park et al., 2017; Ersoy et al., 2021). However, there is a very limited study on the effect of boxing therapy for people with ID or mental illness (Weaver, 2013). Therefore, the purpose of present study was to evaluate the feasibility and efficacy of a 9-month modified boxing exercise training programme for improving balance and gait performance in ageing adults receiving service in sheltered workshop with mild to moderate intellectual disability (ID) or mental illness.

Materials and Methods

Design

This was a clinical-based pilot project primarily focusing on evaluating the benefits of boxing exercise for improving the balance and gait performance in clients with mental disorders in sheltered workshop. A one-group pretest-posttest quasi-experimental design was used for the evaluation. Informed consent was obtained from the participants.

Participants

Adults diagnosed with mild to moderate ID or mental illness, and aged 40 or above were

recruited from a sheltered workshop of The Mental Health Association of Hong Kong (Jockey Club of Community Creative Workshop). Participants were mainly from one training group which served the ageing clients. A convenient sample of fourteen participants was selected. All participants were able to walk independently with or without walking aids. There were four dropouts, and thus, 10 participants have completed all assessment procedures and intervention sessions (Figure 1).

Procedure

The participants completed 36 sessions of balance training over 9 months through modified boxing exercise with duration of 60 minutes in each session.

Balance training through Modified Boxing Exercise

Balance training was incorporated by the Modified Boxing Exercise in every session. Each session included THREE parts: Warm up period, Modified Boxing Training and Cool down period. Stretching and active joint mobilization of whole body involved head & neck, trunk, upper limbs and lower limbs were performed during the warm-up and cool-down period last for 10 minutes separately (Figure 2). In the Modified boxing training, each participant would do 5 types of boxing related exercise. The exercises included Standing Jab (Figure 3), Walking Jab-forward/side to side/backward (Figure 4), Jab in feet together (Figure 5), Jab the throwing object (Figure 6) and Jab Receiving (Figure 7).

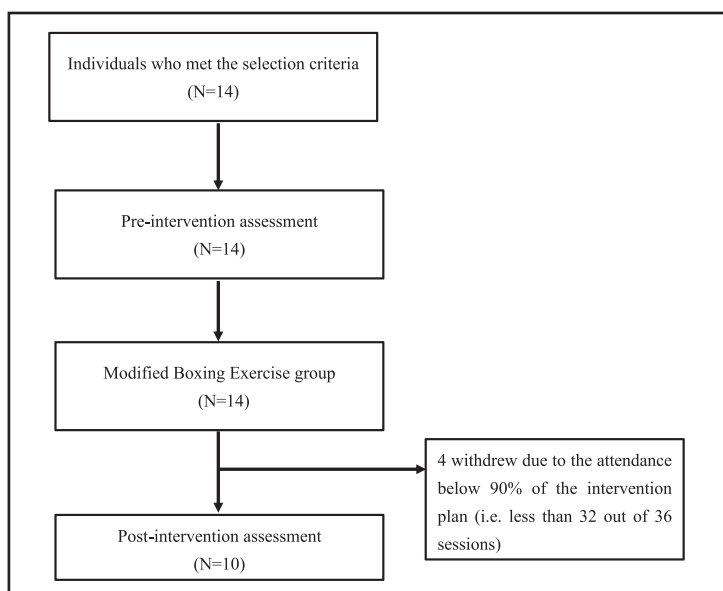


Figure 1: Flowchart of present study



Figure 2: Warm-up/Cool-down period



Figure 3: Standing Jab



Figure 4: Walking Jab (side to side)



Figure 5: Jab in feet together



Figure 6: Jab the throwing object



Figure 7: Jab Receiving

Modified Boxing Exercise for Improving the Balance and Gait Performance of Ageing Adults with Mental Disorders in Sheltered Workshop

For the Standing Jab, participant was instructed to punch the pad in standing position and maintain dynamic balance. In the Walking Jab, participant needed to do a dual task for hit the pad during walking in 3 different directions (forwards, side to side or backward). Based on the past studies, dual-task training in older adults can improve balance and walking speed (Varela-Vásquez et al., 2020).

Jab in feet together is a task very similar to the functional reach test, designed to improve participant's limit of stability. Jab the throwing object challenged the participant to maintain sitting balance on the fit-ball when hit down a flying bean bag. The task of Jab Receiving required participant to gear up the punching pad to bear the jab from another player and keep balance.

Outcome Measurements

Brief-BESTest (Duncan et al., 2013, Padgett et al., 2012) was selected as the assessment tool to evaluate the balance performance of participants after training. This is a simplified version of Balance Evaluation Systems Test (BESTest), designed

to assess 6 different aspects (i.e. Biomechanical Constraints, Stability Limits (Figure 8), Transitions-Anticipatory Postural Adjustment (Figure 9), Reactive Postural Response, Sensory Orientation (Figure 10) and Stability in Gait) contributing to postural control in standing and walking.

There are a total of 8 test items. Two test items are performed bilaterally, which involve Transitions-Anticipatory Postural Adjustment and Reactive Postural Response. The items that were chosen from each category were the ones that had the highest correlation with the overall/complete score using the original BESTest. Each item is scored in a 4-point scale (0-3, higher the score, lower the severity of balance impairment). The total score is 24.

The Timed "Up & Go" (TUG) Test (Podsiadlo et al., 1991) was chosen to assess the change of gait performance for the participants after completed the intervention. TUG Test measures in seconds the time by a stopwatch which is used to take for a person to stand up from a standard armchair, walk a distance of 3-meter, take a turn, walk back to the chair and sit down again (Figure 11). A faster time indicates a



Figure 8: Stability Limits



Figure 9: Transitions-Anticipatory Postural Adjustment



Figure 10: Sensory Orientation



Figure 11: Timed "Up & Go" Test

better performance. TUG Test has been widely used to assess functional stability and walking ability, mainly in frail elderly. It includes the basic everyday movements and daily life tasks such as standing, walking, and turning (Soubra et al., 2019).

