Journal of Physical Education and Sport ® (JPES), Vol. 21 (4), Art 209, pp. 1650 - 1658, June 2021
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Live online exercise programs during the Covid-19 pandemic – are they useful for elderly adults?

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Published online: June 30, 2021
(Accepted for publication June 15, 2021)
DOI:10.7752/jpes.2021.04209

Abstract
The present study aims to investigate the effects of live online exercise programmes, being conducted in Germany during the lockdown period of the COVID-19 pandemic, on the performance levels of elderly adults. The live online exercise programme was conducted in 12 groups at different hours during the specified period.
The study involved a total of 534 individuals, 183 (99 females and 84 males) in the experiment group and 171 (94 females and 77 males) in the control group, aged 60–89. The 60-minute live online exercise programme was conducted once every week for 20 weeks, and a Senior Fitness Test consisting six different parameters was used for measuring the muscle force, aerobic endurance, and dynamic balance skills. The pretest and posttest were used for evaluating and comparing the improvements in the physical performance. It was determined that the exercise programme positively affected the lower body strength, upper body strength, flexibility, and agility/dynamic balance skills of elderly adults. It was also observed that the performance decreased with advancing age, especially after the age of 70. Moreover, men were found to be stronger, more durable, and faster than women, while women were observed to be more flexible than men. The results provide important information regarding the physical performance assessments of elderly adults and suggest that advancing age has a negative impact on physical performance. Therefore, the integration of live online exercise programmes into their lives during the COVID-19 pandemic, which is expected to last a long time, may positively affect the physical performance of elderly adults.
Keywords: Elderly adults, functional test, mobility, physical fitness, Senior Fitness Test

Introduction

The Covid-19 pandemic, which emerged in December 2019 in Wuhan-China (Li et al., 2020), is negatively affecting the lives of people across all social, economic, and educational statuses, regardless of gender, skin colour, belief, age group, and country. Elderly adults, who are 65+ years old and affected by this pandemic are considered the most vulnerable patients and individuals, who have no chance to survive when infected (Spuling et al., 2020). However, aging is not considered a disease but a natural process and is a relative concept and this has not changed during the pandemic. Aging is accepted as an unchangeable risk factor, and it is also related to degenerative alterations, causing increases in multiple diseases and disorders (Aksay, 2021). With advances in age, visual and hearing loss develops, pathological changes increase, and body resistance decreases (Witte, 2018). People think and move more slowly (Davi, 2018), and infection risk increases (Spuling et al., 2020). However, this risk is related to elderly individuals' general medical status such as cardiovascular diseases, chronic diseases, weak immune system, smoking, nutrition, and physical performance (Heisig & König, 2020; Spulin et al., 2020). It is stated that unhealthy nutrition, excessive alcohol consumption, smoking (Feldman & Anderson, 2013; Huttunen et al., 2011) use of addictive drugs such as narcotics (Jordan et al., 2020) lockdowns, and measures limiting the public life significantly affect the use of alcohol/smoking, nutrition, and exercise habits. Increase in the measures taken during the Covid-19 pandemic, such as quarantine, social distancing, use of mask, body hygiene instructions, and lockdown has decreased the risk of infection and prevents the overload on the medical system (WHO, 2020).
However, the realities directly affecting health are overseen, especially as people stay home in the lockdown period, they cook more, perform physical activities less (Jordan et al., 2020), and sleep more. Regarding sleeping more, the muscle power decreases and muscle mass reduces by 20% in a week (Bloch et al., 2020) Cooking more is related to eating more and lays the foundation for obesity and obesity-related diseases (Jordan et al., 2020) increases the use of alcohol (Torres & Nowson, 2007), negatively affects the mental health (Brooks et al., 2020), and creates a more inactive lifestyle (Mattioli at al., 2020).

Although the quarantine during the Covid-19 pandemic inevitably affected the life and health of the elderly in a negative way, it is thought that the lifestyle of the individual, rather than the biological age, is decisive in terms of physical development and health (Aksay, 2021). Thirty percent of aging considered as a natural process and a relative concept is caused by sensory, mental and physical factors beyond the control of the

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person, and seventy percent of aging depends on the lifestyle (Aksay, 2021).) Deficiencies may occur in motor skills, especially after the age of 60, motor functions such as strength, endurance, balance and flexibility decline, and this decline seems to increase considerably after the age of 80 (Witte, 2018). Attention should be paid to preserving motor skills in order to maintain an independent life in elderly period (Brach & Schott, 2003). Decreased muscle strength, signs of wear on the joints and spine, deterioration of the cardiovascular system, loss of sensory function, and age-related psychological and sensory changes are all considered as determinants of physical performance (Witte, 2018). Although the ability of learning new movements slows down with aging, studies show that regular physical activities support the learning process (Witte, 2018).

