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A Preliminary Design for a Community-Based Exercise Program for Balance Improvement and Fall Prevention

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Abstract: *This study was to describe a preliminary design for a 16-week community-based exercise program for balance improvement and falls prevention (ExBP) among older non-fallers who are at risk of falling. Five steps were involved in the development of this program, including 1) Identification on balance and balance-related deficits of the priority group, 2) Intervention targets and training strategies, 3) Movements' selection and organization, 4) Modification based on expert and end-user evaluations, and 5) Exercise implementation. Balance and balance-related deficits were identified through the comparisons among a group of older non-fallers (65~74 years) with risk of falling (n = 40) and without risk of falling (n = 38). Results found significant weaknesses of participants with risk of falling in dynamic balance, postural control at the limits of stability, compensation in sensory systems (somatosensation and vestibular sensation), agility, aerobic endurance, and muscle properties. Following which, intervention foci along with the training strategies were established accordingly. The individual movements were selected and integrated with the consideration of specificity, complexity and organization, safety, feasibility, and gracefulness, and the transfer of exercise learning theory. Movement modifications were made according to expert and end-user evaluations. Implementation process was listed with detailed suggestions. This exercise program is regarded to be effective and feasible for the older non-fallers, who are at risk of falling, to perform in daily life. Further modification and adjustment on this exercise program should be made based on its effectiveness on balance improvement and fall prevention.*

Keywords: *Older adults, Non-fallers, Risk of falling.*

1. INTRODUCTION

With the increasing life expectancy and a growing older population, the world is facing problems from an aging society, of which health is always one of the most prominent issues that professionals are devoted to do. Ageing-associated declines in physical fitness, such as decreased muscle strength/power and increased response time to postural disturbances, would expose older adults to a higher risk of falling. It is reported that nearly one out three adults older than 65 years may fall every year, and this rate continues to increase with age [1].

There is a growing body of evidence-based programs and guidelines on fall prevention, of which exercise has been identified as the most effective single intervention for fall prevention among older community-dwellers. However, there is no one-size-fits-all exercise [2], and the majority of current well-structured exercise programs are developed for the secondary (i.e., recovering from injuries) or the tertiary preventions (i.e., decreasing disability), such as the FallProof, Falls Management Exercise, Otago Exercise Program, A Matter of Balance, and OsteoFit [3]. For the primary fall prevention which aims to maintain balance abilities and delay the first fall for people without history of falling (i.e., non-fallers), the most used exercise is the general exercise (e.g., Tai Chi, dance, and walking) [3]. But the effectiveness of these general exercise programs is inconsistent and questionable [4, 5]. One of the underlying reasons for this would be the large variety of non-fallers, and among these non-fallers older adults with balance deficits and who are identified with risk of falling warrant paramount concern. The older non-fallers at risk of falling are more vulnerable to experience a fall given they do not have sufficient realization of potential fall risks, and do not make sufficient preparation for falls

prevention. Therefore, early identification of potential fallers plus proper implementation of effective balance training in this population is essential to avoid falls [6].

Related studies have found that older adults who are in the transition of frailty or in the process of losing balance can gain more from balance training compared to those with high risk of falling [7, 8]. However, there is lack of well-designed exercise program in the Primary Fall Prevention [9, 10]. In addition, the vague description on the design and development process of an exercise program would compromise the replication in a new environment. A research gap, therefore, is evident in the well-designed exercise programs for older adults without history of fall but who are at risk of falling [11].

Purpose of this study was to describe the development of a 16-week community-based exercise program for balance improvement and falls prevention (ExBP) among older non-fallers at risk of falling. Results from this study can enrich the current literatures related to the development of exercise program for balance improvement and fall prevention. Also, this study might inspire researchers and practitioners to pursue the optimization of balance-related exercise and physical training for older adults who are in the transition from non-fallers to fallers. This study has received the approval from the Committee on the Use of Human and Animal Subjects in Teaching and Research of the University.

