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The Effect of Physical Activity Programs on Dynamic Balance of Older Adults during Covid-19

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Abstract: Dynamic balance has been found to be a very important skill for older adults in improving posture control and preventing falls, injuries and hospitalizations. The aim of this study was to investigate the influence of two different physical activity (PA) programs on the dynamic balance capability of older adults. Overall, 39 subjects (mean age 62.31) from Tel-Aviv, Israel participated in this research, which has begun few weeks before the Covid-19 restrictions. They were divided into three groups: 16 subjects participated in the Harmonic Gymnastics program; the second group also consisted of 16 subjects who practiced in moderate to high intensity regular fitness exercises and 7 subjects were included in the third group of no PA (No PA). Dynamic balance was measured by the Y balance test before and after three months of the program. The results showed that in the two PA groups, the subjects increased the dynamic balance of both legs, although only the Harmonic Gymnastics group revealed significant results ($p = 0.001$). The two PA groups decreased the number of falls ($p = 0.017$ for both groups), and the No PA group decreased the scores of both legs although the decrease was significant only in the left leg's scores ($p = 0.043$). This study emphasizes the importance of PA in older age groups, especially in Covid-19 conditions, and highlights the importance of the Harmonic Gymnastics PA program which involves body awareness, coordination, vestibular and proprioceptive abilities.

Keywords: *Dynamic balance; Harmonic gymnastics; Fitness; Older adults.*

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Introduction

The quality of life of older adults has become most important due to the rapid grow of this population (C.B.S.I., 2019; Roberts et al., 2018). The decline of physical capabilities in this period of life plays the most critical part in the decline of general health and independence, pain, falls, hospitalizations and death (Trombetti et al., 2016). Dynamic balance was found to be an important physical skill for better physical functioning, especially in older age. Balance control is required for various every day activities, from walking, running, climbing the stairs, to moving from one position to another, etc. In dynamic balance there is a transition in the center of gravity since it involves balance control while moving. The center of pressure changes its place on the base of support and sometimes moves out from it. The importance of balance skill is clear for athletes, the general public and patients with neurological diseases (Hrysomallis, 2011; Lichter et al., 2018). In some studies, it has been found that poor dynamic balance was significantly correlated with decreased mobility, increased falls and the fear of falls among older adults, including people who did not have a history of falls (Lopes et al., 2009). Moreover, Blodgett et al. (2019), have found in 3,563 subjects that higher balance ability at age 53 was connected to lower risk and actual falls in subsequent stages of life (age 60 and more).

Physical activity that was practiced in sports clubs and gyms was associated with higher scores of functioning and physical capabilities, health and well-being in general and in older adults population (Langhammer et al., 2018). Taylor (2014), indicated that fitness PA, as recommended by WHO (2018) should actually be described as a medicine for older adults. Practicing at least 150 min. per week of moderate intensity or 75 min. of vigourous intensity revealed significant benefits for older adults especially in strength and aerobics, but Taylor indicated that there is not enough evidence of the benefit for balance capability. In contrast, the study of de la Motte et al. (2019) revealed moderate significant relations between limb power and balance ability. Higher leg muscle power was related to lower risk of falling and general musculoskeletal injuries. Moreover, Fielding et al. (2017) showed that ordinary fitness practice had positive benefits for older adults' balance and mobility also in minimum doses of practice.

Nevertheless, although many studies showed that PA improved physical capabilities such as: posture control and balance, PA may provide in some cases the opposite results, increase injuries and the risk of falls, especially among unexperienced trainees, people who have sustained injuries

in their past, or when the practice was too intense (Alsubaie et al., 2021; Chachula et al., 2016). The importance of a tailored physical activity program for older adults and the specific skills they should master is clear, although the questions - what would be the most appropriate PA program for older adults and what would be the specific exercises older adults should practice in order to improve their dynamic balance, prevent injuries and falls, are not yet fully answered (Schwickert, et al., 2016).

Investigations that have searched for the best intervention program aiming to improve balance control, reduce and prevent falls among older adults, have found that Tai-chi, home-based program and multifactorial intervention programs significantly reduced the rate and the risk of falls in older adults, especially in multicomponent group exercises and especially in older adults who have experianced falls in the past. Physical intervention programs that mostly reduced falls were associated with highly challenged balance exercises and in greater quantity but not necessarily with walking practice (Gillespie et al., 2012; Zhong et al., 2020).

