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The Effects of Hatha Yoga and Specific Balance Exercises in Older Adults Living in Nursing Homes

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Abstract

We tested the effects of Hatha Yoga and specific balance exercises on balance function and fear of falling in older adults living in nursing homes. Twenty-six older adults underwent either Hatha Yoga or simple balance exercises practice. Before, during, and after completing the two programmes, the performance-oriented mobility assessment tool and the Italian version of the falls efficacy scale international were administered to assess participants' balance function and fear of falling. Hatha Yoga practice yielded significant differences in balance function and fear of falling associated with low falls risk and reduced fear of falling. Specific balance exercises practice yielded significant differences only on balance function but with reduced performance-oriented mobility assessment tool scores associated with a greater falls risk. Accordingly, to improve the quality of life of older adults living in nursing homes, the practice of Hatha Yoga should be encouraged.

Keywords: *awareness, balance function, fear of falling, falls risk*

Introduction

Nowadays, there is an increasing interest in balance and falls prevention programmes useful for improving older adults' quality of life (Farlie et al., 2019; Thomas et al., 2019). Exercise interventions with leg strengthening and balance training are considered the most promising (Cumming, 2002). However, there is a growing request for more research related to balance training effects in older adults living in nursing homes. Beyond falls, the fear of falling (FoF) is another common problem that adversely affects older adults' quality of life. This condition may lead to activity restrictions, reducing older adults' physical fitness and balance function (Ruggiero et al., 2009). Although FoF is often a psychological consequence of a fall, it may also affect non-fallers and people in institutional care (Jørstad et al., 2005). Thus, intervention and post-intervention evaluation of FoF may be fundamental to thoroughly assist institutionalized older adults (Dewan & MacDermid, 2014).

Regarding balance training programs, Hatha Yoga (HY) is gaining increasing attention. It is a complementary and/or alternative therapy, which commonly improves health because of its mind-body component (Rinella, Romeo, Di Corrado, & Massimino, 2017). HY encompasses breathing, meditation, and balance/posture control exercises (Tang et al., 2007; Tew, Howsam, Hardy, & Bissell, 2017). It may increase awareness and address postural stability (Ni et al., 2014) and poor balance problems (Kadachha, Soni, & Parekh, 2016).

Based on these considerations, this study aimed to determine the effects of HY and a specific balance exercises (SBE) program on balance function (balance, gait, total balance) and FoF in older adults living in nursing homes. HY exercises were adapted so that older adults could safely participate whilst still benefiting from the intervention (Tew et al., 2017). For SBE intervention, we used exercises commonly recommended by physical activity policies for ageing well (e.g., Williams, 2016). Given the stronger focus of the yogic practice on bodily awareness, we expected to observe better HY (first hypothesis) results. For the same reason, we also ex-

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pected early changes and improvements associated with HY but not with SBE (second hypothesis).

Methods

Participants

A priori power analysis (effect size=0.30, power=0.90, and α level=0.05) was conducted using G*Power (version 3.1) to determine the sample size. The resulting sample size was 26 for the mixed between-within subjects analysis of variance (ANOVA) to run. Two nursing homes took part in our project. We recruited 14 older adults in each nursing home for a total of 28 participants (women=15, men=13), aged from 78 to 82 years (Mean=79.84±1.34). Participants were recruited based on the following criteria: 1) they did not report severe impairments of cognitive functions; 2) they were not using wheelchairs for mobility; 3) they were medically certified to undertake Yoga and balance exercise practice. Participants' demographic and clinical characteristics are provided in Table 1. Each nursing home allowed us to conduct either HY or SBE practice. Therefore, we conducted a quasi-experimental design study in which participants missed random allocation. Two participants involved in the HY condition did not complete the protocol; thus, we considered 26 out of 28 participants (HY condition=12 participants; SBE condition=14 participants).