1.1. METHODS

Five steps were involved in the development of this program, including 1) Identification on balance and balance-related deficits of the priority group, 2) Intervention targets and training strategies, 3) Movements' selection and organization, 4) Modification based on expert and end-user evaluations, and 5) Exercise implementation.

2. RESULTS AND DISCUSSION

2.1. Identification on Balance and Balance-Related Deficits

2.1.1. Target Group

The target group is the older non-faller aged from 65 to 74 years old, who live in community independently and is identified at risk of falling. The non-faller is defined as people have no unintentional falling experience in the preceding 12 months. The risk of falling is tested by using the Fall Risk Test (FRT; Biodex Balance System^{SD}, Medical Systems, USA; *ICC* = .80) [12]. Previous studies have demonstrated its effectiveness in distinguishing balance abilities among participants of different genders and ages [13].

2.1.2. Evaluations on Balance Abilities

All tests for balance evaluation and compensations in sensations were conducted using a commercially available balance device, the Biodex Balance System^{SD} (BBS; Medical Systems, New York, USA). The BBS consists of a movable balance platform which provides up to 20° surface tilt in a 360° range of motion. The platform is interfaced with computer software (Biodex, Version 3.1) which enables it to serve as an objective assessment of balance. By adjusting the COM relationships between the body and the platform, the BBS can measure both static and dynamic balance. Participants are required to stand barefoot on the platform, with hands at their sides, eyes open or closed and looking straight ahead. Tests are ended if any part of the body touches the hand-rail. Except for the FRT, another three tests were adopted in this study, 1) Postural Stability Test (PST) for measuring static balance (*ICC* = .69) [12]; 2) Limits of Stability Test (LOS) for assessing postural control at the limits of stability in different directions (*ICC* = .72) [14]; and 3) Modified Clinical Test of Sensory Organization and Balance (m-CTSIB) for evaluating balance with one or more compromised sensations (*r* = .75) [15].

2.1.3. Evaluation on Balance-related Fitness and Fear of Falling

"*Balance is not an isolated quality, but underlies our capacity to undertake a wide range of activities that constitute normal daily life*" [16]. Given the close relationship among balance, falls, and functional fitness in older adults [17], functional fitness in this study was assessed by using the Senior Fitness Test (SFT) battery [18]. There are seven testing items assessing the five dimensions of physical fitness, including body mass index (BMI), 30s chair stand for lower limbs' muscle strength (CS), 30s arm curl for upper limbs' muscle strength (AC), 2min step test for aerobic endurance (Step), chair sit-and-reach test for lower body flexibility (SR), back scratch test for upper body flexibility (Scratch), and 8ft up-and-go test for mobility and dynamic balance (UG) [18].

Fear of falling (FF) is an important psychological factor that is reported by older fallers and frail individuals. In this study, it was tested using the Falls Efficacy Scale-International (FES-I), which is a widely administered tool that measures the level of concern regarding falling during physical activities in daily life [19]. The FES-I uses a 4-point Likert scale ranging from 1 (not at all concerned) to 4 (very concerned) to assess the level of concern regarding the possibilities of falling while performing daily activities (e.g., taking a bath or shower). The Chinese version of FES-I was validated by Kwan and colleagues and demonstrated good overall structure and measurement properties in terms of internal consistency (r = .94), test-retest reliability (*ICC* = .89), and inter-rater reliability (*ICC* = .95) [20].

2.1.4. Balance and Balance-related Deficits

A group of qualified 78 older adults were recruited from a local senior community center. They were apparently healthy, independent adults without uncontrolled hypertension (over 160mmHg), joint replacement, incontinence, dizziness, and other related diseases that may limit their ability to do exercise. Results from the FRT found that 48 participants were at risk of falling (mean age = 69.7 ± 3.64 years, OSI = 4.64 ± .87) and 30 participants were without risk of falling (mean age = 70.1 ± 3.75 years, OSI = 2.37 ± .65). All participants received the tests for balance and balance-related abilities as listed above.