The aim of this research was to investigate the effect of two different types of PA on dynamic balance skill of older adults: the Fitness program and the Harmonic Gymnastics (HG) program. These two PA programs are different in the intensity level, the nature of the exercises and in the manner of practicing. The Fitness is the ordinary, most popular PA program that is practiced in various gym clubs all over the world. In this practice the focus is usually onn building body muscles' strength, endurance and aerobic training using the gym's fitness machinery and equipmemts such as the treadmill, stepper, stationary bycicles and lifting, pulling and pushing machines to perform weight-bearing exercises in various directions such as: flexion, extention, abduction and adduction press of legs, chest, shoulders, abdominum, back muscles and all primary muscles of the body (Potop et al., 2009).

The HG is a low impact PA program that is based on the 'Healthy Physical Activity' course that was conducted by Efrat Heyman, following the HG approach brought by Judith Binetter and Lotte Kristeller from Germany, to the Physical Education and Movement faculty of the Kibbutzim College of Education in Tel-Aviv, Israel, in 1940. The HG approach includes the practice of posture alignment, muscle and joint strength and flexibility, coordination, proprioceptive and vestibular ability, in order to create harmonious, controled and concious movement (Binetter, 1972; Heyman & Shkedi, 1998; Mullan, 2016; Stebbins, 1892).

Hypothesizes

The hypothesizes of this research were: 1- The participation of older adults in Fitness and Harmonic Gymnastics PA programs will improve their dynamic balance. 2- The influence of the HG program on the dynamic balance of older adults will be greater than that of the Fitness programs.

Methods

Participants

The research took place between February and May 2020 and was approved by the Ethics Commission of Babeș - Bolyai University Cluj-Napoca. Fifty-eight elderly adults from Tel Aviv, Israel, volunteered to participate in this study, signed a participation consent form and agreed to have their photo published. They participated in the first measurement session, which was conducted from 14th to 28 of February 2020, only few weeks before Covid-19 burst into global recognition and imposed constraints that limited the subjects' registration, participation and the ability to adhere to the original research program. The subjects were divided into three groups, depending on the option to participate in the intervention programs: twenty-five subjects were assigned to the HG group, twenty-two subjects to the Fitness group, while 11 subjects were assigned to the No PA group. After three months, 19 subjects were excluded from the statistical analysis: one subject due to a disease, 6 subjects did not submit themselves for the second measurement and 12 subjects stopped participating in the research program. The 39 subjects who participated in the program for three months, consisted of 16 subjects who were part of the HG group, 16 subjects who were part of the Fitness group and 7 subjects who did not participate in any physical activity and were part of the No PA group. Figure 1 represents the flow chart of the participants.