Table 1. Demographic and clinical characteristics of participants in the two conditions

	Hatha Yoga (HY)	Specific Balance Exercises (SBE)
Participants	12	14
Women	7/12	7/14
Men	5/12	7/14
Hypertension	8/12	9/14
Stroke	2/12	1/14
Dementia	1/12	2/14
Osteoporosis	8/12	7/14
Parkinson	1/12	1/14
Fallers	8/12	2/14
Age	79.66±1.55	80±1.17
Weight	58.41±9.87	57.42±13.36
Height	1.48±0.05	1.50±0.09

Legend: Dementia and Parkinson were at their early stage; the column Fallers indicate the number of participants who experienced falls in the past. Age, Weight, Height - Mean±SD

Instruments

Balance function (balance, gait, total balance) was measured using the performance-oriented mobility assessment (POMA) tool (Monti Bragadin et al., 2015; Tinetti, 1986). The total score, defined as total balance, indicates a person's chances of falling. Balance assessment is characterized by the appraisal of eight positions/position changes: sitting balance, arising from a chair, immediate and prolonged standing balance, withstanding a nudge on the sternum, balance with eyes closed, turning balance, and sitting down. The gait assessment includes the observation of eight gait components: initiation, step height, step length, step continuity, symmetry, path deviation, trunk sway, and walking stance. For each task, a score of 2 (steady), 1 (steady with adaptation), or 0 (unsteady) is given. Balance and gait are first scored separately and then combined to determine the total score. Maximum scores of 16 and 12 can be assigned to balance and gait sections, respectively, with a maximum total balance score of 28. A score below 19 indicates the highest falls risk, while a score of 19 to 24 suggests a lower falls risk. A score of 25 to 28 represents the lowest falls risk.

FoF was measured using the Italian short version of the falls efficacy scale international (FES-I; Ruggiero et al., 2009). The short FES-I includes seven activities: getting dressed/undressed, taking a bath or shower, getting in or out of a chair, going up or down stairs, reaching for something above the head or on the ground, walking up or down a slope, going out to a social event (e.g., religious service). If a person is currently not doing one of the activities, this is asked to answer whether he/she would be concerned about falling when doing that activity. The possible answer options are: 1 (not at all concerned), 2 (somewhat concerned), 3 (fairly concerned), 4 (very concerned). A total score for the Short FES-I ranges from 7 (no concern about falling) to 28 (severe concern about falling) and is obtained by adding the scores on all the items together.

Intervention

Each HY lesson lasted approximately one hour with a long warm-up (~20 minutes), including breathing exercises, slow dynamic, gentle muscle and joint movements (e.g., shoulder/arm/wrist circling, neck rolling). Each lesson then included mindful walking exercises and physical postures, also known as asanas or poses (~25 minutes), followed by other breathing exercises (pranayama) and relaxation techniques (~15 minutes). As concerns poses, Chair (Utkatasana), Tree (Vrksasana) and Crescent Lunge (Alanasana) were used because of their general strengthening effect on lower-limb muscles (Hamrick, Mross, Christopher, & Smith, 2017). A complete list of the used poses is provided in Table 2.

The practice was safe enough to preserve participants' health. For example, when performing poses such as Chair, participants were instructed to perform them without jeopardizing their joints and use aids to make the exercise easier or for support in accordance with the practice proposed by Tew et al. (2017; see also Figure 1). When participants were concerned with getting up from the floor, the key elements

Table 2. Complete list of asanas (poses) used in the Hatha Yoga intervention

Asanas	Poses
Urdhva Hastasana	Arms over head
Indudalasana	Crescent side stretch
Pawanmuktasana	Knee to chest
Utkatasana	Chair
Tadasana	Mountain
Uttanasana	Forward bend
Adho Mukha Svanasana	Down dog
Garudasana	Eagle
Alanasana	Crescent lunge
Vrksasana	Tree
Natarajasana	Dancer
Virabhadrasana II	Warrior II
Utthita Trikonasana	Triangle
Savasana	Corpse

Legend: Most of the *asanas* were adapted in a seated position or using a chair as a support. When necessary, both sides were required

of traditional supine postures (e.g., Corpse Pose-Savasana) were integrated into seated postures. In the case of a forward bend, the movement was modified so that the head was never lower than the heart, protecting participants with cardiac conditions; for the same reason, breath retention was avoided (Tew et al., 2017). Classes started with participants seated and continued with the practice of a few standing postures. Finally, participants sat again to rest and breathe.