Comparisons of each of the testing items between participants with and without the risk of falling were conducted using independent t-test. Results found significant group differences on FRT, LOS, m-CTSIB, AC, UG, Step, and FF. All these indicated an overall reduction in balance abilities in people with risk of falling, especially in dynamic balance, postural control at the limits of stability, compensation in sensory systems (somatosensation and vestibular sensation), mobility and agility, aerobic endurance, muscle strength, and fear of falling. Detailed values of each testing parameter for each group are presented in Table 1.

Table1. *Comparisons of Balance and Balance-related Deficits between Participants with and without the Risk of Falling*

	People with risk of falling		People without risk of falling	
Parameters	*M*	*SD*	*M*	*SD*
OSI in FRT	4.64	.867	2.37*	.65
OSI in PST	1.28	.740	.735	.41
Score in LOS	26.7	948	36.5*	.92
m-CTSIB				
ECFS-sway	1.22	.331	1.05	.40
EOSS-sway	1.73	.717	1.18*	.34
ECSS-sway	4.18	1.24	3.43*	.89
BMI (kg/m^2	23.48	3.07	22.24	2.58
AC (reps)	14.80	4.00	16.80*	4.00
CS (no.)	13.80	4.00	14.30	3.70
Scratch (cm)	-2.59	7.89	-.39	4.80
SR (cm)	3.20	8.80	3.70	8.60
UG (s)	6.75	1.12	5.85*	.95
Step (no.)	82.70	16.50	16.80*	4.00
FF	35.4	12.43	21.9*	5.44

Note. *M = Means, SD = Standardized Deviation; *p< .05; OSI = Overall Stability Index;FRT = Fall Risk Test; PST = Postural Stability Test; LOS = Limits of Stability Test; m-CTSIB= Modified Clinical Test of Sensory Interaction on Balance; ECFS-sway = sway index in Eyes Closed Fixed Support, EOSS-sway = sway index in Eyes Open Sway-referenced Support, ECSS-sway = sway index in Eyes Closed Sway-referenced Support;BMI = Body Mass Index; AC = Arm Curl test; CS = Chair Stand test; Scratch = Back Scratch test; SR = Sit and Reach test; UG = Up and Go test; Step = 2min Step test; FF = Fear of Falling*.

2.2. Rationales for Development of the ExBP

2.2.1. Training Foci and Corresponding Strategies

All these balance deficits in participants at risk of falling were further analyzed along with the considerations of evidences from related studies and previous practice experience. They were finally divided into different ExBP training foci with corresponding training strategies.

Table2.*Training Foci and Strategies*

Focus 1. Control of center of mass
1) Gradually reducing the base of support (two leg stance, tandem, one leg support);
2) Continuous change of center of mass in different directions;
3) Frequently reaching limits of stability and hold postural stability at limits of stability.
Focus 2. Muscle strength & power in lower limbs
4) Standing still in a semi-squatting posture;
5) Weight-loaded training with different duration in a single-leg stance;
6) Time-critical movements.
Focus 3. Range of motion, especially in the ankle joint
7) Stretching movements in ankle, knee, and hip joints;
8) Gradually increase movement' scope.
Focus 4. Plantar tactile sensitivity and joint proprioception around knee and ankle
9) Even and slow tempo for sensory awareness of the movements of lower limbs in terms of speed, force, and trajectory;
10) Activating additional plantar muscles and wider plantar contact areas;
11) Additional practice in the virtual environment.
Focus 5. Gait pattern, Agility and Response time
12) Gradually increasing stride length and walking speed;
13) Walking in different directions (i.e., forward, backward, left, right, and turn around);
14) Time-critical tasks with repeated practice.
Focus 6. Balance control with compromised sensory input
15) Balance challenging exercise with gradually decreasing visual input;
16) Balance challenging exercise with sensory conflicts between vision and somatosensation;
17) Synchronizing eye movement with body movements (i.e., the pivoting of the whole body, the twisting of the trunk, and the coordination of head and upper and lower limbs);
18) Simultaneous hand-eye movements with different body postures and movements.
Focus 7. Distribution of attention
19) Gradually increasing the complexity of body movements through coordination among body, arms, head, and legs;
20) Maintaining proper difficulty of exercise movements.
Focus 8. Confidence in balance-required tasks
21) Exercise repetitions on balance-challenging movements, such as postural control at the limit of stability and single-leg stance with compromised sensation;
22) Education on how to avoid and how to recover from falling.