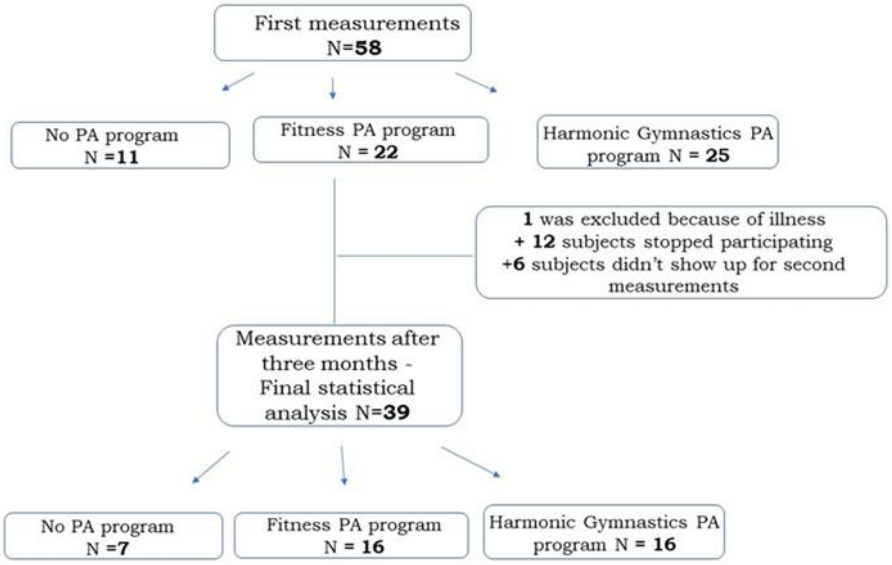

Figure 1. The participants flowchart
Source: Authors' own conception

The physical activity programs

The Fitness group practiced aerobic, endurance and strengthening exercises led by a skilled and experianced trainer. The practice was conducted two times a week, 50 minutes each practice for three months. The practice was divided into four stages: The first stage was aerobic practice on a treadmill, ergometer gym bycicles or stepper for 15-20 minutes. in the second stage all trainees gathered together for flexibility and balance exercises in standing and sitting positions for 5-10 minutes, in the third part of the practice they were directed to the strengthening and power facilities for 15-20 minutes and at the end of the practice they gathered again for general flexibility and balance exercises for another 5-10 minutes. The muscles' strengthening exercises worked on the major body muscles such as: Quadreceps, Hamstring, Gastrocnemius, legs abductors and adductors, Gluteus maximus, foot extensors and flexors, abdominal muscles, Latissimusdorsi dorsi, Biceps brachii, Triceps brachii, Deltoid, Pectoralis Major, Sternocleidomastoid and so on. The muscles strengthening training included three sets of 10-15 repetitions in each set, at low to moderate intensity at the beginning, starting from 50-60% of maximum individual ability with the intention of elevating the intensity level progressively, up to

70-80% of ability. Breaks between sets lasted for 10-15 seconds. The exact level of intensity was performed according to the subject's ability and readiness. The muscle strengthening exercises were conducted by means of the gym fitness machines which included: Chest press / Verticle Chest press / Shoulder press / Leg press/ Over head press / Lat pull down / Seated row / Sitted cable row / Pectoral fly / Assisted pull up / Lateral raise etc.

Examples of flexibility and balance exercises in the Fitness group:

1. Sitting with one leg straight ahead while the other leg is bent aside, bringing both hands towards the foot of the straight leg. Holding this position with the head down to the knee for 15 seconds.
2. Hurdle sitting and reaching towards the straight leg with the opposite hand.
3. Same position as in exercise 2 - positioning hands on the floor behind the back with bended elbows, leaning on the forearms with bended knee down to the floor.
4. Standing on the right leg, with right arm pointing right at shoulder level,, holding the left leg by the ankle with the left hand while bringing the heel up to the buttocks.

When Covid-19 restrictions prevented people from gathering or entering gyms and fitness clubs, some of the Fitness group practiced outdoor walking, running, biking or muscle strengthening in outdoor neighboorhood facilities, and some of them practiced fitness through digital applications, while others stopped participating and were excluded from analysis.

Harmonic Gymnastics practice

The HG group practices contained various exercises in a studio, delivered by a skilled and experienced HG trainer. In HG the trainer describes the exercise in words and the trainees translate the words into movements. The exercises comprise several movements which are performed at a slow pace and in one sequence, so that they form a kind of choreography of a series of movements. The HG practice aims to strengthen and flex the muscles and the joints, while emphasizing the joints' movement. The aim is also to develop attention and body awareness, and to perfect coordination, proprioceptive and vestibular ability. In translating words to movements, and when the exercise includes a series of movements, cognitive qualities are involved and coordination and proprioceptive capabilities are trained. The teacher explains the exercise at the beginning,

and then lets the trainees continue by themselves, relying on memory. Memory is another cognitive capability that is involved and trained by HG. Vestibular ability is practiced in HG in exercises which are conducted when moving from side to side, from lying on the back to lying down on the stomach and when moving from lying down on the matt into sitting and standing positions, and vice versa. Every practice in HG is focused on a specific theme such as: shoulder blades / knee joints movement/ extension and flexion of the feet/ hurdle sitting / extending the quadriceps/ strengthening core muscles using a stick/ hands and wrist movement using a soft ball etc.

Below, we present a Harmonic Gymnastics practice for flexing and strengthening the shoulder and the hip joints with a small bean bag (small sewn cloth bags containing bean seeds). Between the exercises the trainees are asked to rest and follow the trainer's instructions to focus attention and body awareness. The rest sessions are considered part of the practice and usually last about 20 seconds.