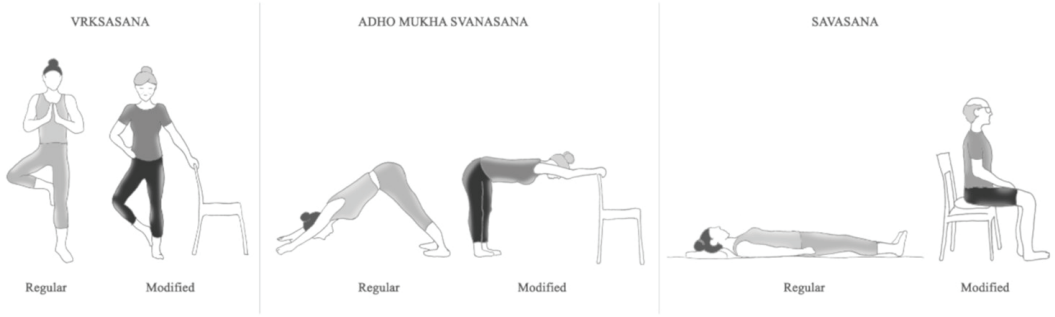

FIGURE 1. Examples of how asanas were modified

SBE practice, with lessons lasting approximately one hour each, was characterized by a warm-up encompassing slow dynamics, gentle muscle and joint movements (e.g., shoulder/arm/wrist circling, neck rolling) and gentle total body stretching exercises (~20 minutes), followed by balance exercises and different kinds of walking. Each lesson included exercises such as heel/toe rising, standing on one leg at a time, walking backwards or sideways, walking heel to toe in a straight line (~25 minutes). Gentle total body stretching exercises were practised again during the last part of the lesson (~15 minutes). A reduction of supporting aids and personal assistance was gradually suggested. Challenging changes of direction and experiences on mats of different heights were also proposed. Overall, SBE practice could challenge the visual, somatosensory, and vestibular mechanisms of balance.

Participants in both conditions could recover for a greater time than normal, especially after the most intense activities. The instructor demonstrated all the exercises.

Procedure

Participants in both HY and SBE conditions attended a 20-session programme (one hour per two sessions a week), delivered across an intervention period of three months. All sessions were medically supervised and conducted by a qualified kinesiologist and Hatha Yoga expert. In each nursing home, intervention and assessment occurred in a large but quiet and safe environment to guarantee participants' activities and comfort. The POMA tool and the short FES-I were administered the week prior to beginning (T0), 1.5 months after the beginning (T1), and one week after the conclusion (T2) of the intervention programs to assess balance function and FoF, respectively. The mid-term assessment (i.e., T1) was performed to identify early changes associated with the interventions. To avoid the overestimation of the effects of one of the interventions, we performed a blinded assessment of the outcomes; thus, the observers and participants were not aware of the purposes and hypotheses of the study. In the two conditions, the POMA tool was administered by the same qualified nurse and double-checked by a qualified therapist to guarantee the accuracy of the assessment process. Regarding POMA tool administration, see the procedure used by Abruzzese (1998). The study was conducted in accordance with the Declaration of Helsinki and approved in advance by University "G. d'Annunzio" of Chieti-Pescara (ID

richiam7px, May 16, 2019). Each participant voluntarily provided written informed consent before participating.

Statistical analysis

Examination of histograms, skewness, and kurtosis of the variable scores showed no substantial deviations from a normal distribution. A series of mixed between-within subjects ANOVA 2 (condition) × 3 (time) was performed comparing HY and SBE conditions on each dependent variable (i.e., balance, gait, total balance, FoF scores), over the time (i.e., T0, T1 and T2). The least significant difference (LSD) test was used for post hoc pairwise comparisons. The sphericity assumption was evaluated using the Mauchly test, and Huyn Feldt correction for degrees of freedom was applied in the case of non-sphericity. Effect sizes were calculated using partial eta squared (ηp2; Lakens, 2013) in the analyses of variance and using Cohen's d (Cohen, 1988) in the case of multiple comparisons. The significance level was set at 0.05, and all statistical analyses were performed using the Statistica software (Version 12).