2.2.2. The Preliminary Plan for Movements involved in the ExBP

The entire exercise program emphasized movements of the trunk and lower extremities and was performed in a standing posture. The main postures for the trunk included 1) straightening the body by pushing the chest forward and straightening the body upwards, and 2) bending the body forwards, sideways, and backwards if required. Movements in the lower extremities including marching, walking, step touch, forward heel tap, squatting, Ezy walk, V step, grapevine, calf raise, straightening of the leg, pointing the toes, keeping the legs apart, and bringing the legs together. The basic movements in the upper limbs included arm circles, arm crossovers, stretching arms, arms forward, arms upwards, arms sideways, arms obliquely upward, arms obliquely downward, swinging arms downward (forwards, backwards), bending arms, and hands on hips. The upper limb' movements were secondary to the lower extremity movements with the main purpose to increase the complexity and organization of movements. Several of these movements have been selected based on their effectiveness which were evidenced in previous studies (e.g., the squat), some were selected according to previous practice experience (e.g., calf raise), and others were selected as interim movements (e.g., walking). Moreover, all these movements were choreographed using different directions, speeds, and ranges, in accordance with the various requirements for physical training.

2.2.3. Movement Selection and Organization

2.2.3.1. Movement complexity and organization

The complexity and organization of the movements in ExBP were established according to Gentile's two-dimensional taxonomy of motor skills [21]. Totally, there are 16 skill categories which can be divided into "environmental context" (stationary or regulatory motion condition & intertrial or no intertrial variability), and "action function" (body stability or transport & object or no object

manipulation) [21]. Movements in the ExBP did not include "object manipulation", and thus had 12 types of motor skills. Therefore, movement' difficulties only covered 1) "stable movements" in a "stationary regulatory environment" without "intertrial variability" (i.e., standing still in a room), and 2) "mobile movement" under the "regulatory-motion condition" with "intertrial variability" (i.e., moving a basketball across defenders).

2.2.3.2. Safety, feasibility and gracefulness

Due to an age-associated decline in physical fitness, older adults have comparatively increased timing errors, greater variability, and decreased safety margins in movement control compared to young adults [22]. Safety has always been of paramount concern in physical training of older adults. However, in order to achieve an optimal training effect from exercise, all movements should be performed to older adults' full potential. This paradox could be resolved through proper implementation of training strategies and one-to-one guidance. The feasibility of movement emphasizes participants' acceptance to the ExBP and their subjective feelings during the practice process. Gracefulness requires all movements in ExBP to be smooth, gentle, and enjoyable. Ultimately, through continuous practicing of the ExBP, participants may not only become physically healthier but also benefit from positive psychological feedback.

2.2.3.3. Transfer of learning

Transfer of learning is defined as the influence of previous experience on the performance of a skill in a new context or in learning a new skill [21]. This influence may be positive, negative, or neutral. In the present study, movements in the ExBP were selected with consideration of the similarities of skills, context components, and processing requirements between exercise and falls prevention in real life. For example, the quick transfer of the center of mass, by quickly stepping out in either the left, right, anterior, or backward directions, can help to keep the center of mass within the base of support in case of any sudden postural disturbances.

Finally, all the individual movements were grouped into eight forms of exercise movements, including Left and Right Walking (Form 1), Multi-directional Walking (Form 2), Hops in Four Directions (Form 3), Side Twist (Form 4), Foot Touch (Form 5) Walking and Knees Lifting (Form 6), Tap Step (Form 7), and Revised Cha-cha Step (Form 8).