The beginning of the practice: the trainer speaks:" Please lie on your back on the mattress. Spread your legs down and place your arms on the floor next to the sides of your body. Take a deep breath and exhale slowly. Focus on the contact of your back with the floor. What part of the head lies on the floor, where do you feel the weight of the head? Feel the way your vertebral column lies on the floor: the Cervical vertebrae, the Thorax vertebrae, the distance of the Lumbar vertebrae from the floor. How do you feel your pelvis lies on the floor? What would be its shape? Its weight? Consider how the right leg presses down and how the left leg does? Are the heels in the same line?

1. Please place both feet standing on the mattress, knees bended, in line with the width of the pelvis. Place the bean bag on your right hand. Lift both hands to the ceiling in plantar flexion and with open fingers. The left hand descends down to the side of the pelvis on the floor and the right hand goes up next to the right side of the head on the floor. And now the hands rise again to the ceiling and this time they move to the floor in the opposite directions: the left hand to the side of the head and the right hand to the side of the pelvis. Pay attention to what do you have to do with the right hand (that carries the bean bag) so that you do not grab it and your fingers remain open without the bag falling. + When the right hand lies on the floor next to the head, lower your knees to the left and when it's on the floor next to the pelvis, lower your knees to the right. + When the knees are on the right side

and the right hand is down by the pelvis, bring the left leg bent over your stomach and right towards the bean bag that is on your right hand.

Rest. Put your hands down on both sides of the body. Consider again how your body lies on the floor, especially your left and right hands.

Repeat the exercise the other side: place the bean bag on the left hand etc.

2. On your back again, both feet are standing at the width of the pelvis and the bean bag is on the right hand. This time the right hand holds the bean bag with the thumb on one side and the fingers on the other side of the bag. Bring both hands up on the floor, lying on both sides of the head, so that the head is between them. Lower the knees to the left side. Roll and stay on the left side (the head is placed between the hands). Lift the right leg a little bit from the floor so it's bent and in the air. Lower the right hand down on the ankle (on the Malleolus lateralis) so that the bag touches the ankle for a minute and then the right hand goes up again. The right leg returns down on the floor. + Now the right hand puts the bean bag on the ankle (Malleolus bone) and the right leg stays in the air for a minute and then the right hand takes the bean bag up again. + When the bean bag is on the right ankle, the right hand moves to the floor on the right side of the body and rests there, while the right leg moves to the left side bent with the bean bag on the ankle. At the next step see if you can lengthen the right leg on the left side with the bean bag on it. The right leg goes back to a bent position and the right hand arrives to take the bean bag up over the head again.

Rest. Shake your legs a little bit and look if the right heel is in the same line as the left heel. Does one of the legs feel longer?

Do the same exercise on the opposite side: the bean bag on your left hand/ right leg etc.

3. Lie on your back. The left leg stands on the floor. The right leg is up "looking" at the ceiling and the bean bag is on the sole of the foot. Please lengthen your leg to the ceiling and bend it a little bit up and down. Please notice what do you have to do with your ankle and your leg so that the bean bag will not fall + Now lower the right leg while it is straight with the bean bag on it. How far can you lower the leg down while the bean bag stays on the sole of the foot? What do you have to do with your ankle? + Interlace

your fingers behind your head and lift your head from the floor at the same time as you lower the right leg straight down again as far as you can, without dropping the bean bag from the right leg.

Rest. Breath slowly into your stomach and exhale slowly.

4. Please lie on your left side. The hands are one on top of the other straight ahead at shoulder height. The left leg is bent and close to the belly and the right leg is up straight to the ceiling, with the bean bag on the sole of the flexed foot. Please move your right leg like a pendulum right and left in small movements. + When it moves to the left side the right hand opens and comes down to the floor on the right side, in a semi-circular movement, and when the right leg moves to the right side the right-hand closes towards the left side, to be on top of the left hand as before. + When the hands are together on the left, and the right leg is on the right side, lift the left forearm from the floor and keeping the hands together move to your back and straighten your left leg to the ceiling so that now you're on your back, two legs straight and up to the ceiling, the bean bag on the sole of your right foot, your hands are bent, bring the elbows up to touch your knees, while the palms of your hands together as if praying. Easily and slowly move back to the left side. Bend your left knee, put your arms straight one on top the other on the floor on the left side and hold your right leg straight up.