Physiotherapist was responsible for carrying out all assessments and data collection procedures. The present study used The Brief-BESTest and Timed “Up & Go” time to represent balance ability and gait performance of participants respectively. Since the study adopted one-group pretest-posttest design, collection of participants’ results on Brief-BESTest and Timed “Up & Go” time were done before (baseline assessment) and after (post-intervention evaluation) they had finished the 9 months’ balance training.

Statistical Analysis

SPSS version 25 (IBM Corporation, NY, the USA) was used for all statistical analysis. Shapiro-Wilk test was adopted to check the normality of data distributions. For the total score of Brief-BESTest,

data were normally distributed, so a parametric test was preferred. In contrast, the values for the Timed “Up & Go” time were distributed abnormally, a non-parametric test would be recommended. Therefore, the Paired Samples t-Test and Wilcoxon signed-rank Test were used to compare the pre- and post-intervention values of the total score of Brief-BESTest and TUG time, respectively. All statistical significance levels (α) were set at $<.05$. The effect size for the change of total score of Brief-BESTest was computed using a web-based effect size calculator for Repeated Measures designs (Lenhard, W. & Lenhard, A., 2022). While the effect size of TUG time was calculated by manual through the formula: $r = Z/\sqrt{N}$ (Rosenthal,1994).

Results

The results included data for 10 participants. Participants’ characteristic were shown in Table 1. In the Brief-BESTest, significant improvement result was found in the total score ($p<0.05$; Table 2) and significant difference in Timed “Up & Go” Test was obtained in within-group differences ($p <0.05$; Table 2) as well.

Table 1.
Baseline demographic characteristics of the participants (N=10)

Age mean (min. - max. in years)	62.6 (56.2-66.7)
Sex (female/male)	5/5
Height mean (min. - max. in meter)	1.57 (1.42-1.71)
Body weight mean (min. - max. in kg)	62.7 (40.7-76.9)
Body Mass Index mean (min. - max.)	25.4 (19.8-31.4)
Mild ID severity/Moderate ID severity/Mental Illness	3/2/5

Table 2.
Pre-intervention and post-intervention comparisons for all outcome measures

Brief-BESTest Total Score (score:0-24)	Pre-mean (SD)	Post-mean (SD)	Change	95% confidence interval		t	ES (d_{RM})	p value
				Lower	Upper			
	9.80 (6.20)	11.40 (6.08)	1.6 (-0.12)	0.08	3.12	2.34	0.26	0.041*

Timed “Up & Go” Test (measured in second)	Pre-mean (SD)	Post-mean (SD)	Change	Z score	ES (r)	p value
		16.03 (10.93)	12.79 (8.52)	-3.24 (-2.41)	-2.19	-0.69

* p value <0.05

Modified Boxing Exercise for Improving the Balance and Gait Performance of Ageing Adults with Mental Disorders in Sheltered Workshop

Discussion

In this study, Modified Boxing exercise was used for the balance training to the participants with mild to moderate ID or mental illness, including with 5 types of boxing related items besides the warm-up & cool down period. After the intervention, the total score of Brief BESTest and Timed "Up & Go" time were significantly improved. Time "Up & Go" Test reflects the ability of gait which is a kind of dynamic balance. Our result matched with several studies and systemic review reflect boxing training would have positive effect in gait performance, such as gait stability, gait speed and gait independence (Sánchez-Lastra et al., 2020; Horbinski et al., 2021). There were no reports of any accidents (e.g. falls or injuries) during the period of study.

And this is interesting to know the decrease of mean value in the item of Transitions-Anticipatory Postural Adjustment (Stand on one leg-Left) and Reactive Postural Response (Compensatory Stepping of Right leg). A further investigation should be needed.

There were several limitations in this study. First of all, our sample size was small with only 10 subjects. Moreover, we have no control group and the assessor was not blinded during data collection. Thirdly, no follow-up evaluation was done to investigate whether the effect of modified boxing exercise can persist over time after training had been stopped. Finally, the subjects involved both people with ID and mental illness. Different balance evaluation tool may be used in these two groups due to the discrepancy of cognitive level.

Conclusion

The results reveal that modified boxing exercise can have benefits on balance ability and improve gait performance in adults with mild to moderate intellectual disability (ID) or mental illness. More in-depth research is needed.

摘要

運用改良版拳擊運動改善於庇護工場接受服務的老齡精神障礙人士的平衡能力和步姿表現

目的：探討採用改良版拳擊運動訓練改善在庇護工場接受服務的輕 / 中度智障或精神病老齡人士平衡能力和步姿表現的可行性。

受試者與方法：10名被診斷為輕度至中度

智障或精神病的40歲或以上的成年人，接受一套由物理治療師設計的改良版拳擊練習，為期9個月，共進行36節，每節做60分鐘。使用了「Brief-BESTest」的總分和「起立-行走計時」測試，作為成效評估工具。採用SPSS的配對樣本t檢驗和威爾科克森符號秩檢驗為前後測的資料進行分析，比較組內差異。

結果：訓練後，介入前和介入後資料中的「Brief-BESTest」的總分和「起立-行走計時」測試的時間均有顯著組內差異和進步。

結論：結果顯示，改良版拳擊練習有助提高參與者的平衡力和步態表現。

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Cyrus S H Lee

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