2.3. Expert and End-user Evaluations

2.3.1. Expert Consultation

The main purpose of the expert consultation was to improve the ExBP in light of their abundant experience in related areas. The experts were delimited to those 1) having more than 10 years of working experience in a related area of exercise improving balance and preventing falls, and 2) having a job title as associated professor and above, or senior physical therapist. Finally, two experts from exercise and physiotherapy areas accepted the invitation to provide their subjective evaluations in terms of effectiveness, suitability, and feasibility of exercise movements in ExBP. Two rounds of consultations were conducted with a month apart. The first round was conducted to gather detailed opinions from the two experts. Assessments were made using the Likert 5-point scale (i.e., very bad = 1, bad = 2, neutral = 3, good = 4, and very good = 5). They were required to give comments and suggestions for any item with a score less than four. Modifications were then conducted following their opinions and suggestions. On occasions where 1) there were any disagreements among the experts, or 2) any there were any queries or confusion about the expert opinions, a confirmation letter was sent to them with the appropriate explanations. Subsequently, a revised version of this exercise program was sent back to the experts for a second round of consultation. Experts were asked to give their final evaluation on the whole exercise program with a score of either Pass or Fail (Pass: mean score ≥ 4, and Fail: mean score < 4).

Table3. *Expert evaluation on the Effectiveness, Suitability, and Feasibility of ExBP Movements*

Forms	Form 1		Form 2		Form 3		Form 4		Form 5		Form 6		Form 7		Form 8	
Indicators	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
Effectiveness	4	5	4	5	4	5	4	4	4	5	4	5	4	5	4	5
Suitability	4	5	4	4	3	5	4	5	4	4	4	5	4	5	4	4
Feasibility	4	5	4	5	3	5	4	5	4	5	3	5	4	5	3	3

All the numbers listed in Table 3 were the lowest values given by the two experts. The comparatively low values were presented in the suitability and feasibility of Form 3 (Hops in four directions) in Round 1, the feasibility of Form 6 (Walking & Knees lifting) in Round 1, and the feasibility of Form 8 in both Round 1 and Round 2. Other values in corresponding items were all over 4, indicating that the movements (after modification) were suitable to be performed in the target population in terms of effectiveness, suitability, and feasibility.

2.3.2. Changes Made after Expert Consultation

Form 1 (left and right walking): lowering the COM and increasing the bent angle of the knee so as to increase the load and intensity of stimulation on quadriceps. Form 2 (multi-directional walking): stressing the twist of the upper body in moving and the synchronized movements of the upper body and head. Form 3 (hops in four directions): single leg hops in four directions were suggested to be replaced with walking in four directions. The rationale for the original design of this movement was to improve muscle force, response time, and muscle synergies in case of falling. This movement was retained given the results from the feasibility test. No change was made in Form 4 (side twist). Improving vestibular functions can be achieved through continuous and synchronized movements of head and upper body. No change was made in Form 5 (foot touch). One expert who gave a comparatively lower score had doubts as to the effect of this muscle endurance form (she asked why it was not muscle strength). One explanation for her question was that all the exercise movements were practiced with a bent knee. The duration of the stimulation of muscle strength would be long enough to have effects on both muscle endurance and muscle strength. In addition, the plantar sensitivity was deleted from training foci in Form 5. Form 6 (walking & knee lifting). The main dispute for this exercise form was about the suitability and feasibility of the single leg hop movement, which may not be safe for older adults. However, movements in Form 6 were retained given that it was demonstrated to be safe in the feasibility test. No change was made in Form 7 (tap step). Form 8 (revised Cha-cha step). One expert held the view that continuous changing of direction (360^{o}) might require too much for older adults. However, this movement was retained given the results from the feasibility test.

2.4. End-user Evaluation

An end-user evaluation on the initial ExBP was conducted to assess the suitability and feasibility of this program, and to gather participants' feedback and opinions about this program. Ten older adults were randomly selected from the participants who had been identified with risk of falling (males: n = 5; females: n = 5) to participate in the initial ExBP for two weeks, with 90 min per session and 3 sessions per week. Their detailed biographic information was presented in means (95% CI).