Rest. Consider how your body is on the floor. Look at the space between your knees and the floor and the space between your ankles and the floor. Do you sense any difference between the right leg and the left leg?

Do the same exercise on the opposite sides.

5. Please lie on your back. The left leg stands on the floor. The right leg is up "looking" at the ceiling and the bean bag on it. Now please find a way to turn over on your stomach while keeping the bean bag on your right leg and then move back to lying down on your back with the right leg straight up and the bean bag on it.

Rest. Notice how your left side lies on the floor and how your right side does. Is there a difference between them?

Do the same exercise with the left leg.

6. Please stand up. Place the bean bag on your right hand straight up to the ceiling while the left hand is down by the side of the body. Now switch the directions of the arms so that the right hand will be down and the left hand will be up, without dropping the bean bag.

Rest. Shake your hands a little bit while standing.
Repeat the exercise on the opposite side.

7. Stand on the left leg. Lift your right leg up with the bean bag on the instep of the foot Take the bean bag from the foot with the left hand, now lift both hands up and place the right leg standing next to the left leg. The left hand passes the bean bag to the right hand, and now lift the left leg and put the bean bag on the instep of the left foot … and so on from the hand to the opposite leg over and over, like in a circle.

Rest. Shake your legs a little bit while standing. Walk around the room while leaving the shoulders down and relaxed, feeling the movement of the hip joints".

The Research tools

The dynamic balance was measured by the Y Balance Test (YBT), a valid and reliable test that measures dynamic balance and postural control. In addition, it is considered as a tool that measures coordination, lower limbs strength, movement ability and proprioceptive capability (Francis & Perrem, 2017; Plisky et al., 2009; Walaszek et al., 2017).

Figure 2. The Y balance test (Retrieved from: http://www.functionalmovement.com)

In the YBT, the subject stands on a three-sided interface point that is connected to three tracks that formulate a structure that is similar to an upside-down letter Y: one track is in the anterior-posterior direction, one in the posterior-medial direction and the third track in the posterior-lateral direction. Every track has a dice which the subject must move to the longest distance he can in a smooth continuous movement, standing on the other leg as seen in Figure 5 the subject is allowed to put the leg that pushes the dices on the floor only after he/she pushed the three dices in the three directions. Every subject must perform three attempts for each leg. The score of the performance of every leg is calculated by dividing the average of the distance one leg has achieved in every direction by the length of the leg *(multiplied by) 100. The average of the three attempts provides the composite score, which is expressed in percentage. Figure 2 presents all three directions in which the subjects in the YBT push the dices with each leg. The left picture presents the anterior-posterior direction. The picture in the middle presents the posterior-medial direction and the picture in the right side presents the posterior-lateral direction.

Data recorded as a result of the measurements were statistically analyzed using the SPSS software, version 23.0. The scores that had normal distribution were analyzed using parametric tests, and those that did not have normal distribution were analyzed using non-parametric tests.

Results

The sociodemographic data of the subjects are presented in Table 1. In the No AP group only 7 women participated, whereas 9 women and 7 males were part of the Fitness group, with the same division in the HG group. In the No PA group and the Fitness group all participants had a minimum of high school education and in HG group only one participant didn't finish high school. Most of the participants in the Fitness and HG groups had academic education (11 and 13 respectively), whereas in the No AP group 4 participants out of 7 had academic education. In the Fitness and HG group 11 subjects were married and 4 subjects were divorced whereas in the Fitness group one subject was a widow and in the HG group one subject was single. In the No AP group two subjects were single, two subjects were married and three were divorced.

Table 1. Sociodemographic characteristics of subjects (N=39)