Results

Means and standard deviations of the variable scores over the time in the two conditions are provided in Table 3.

The between-within ANOVA on balance, gait, total balance and FoF scores did not reveal significant main effects either on time or condition except for a between conditions difference on FoF scores, with F(1,24)=16.055, p=0.001, ηp2=0.401, power=0.970, and HY<SBE. However, we were mainly interested in the condition × time interactions subsequently described.

Table 3. Means±SD over the time of balance, gait, total balance, and fear of falling (FoF) scores in the two conditions

		T0 (M±SD)	T1 (M±SD)	T2 (M±SD)
Balance	HY	10.91±1.92	12.41±2.23	13.41±1.92
	SBE	10.71±3.62	10.64 (3.27	10.50±3.85
Gait	HY	6.25±2.89	8.33±2.53	8.25±2.70
	SBE	6.07±3.98	4.78±3.94	4.35±3.22
Total balance	HY	17.16±4.42	20.75±4.55	21.66±4.49
	SBE	16.78±7.24)	15.42±6.83	14.85±6.61
FoF	HY	6.25±3.40	8.33±1.66	8.25±0.38
	SBE	6.07±7.18	4.78±6.85	4.35±6.39

Legend: T0 - First Assessment; T1 - Mid-Term Assessment; T2 - Last Assessment

Balance Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=4.658, p=0.014, ηp2=0.163, power=0.758). According to the pairwise comparison using LSD, only the participants who underwent HY showed significant differences between T0 and T1 (p=0.026, d=0.799) and between T0 and T2 (p<0.001, d=1.456) with increased scores associated with improved balance. Moreover, after the completion of the two programs (T2) there were significant differences (p=0.018, d=0.933), with HY>SBE (Figure 2).

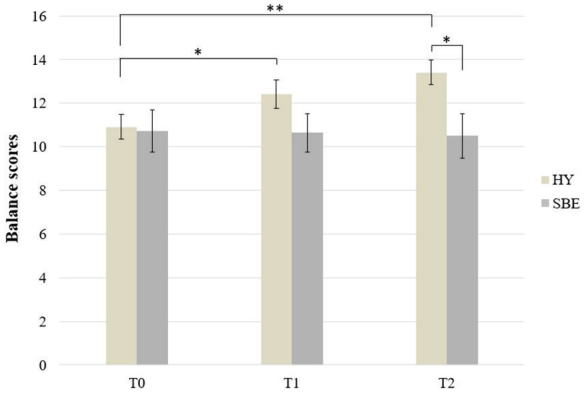

FIGURE 2. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for balance scores. Error bars represent standard error (*p<0.05; **p<0.001)

Gait Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=22.916, p<0.001, ηp2=0.488, power=1.000). According to the pairwise comparison using LSD, both conditions showed significant differences between T0 and T1, with HY: p<0.001, d=0.861, SBE: p=0.045, d=0.361, and between T0 and T2, with HY: p<0.001, d=0.798, SBE: p=0.001, d=0.519. While HY yielded increased scores associated with improved gait, the SBE condition yielded reduced scores associated with impaired gait. Moreover, there were significant differences at T1 (p=0.010, d=1.052) and T2 (p<0.001, d=1.299), with HY>SBE in both cases (Figure 3).

Total Balance Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=13.916, p<0.001, ηp2=0.361, power=0.957).