Table 4.*Demographic characteristics of end-user evaluation participants*

Age (yrs)	Height (cm)	Weight (kg)	Body Fat%	Blood Pressure		Heart rate (b/min)	Fall Risk Test OSI
				SBP	DBP		
69 (65, 71)	154.2 (147, 161)	56.8 (50, 63)	26.9 (15, 30)	137 (109,154)	83 (67, 100)	68 (62, 75)	4.88 (4.2, 6.3)

Note.*SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure; OSI = Overall Stability Index; Fall Risk Test was conducted using the Biodex Balance System*^{SD}.

Participants were required to give their evaluation and subjective feelings about the difficulty, confidence, and enjoyment of this exercise program. The numbers "1, 2, 3, 4, 5" were used to score subjective feelings on the above aspects. The higher the value, the more difficult or more confident, or interesting the older adults would consider the ExBP. Finally, average scores are summarized in Table 5.

Table5.*Participants' EvaluationonDifficulty, Confidence, and Enjoyment of the ExBP*

Forms	1st	2ed	3rd	4th	5th	6th	7th	8th	Overall
Difficulty	1	1	3	2	1	3	1	3	2
Confidence	4	5	4	5	5	5	5	5	4
Enjoyment	5	5	5	5	5	5	5	5	5

2.4.1. Summary of Participants' Feedback

Forms 3, 6, 8 were regarded to be comparatively difficult due to the requirements of changing direction and single leg hops. Together with experts' suggestions, it was decided to lower the

requirements for these three movements. For Form 3 & Form 6, hops were replaced by walking. For Form 8, the pace for changing body directions was reduced. The sequence of movement was also adjusted to reduce movement difficulties. The overall scores demonstrated that participants considered that this exercise program was not very difficult (overall score = 2), very interesting (overall score = 5) and participants were confident they could master it (overall score = 4). Finally, the revised ExBP was summarized and illustrated in Table 6 below.

Table 6. *The Tailor-made Exercise Program for Balance Improvement and Falls Prevention (ExBP)*

Name	Details			Focus
	Content	Trajectory	Direction	
Warm up (15 min)	The warm up process focus on the lower extremities, which adapts to the main purpose of each of the various training sessions			Flexibility; warming up body
Group 1. Left and right walking	1.1 Trunk 1.2 Step 1.3 Arm 1.4 Head	1.1 Straighten body; 1.2Calf raise → leg apart → leg together (gradually changing into grapevine if possible); 1.3 Hands on hips; and 1.4 Lengthen neck.	Left side → right side	Control of COM; Muscle power in Knee extension, plantar flexion, & hip abduction; Agility.
Group 2. Multi-directional walking	2.1 Trunk 2.2 Step 2.3 Arm 2.4 Head	2.1 Lean forward 15^{o}; 2.2 V-step → one leg stance → toe tap backward; 2.3 Arms cross → Arms sideways; and 2.4 Head changes with the trunk.	Left diagonal front → right diagonal front → left diagonal back → right diagonal front → right diagonal front → left diagonal front → right diagonal back → left diagonal back	Vestibular functions; Control of COM; Muscle strength & power in plantar flexion, knee extension, & hip abduction; Hip abduction range.
Group 3. Hops in four directions	3.1 Trunk 3.2 Step 3.3 Arm 3.4 Head	3.1 Straighten the body; 3.2 Hop (or Ezy walk) → hip twist; 3.3 Circle with jazz hands in the front of body; and 3.4 Lengthen the neck.	Forward → backward → left → right	Muscle strength & muscle power of plantar flexion and knee extension; Agility; ROM of the hip.
Group 4. Side twist	4.1 Trunk 4.2 Step 4.3 Arm 4.4 Head	4.1 Bend body forwards (left twist→ right twist); 4.2 Stance is still with the center of mass in the anterior soles of feet, bend the knee; 4.3 Swing arms forward & backward; 4.4 Face right and left alternatively.	On the spot	Vestibular sensation; Proprioception in joints of knee & ankle; ROM of the lumber spine.
Group 5. Foot touch	5.1 Trunk 5.2 Step 5.3 Arm 5.4 Head	5.1 Straighten body; 5.2 One leg stance and the other tapping (heel tap forward → toes tap left & right side → toe tap backward); 5.3 Bend arms→ stretching left (or right) side; and 5.4 Lengthen neck.	Forward - left- backward - right	Control of COM; Muscle endurance; ROM of ankle (dorsiflexion & plantar flexion) & hip (abduction, flexion, extension); Plantar sensation.
Group 6. Walking &knees lifting	6.1 Trunk 6.2 Step 6.3 Arm 6.4 Head	6.1 Straighten body; 6.2 walking and knees lifting; 6.3 Handclap; and 6.4 Straighten neck.	Forward - backward	Agility & Gait pattern; Vestibular system; Muscle strength & power in knee flexion
Group 7. Tap step	7.1 Trunk 7.2 Step	7.1 Bend body side-wards; 7.2 Single leg stance → foot	On spot	Muscle strength, endurance & power in plantar flexion, knee