Variable		No PA group	Fitness group	HG group	Total
Age (years)	Mean (SD)	64.14 (14.15)	63.44 (8.25)	59.37 (10.71)	61.90 (10.41)
Height (cm)	Mean (SD)	157.57 (8.73)	168.94 (11.26)	167.75 (10.71)	166.41 (10.68)
Weight (kg)	Mean (SD)	65,86 (13.41)	78.97 (14.66)	77.41 (11.45)	75.97 (13.73)
N (%)	Male	0 (0%)	7 (17.95)	7 (17.95)	14 (35.90)
	Female	7 (17.95)	9 (23.08)	9 (23.08)	25 (64.10)
	Total	**7 (18%)**	**16 (41.5%)**	**16 (41.5%)**	**39 (100)**
Education [N (%)]	< 12 years	0 (0%)	0 (0%)	1 (2.56)	1 (2.56)
	Hight school	3 (7.68)	5 (12.80)	2 (5.12)	10 (25.60)
	Academic	4 (10.26)	11 (28.23)	13 (33.35)	28 (71.84)
Marital status [N (%)]	Single	2 (5.13)	0 (0%)	1 (2.56)	3 (7.69)
	Married	2 (5.14)	11 (28.21)	11 (28.21)	24 (61.54)
	Divorced	3 (7.69)	4 (10.26)	4 (10.26)	11 (28.21)
	Widow	0 (0%)	1 (2.56)	0 (0%)	1 (2.56)

Source: Authors' own conception

The mean age of all research participants was 61.90 (10.41). The mean value of the No PA group's age was 64.14 (14.14), in the Fitness group it was 63.44 (8.25) while the HG group consisted the younger mean age which was 59.37 (10.71).

Table 2. Comparisons of means of the YBT variables between the three groups before (T1) and after (T2) the program

Variable	Group	Time 1 Ranks		Time 1 Kruskal Wallis Test Statistics [a, b]			Time 2 Ranks	Time 2 Kruskal Wallis Test Statistics		
		N	Mean Rank	χ^2	df	Sig.	Mean Rank	χ^2	df	Sig.
CSRL (%)	No PA	7	19.29	0.778	2	0.678	10.43	12.952	2	0.002
	Fitness	16	18.44				16.81			
	HG	16	21.88				27.382			
CSLL (%)	No PA	7	20	1.364	2	0.506	10.71	10.875	2	0.004
	Fitness	16	17.66				17.44			
	HG	16	22.34				26.63			

NF	No PA	7	21.57	3.091	2	0.213	26.43	9.118	2	0.01
	Fitness	16	23.03				22.97			
	HG	16	16.28				14.22			

a. Kruskal Wallis Test; b. Grouping Variable: PA /CSRL = Composite score of the right leg; CSLL = Composite score of the left leg; DBL= the difference between the leges; NF= the number of falls
Source: Authors' own conception

Table 2 shows the comparisons of the dynamic balance parameters that were measured by the YBT: the composite score of the right leg (CSRL), the composite score of the leg (CSLL) and the number of falls (NF), of the three groups, before (time 1) and after the program (time 2). There were no differences between the groups before the program in any of the YBT variables and significant differences between the groups after the program. The distributions of the CSRL and the CSLL were found not normal, in contrast the NF variable of the No PA group was found normally distributed therefore, the statistical analysis was conducted by the t-test only for the NF in the No PA group and by the non-parametric Kruskal Wallis test for all the other YBT variables which were not normally distributed. The Wilcoxon test was used for the differences within groups before and after the program for all variables, except for the NF in the No PA group which was analyzed by the t-test.

Table 3. Comparison of the YBT variables' mean scores within groups before and after the program (N = 39)

Physical Activity (N)	Variable	Mean (SD) Time 1	Mean (SD) Time 2	Z*/t**	Sig p	Size effect d
No PA (7)	CSRL	36.87 (30.10)	26.22 (24.77)	-1.214*	0.225	-
	CSLL	44.13 (31.4)	36.94 (26.74)	-2.023*	0.043	- 0.76
	NF	2.57 (2.5)	2.71 (2.63)	-.420**	0.689	-
Fitness (16)	CSRL	34.77 (29.71)	41,31 (26.64)	-1.664*	0.096	-
	CSLL	33.76 (30,16)	49.93 (25.93)	-1.817*	0.069	-
	NF	3.00 (2.28)	1.62 (1.96)	-2.382*	0.017	0.60
HG (16)	CSRL	43.99 (26.10)	64.17 (23.23)	-3.351*	0.001	0.84
	CSLL	48.84 (26.81)	67.82 (20.65)	-3.408*	0.001	0.85
	NF	1.75 (2.17)	0.5 (1.54)	-2.378*	0.017	0.60

Notes: * Wilcoxon Signed Ranks Test/ ** Paired Sample t-Test;
CSRL = Composite score of the right leg; CSLL = Composite score of the left leg; DBL= the difference between the leges; NF= the number of falls
Source: Authors' own conception