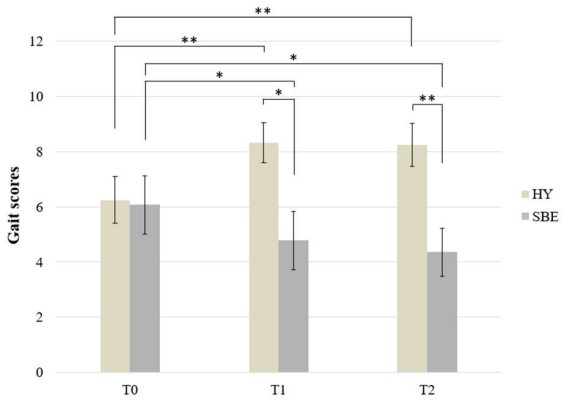

FIGURE 3. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for gait scores

According to the pairwise comparison using LSD, the participants who underwent HY showed significant differences between T0 and T1 ($p<0.001$, $d=0.890$) and between T0 and T2 ($p<0.001$, $d=1.129$) with increased total balance scores associated with low falls risk. The participants who underwent SBE yielded significant differences between T0 and T2 ($p=0.033$, $d=0.310$) with reduced total balance scores associated with higher falls risk. Moreover, there were significant differences at T1 ($p=0.029$, $d=0.902$) and T2 ($p=0.033$, $d=1.185$), with HY>SBE in both cases (Figure 4).

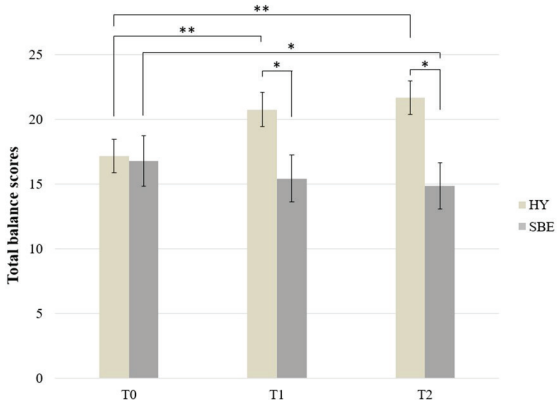

FIGURE 4. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for total balance scores

FoF Scores

Between-within ANOVA showed a significant condition × time interaction, $F(1.852,44.453)=7.845$, $p=0.002$, $\eta p2=0.246$, power=0.926). According to the pairwise comparison using LSD, only the participants who underwent HY showed significant differences between T0 and T1 ($p=0.006$, $d=0.911$) and between T0 and T2 ($p<0.001$, $d=1.149$) with reduced FoF scores associated with lower concern about falling. Moreover, there were differences at T0 ($p= 0.009$, $d=0.994$), T1 ($p<0.001$, $d=1.607$) and T2 ($p<0.001$, $d=2.103$) with HY<SBE in all cases (Figure 5).

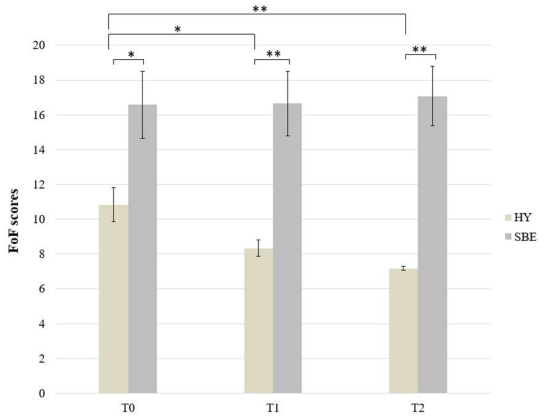

FIGURE 5. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for FoF - fear of falling - scores

Discussion

The current study aimed to explore the effects over the time of HY and SBE practice on balance function (balance, gait, total balance) and concern about falling in institutionalized older adults. Only HY practice significantly improved balance scores between the first (T0) and the mid-term assessment (T1) and between the first (T0) and the last assessment (T2). This is in line with the literature (e.g., Cuevas-Trisan, 2017) and could be ascribed to the focus of HY practise on physical isometric postures, strengthening muscles that account for the retention and enhancement of balance function. The pre-post intervention improvement of balance scores is also consistent with the study of Schmid, Van Puymbroeck, and Koceja (2010), who observed balance enhancement in older adults after a 12-week single-armed yoga intervention. The last assessment revealed a clear difference between HY and SBE practice, and no significant improvements were observed by means of SBE practice (see Figure 2). This could be due to the low strengthening effect of SBE in general, echoing the notion that strength is a crucial element for balance, even in the geriatric population (Cuevas-Trisan, 2017; Hamrick et al., 2017).