	7.3 Arm 7.4 Head	anterior soles tap → toe touch & heel touch; 7.3 Hands on hips; and 7.4 Straighten neck.		extension & hip flexion; Control of COM; Planter sensation; ROM of ankle (i.e., dorsiflexion, plantar flexion)
Group 8. Revised cha-cha step	8.1 Trunk 8.2 Step 8.3 Arm 8.4 Head	8.1 Straighten body; 8.2 Cha-cha step, hip rotation → body rotation (clockwise/anti-clockwise) 8.3 Arms obliquely upward/downward → arms sideward; and 8.4 360^{o} Rotation of body	Right diagonal front → anticlockwise rotation → left diagonal front → clockwise rotation	ROM of lumber spine (New); Vestibule system; Control of COM; Agility.
Cooling down (10 min)	Body stretching, adjusting breath, and relaxation			Flexibility, Relaxation

2.5. Exercise Implementation

The delivery process of the 16-week ExBP program is suggested to include three stages based on the classic learning stage model [23], they are the cognitive stage (week 1 to 8), the associated stage (week 9 to 12), and the autonomous stage (week 13 to 16). Along with various training strategies, requirements on degrees of exercise movements and exercise skills would be different with three training stages. In the cognitive stage gross motor skills and individual exercise movement would be emphasized with personal guidance to help participants understand and learn the ExBP. Another emphasizing aspect is to instill participants' interest to attend the training sessions. In the associated stage, higher standard for movement quality is required from participants, and feedback should be given at appropriate time. Different from the discrete training method used in the first stage, the associated stage could apply more of the integrated training method so as to give participants a "full map" about the ExBP. Additionally, the "one-to-one" personal guidance can be used here to correct movement and increase movement accuracy. For example, to help participants to reach certain knee lifting height, a tutor may hold participant's knee at the required height to give him/her a sense of such height; or to accelerate the leg stretching out speed, the physical trainer would push the participant's leg at a certain speed to help him/her achieve the correct sensation for stepping-out. In the Autonomous stage, movement coordination and perfection along with fluentness should be the main training objectives. Repeated practice can be used to strengthen memory and increase movement quality in a short time. In addition to following these recommendations strictly in the implementation of exercise program, the art of physical training should always be of concern to obtain an optimal training effect.

3. CONCLUSION

This study described the development of a community-based exercise program for balance improvement and fall prevention among older non-fallers who are at risk of falling. Based on the falling risk factor identified in the target group, training foci along with training strategies were established accordingly. Results from the expert and end-user evaluations demonstrated that the ExBP is effective and feasible for the target group to perform in daily life. A study with a randomized controlled trial (RCT) design is currently underway among a group of older community-dwellers. The ExBP would be slightly adjusted based on the results from the validation study.

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