Table 3 shows that the No PA group decreased their right leg [from 36.87 (30.10) to 26.22 (24.77)] and left leg [from 44.13 (31.4) to 26.22 (24.77)] composite scores of the YBT, although only in the left leg the decrease was significant ($Z = 2.023$, $df = 6$, $p = 0.043$). The Fitness group increased their right leg [from 34.77 (29.71) to 41,31(26.64)] and left leg [from 33.76 (30.16) to 49.93 (25.93)] composite scores, although with borderline significance ($Z = 1.66$, $df = 15$, $p = 0.096$ in the right leg and $Z = 1.817$, $df = 15$, $p = 0.069$ in the left leg). The HG group increased the right leg mean score [from 43.99 (26.10) to 64.17 (23.23)] and the left leg [from48.84 (26.81) to 67.82 (20.65)] composite scores significantly ($Z = 3.351$, $df = 15$, $p = 0.001$, $d = 0.84$ in the right leg and $Z= 3.408$, $df = 15$, $p = 0.01$, $d = 0.85$ in the left leg). The number of falls did not change for the No PA group but decreased significantly in the Fitness ($Z =-2.38$, $df = 15$, $p = 0.017$, $d = 0.6$) and HG groups ($Z = 2.378$, $df = 15$, $p = 0.017$, $d = 0.6$).

Discussion

This research study is part of a Doctoral research in the Faculty of Physical Education and Sport, Babeș-Bolyai University (UBB) in Cluj-Napoca, Romania. The main research intended to investigate the influence of Harmonic Gymnastics on posture control, balance, proprioceptor ability, body awareness, health and well-being of older adults. The Ethical Approval (No 8436) was conducted by UBB on 21. 05. 2019. The research was performed with healthy people from Tel-Aviv, Israel aged 50 years and older. The participants signed the consent form between 14-28/2/2020, before the program began, about two weeks before the outbreak of Covid-19.

In this research at baseline conditions there were no differences between the groups before the program in the YBT right leg and left leg composite scores, in the differences between legs and in the number of falls. The results of this study show that the two PA groups increased the right leg and left leg scores of the dynamic balance although only in the HG intervention program group the dynamic balance scores significantly increased (the p value of both legs was 0.001), while in the Fitness group the differences in both legs were not significant ($p = 0.069$ for the left leg and $p = 0.096$ for the right leg). Both PA groups significantly decreased the number of falls ($p = 0.017$ in both groups), thus reducing the risk of falls and therefore injuries. People who did not participate in any PA programs did not improve any of the dynamic balance parameters measured by the

YBT, but rather decreased their dynamic balance of both legs after three months, while in the left leg the decrease was significant ($p = 0.043$).

Naturally, the scores of the subjects in this research were rather lower than those of measured in athletes and young subjects. Therefore, the difference between the legs, that was found related to the risk of injuries was also not relevant in this case because of falls, which created large gaps with the cut points that were indicated in several studies (Plisky et al., 2006; Plisky et al., 2009; Smith et al., 2015).

The results of this study follow many studies of recent years that emphasized the importance of PA for better balance and on the other hand, the risks of inactivity and sedentary behavior especially during the Covid-19 period of time (Hall et al., 2020; Langhammer et al., 2018). Finally, the Fitness participants increased the dynamic balance scores, but not as much as the HG participants, who practiced various abilities other than strength and endurance. Although some researchers have shown that the YBT scores are related to the strength of the hip extensors and abductors and the knee flexors (Lee et al., 2014), the results of this research are in line with the study of Muehlbauer et al. (2012) who revealed no correlations between balance and muscle strength, and concluded that balance control is a specific complex task, independent of muscle strength. This conclusion was also reached by Horak (2006), who also indicated that balance control is a complex capability that involves multiple physiological and neurological systems and requires a cognitive effort to process the body organization against the forces which may interfere with body equilibrium during movement.