While HY yielded a significant improvement, SBE practice yielded a significant pre-post intervention impairment of gait function (see Figure 3). Findings corroborate that yoga programs tailored to older adults may offer an effective means of preventing or reducing age-related changes in gait function (Di Benedetto et al., 2005). The mindful approach that characterized the walking exercises of each HY session likely influenced gait function and walking tasks of the POMA tool, improving participants' awareness (Schmid et al., 2010). The most intense and/or difficult exercises of SBE practise (e.g., changes of direction, walking backwards), along with the lack of a mindful approach, might have contributed to the significant impairment of gait function. Such findings suggest that exercise intensity is an important factor in balance exercise prescription for the elderly and that challenging activities should be administered with caution (Farlie et al., 2019).

Similar results patterns were observed for the total balance (see Figure 4). While a significant pre-post intervention improvement was observed for HY, SBE practice impaired total balance. After completing the intervention, participants who practised HY could be considered at a lower falls risk compared to the pre-intervention phase. This finding is in line with the study of Hamrick and colleagues (2017), who proved that short yoga classes were associated with reduced self-reported falls. Moreover, balance improvements after HY interventions could be due to the integration of postures with attention, awareness, meditation, and pranayama exercises (Nick, Petramfar, Ghodsbin, Keshavarzi, & Jahanbin, 2016). These exercises contribute to the "sustenance" of the core stability essential for balance function (Ryba, 2006). SBE practice effects on total balance in contrast to the results of Ni and colleagues (2010), who found balance exercises effective in a geriatric population. This finding could be interpreted considering the slightly older population we involved and concurs with the importance of combining mind and body training to achieve better health (Tang et al., 2020).

We observed a reduction of FoF scores only by means of the yogic practice (see Figure 5). This finding is in accordance with the study by Keay and colleagues (2018), who determined Yoga to be an important falls prevention strategy and as an effective means to increase self-awareness in older adults in India. The self-awareness achieved was also evident in the last filling in of FES-I (Hamrick et al., 2017). Participants who underwent HY indeed took more time to complete the scale and answered the questions in a more conscious way. Instead, FoF in participants who underwent SBE practice remained stable and high. As mentioned above and suggested in the literature (Farlie et al., 2019), this finding is likely due to the intense and quite challenging exercises that were proposed. Overall, our first hypothesis is confirmed.

As also hypothesized, early changes and improvements were only associated with HY, which is likely due to the completeness of the yogic practice (Nick et al., 2016; Rinella et al., 2017). Instead, the lack of significant differences between the mid-term and the last assessment is related to the fact that both groups of participants had not previously practised HY or SBE. Thus, in accordance with motor learning principles, changes and improvements were only initially observed, but longer times are necessary for obtaining further results (Schmidt & Wrisberg, 2008). Future research should envisage longer protocols and follow up that permit better examining the late changes related to yogic or balance practice in older adults. Although our hypotheses were confirmed, more studies are necessary to explore the characteristics of yogic practice further. For example, a comparison of HY with brand new methods, such as the use of rhythmic auditory stimulation to ameliorate gait function (e.g., footsteps sound; Murgia et al., 2018), should be considered.

Furthermore, it could be interesting to investigate psychophysiological parameters and psycho-biosocial states (di Fronso et al., 2017; Robazza et al., 2017). Finally, future studies should envisage randomized trials and larger samples of participants to attain more generalizable findings.

In conclusion, the use of (an adapted programme of) HY should be encouraged for older adults living in nursing homes. This practice could improve balance function and reduce the risk of falls and fear of falling, thereby improving older adults' quality of life. Additionally, it represents an attempt to provide a kind of adapted physical activity that benefits the mind and the body in a context in which the holistic approach to the patient should be adopted and/or reinforced.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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