It seems that the practice of flexibility of the muscles and joints, coordination vestibular and proprioceptive mastering as was conducted in the HG intervention program, was found to enhance the sensorimotor functioning and to contribute to the balance and posture control of older adults. Chatzopoulos et al. (2014), have shown that when flexibility is practiced thotoughly, it contributes to various functional capabilities including dynamic balance. The coordination practice in the HG program also involves motor learning, which has also been found to contribute to balance control. New exercises and combinations are practiced regularly in HG program and rarely repeat themselves. In his article from 2016, Stoffregen, argued that exercises that involved motor learning with new and surprising challenges, improved posture and balance conrol in older ages. Recent studies showed the contribution of coordination skill to dynamic balance in atheletes and in older adults (Chagas et al., 2017; Dunsky, 2019). The relationship between coordination and balance has been known for

many years, Shunway-Cook and Horak (1986) explained how balance and posture control involve coordination between the trunk and leg muscles, in order to gain equilibrium on the base of support. They showed that older adults relied on proprioceptive sensors of the standing feet, rather than visual and vestibular systems, as these systems decline with aging.

Proprioceptive and vestibular abilities were also found to contribute to balance ability (Ghai et al., 2017). Shaffer and Harrison (2007), have found that aging has a negative influence on the proprioceptive ablity, and one of the trubling consequences is that it causes poor balance conrol and increases the risk of falls in older adults. Yong and Lee (2017), have found that different proprioceptive exercises on dorsiflexion and planter flexion contributed significantly to the dynamic balance.

In addition to coordination and proprioceptive practice, Anson and Jeka (2016) have shown that dynamic balance would be the best indication for vestibular ability in older ages. In the HG intervention program, there are large number of exercises which combine rolling from side to side or tilting the pelvic or head gently to various directions. Karmeli et al. (2017), who searched for the vestibular threshold of modified Romberg test, have found that the vestibular component and age had significant impact on the dynamic balance performance. The more people age and the lower their vestibular threshhold, the higher their danger of falls. In the highest vestibular threshold, older adult had a 5% chance of falling but when the vestibular thresholds were lower the odds of falling climbed to 80%. Moreover, the vestibular ability explained 40% of the balance ability whereas age explained 20% of the variance. Nevertheless, this research may strengthen the assumption that low impact somatic physical activity methods such as HG and also Feldenkrais method and Pilates practice that were influenced by the original HG approach may reveal a significant positive effect on balance control, as was found by Hillier and Worley (2014) and by Moreno-Segura et al. (2018).

The unique conditions of this reseach that were influenced by the Covid-19 pandemic must be taken into account. Researchers have also shown that digital behaviour such as participating in practices through the Zoom application, as was practiced fully in the HG group, and partially in the Fitness group, promoted PA levels and health among older adults in the Covid-19 period of time (Stockwell et al., 2019).

Generally, it was surprising to see that after three months the No PA group decreased balance scores of both legs and significantly decreased the scores of the left leg, because it was expected there would be no changes before and after the program for this group. Goethals et al. (2020), stressed

that these phenominons may occur as a result of the lack of PA in older adults in the Covid-19 pandemic attack conditions that broke out few weeks after the first measures of this research. Researchers indicated that these unusual conditions were harsh and frustrating and evoked feelings of depression (Mills et al., 2020). Depression was found significantly related to posture and balance deficiencies in animals, children, young and older adults, and people with neurologic illnesses such as Parkinson's disease and Alzheimer's disease. Scientific studies have shown that balance control decreased in the presence of depression (Beheydt, et al., 2015; Kim et al., 2018). Moreover, Lepicard et al. (2003), showed that mice with anxiety were more prone to fall off the rotating beam test than the healthy control group.

Limitations

This study was conducted in the Covid-19 pandemic period of time, which prevented studios, gyms and fitness clubs from opening and prohibited any kind of gathering. Therefore, the intervention program was conducted online by Zoom application and the Fitness program was partially online and partially performed individually outdoor.

Conclusions

This study shows that the participation of older adults in two physical activity programs – Harmonic Gymnastics and Fitness improved the dynamic balance. The evaluation of the dynamic balance parameters that were measured by the YBT, indicated significant differences after three months program. The value of significance of the statistical analysis tests indicated that the influence of Harmonic Gymnastics program was greater than that of the Fitness program. Furthermore, the special conditions in which the physical activity programs took place most of the time, determined by the Covid 19 pandemic, highlighted even more the beneficial effects of these programs on the dynamic balance of older adults, especially those of Harmonic Gymnastics, which involves attention, body awareness, flexibility, coordination, proprioceptive and vestibular ability practice. Investigation in larger samples and in normal conditions is required to strengthen these findings in this population.

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