Individuals think more slowly and act more slowly with advancing age (Davi, 2018). Furthermore, cognitive function loss may occur in the elderly, and physical performance of those with inadequate cognitive function may be low due to these losses (Allmer, 2005; Ruiz-Montero, & Castillo-Rodríguez 2016). It is stated that performance losses should not be associated only with aging, but aging is an important factor, and it is emphasized that the human organism is capable of being trained at all ages (Mason et al., 2016). The type of physical activity and exercise to be performed with the elderly should be carefully determined for the protection of health (Aksay, 2021). When planning exercise, the elderly, meeting the daily needs independently, preserving and developing endurance, strength, flexibility and balance, and slowing down aging are the primary objectives (Rikli & Jones, 2013; Wessel & Hummel, 2019). Especially muscle strength and endurance are two inseparable features and should be trained together (Aksay, 2021). After the age of 50, muscle strength decreases by 15-20% on average for each passing decade, and the decrease in muscle strength can bring many difficulties, especially by reducing the quality of daily life (DOSB, 2016). Studies show that with regular and targeted strength training, muscle strength can be improved despite advancing age (Granacher et al., 2009). Considering that endurance decreases by 5-15% for each decade starting from the age of 30 (DOSB, 2016), it is stated that endurance is also required in addition to a certain level of muscle strength in order to perform daily activities of different difficulty levels (Chmelo et al., 2015). Although there is a decrease in the tempo of movement with advancing age, it is stated that it is not impossible to develop endurance after the age of 65 (Aksay, 2021). In addition to strength and endurance, loss of flexibility that may occur prevents many physical functions required for mobility, increasing the risk of joint injury and the risk of falling with advancing age (DOSB, 2016, Rogan et al. 2015; Verma et al. 2017). At the same time, it is stated that motor learning and motor skills are an important factor in changing direction during movement and it is important in preventing injuries in the elderly during sudden changes in direction during any type of daily activity (DOSB, 2016).

In general, it is known that physical activity and exercise decrease the age-related medical problem and dependency risks, increase the quality of life (Cho & Bum, 2019) strengthen the immune system, decrease the risk of diabetes, hypertension, blood pressure levels (Doro et al., 2018) and age-related risk of fall, and positively affect mental health (Wettstein, 2020). In its suggestions regarding the eradication of the Covid-19 pandemic, World Health Organization (WHO) emphasizes the importance of exercise and a healthy lifestyle (WHO, 2020). For this reason, physical activity gained further importance for a healthy life in the lockdown period. Considering the benefits of physical activity and exercise, elderly adults are recommended to regularly participate in physical activity and exercise programs (Wettstein, 2020). However, lockdowns and social interaction limitations during the Covid-19 pandemic caused people to be scared of being close to one another and this negatively affected their lifestyle. Swimming pools, fitness centres, and sports halls were closed and the elderly adults, who are considered the top risk group, were affected at most. Considering all these, we aim to bridge this gap via Live-Online Exercise Programs by making use of technological advancements and providing individuals with the opportunity to exercise at home.

In literature, there is no study investigating the effects of Live-Online Exercise Program on elderly individuals during the Covid-19 pandemic. In this parallel, the present study aims to bridge this gap by examining the effects of Live-Online Exercise Program on elderly individuals during the lockdown period. Live-Online Exercise Program might not decrease the risk of Covid-19 infection, but the body might struggle more strongly with a potential infection because performance at a high level is considered an important factor in coping with infection (Claussen et al., 2020).

Method

Study Group: The present study involved 357 individuals aged between 60 and 84 years, 162 individuals in experiment group (107 females and 55 males) and 195 individuals in control group (124 females and 71 males). All the individuals in experiment and control groups were chosen from those participating in physical activity and exercise program in TV Eberbach e.V. Department of Medical Sports in Germany. Participants with access to technological settings allowing participation in the in-home Live-Online Exercise Program constituted the experiment group, whereas those who did not have or use such a technological opportunity were involved in the control group.

The data were collected in accordance with the provisions of the "Federal Law on Data Collection" (BDSG). The approvals were obtained from relevant federation and Germany TV Eberbach e.V. Medical Sports Department (TVE/GS 2019-0910). The volunteer participants were involved in the present study and, in

harmony with the Declaration of Helsinki, the participants were informed about the objectives and the content of the study and protection of the data. Then, written consents of participants were obtained.

Activity Protocols: All the participants were selected from the individuals participating in the Rehabilitation Sports program of TV Eberbach e.V. Department of Medical Sports in Germany. The *Experiment group* was provided with 60-min Live-Online exercise program once every week. The exercise program consisted of general information, warming-up, the main process, and cooling down. In these exercises, simple instruments such as elastic band, balance mat, dumbbell, chair, and towel were used. Every participant was given an elastic band and a balance mat before the procedure, and they were asked to bring their own dumbbells of 0.5–2 kg weight. If they had no dumbbell, they were instructed to use 0.5–2l water bottles, which can be easily found anywhere. One or more of the instruments can be used in a single exercise unit. After 10 minutes of warming up, the exercises for lower body strength, upper body strength, endurance, balance, and flexibility were performed in the main process, using body weight and supportive instruments. The program was established with exercises that can be performed at home. In the cooling-down part, 5-min stretching exercises were performed and then, in the final part, feedbacks were received from the participants. The duration of feedbacks was not included in the exercise time.

In order for the participants to be able to clearly see the instructor in Live-Online Exercises, a professional camera and microphone system was used and in order for the instructor to see the participants, the image was reflected on a 160" screen. Zoom Video Communication system was used in all the online videos.

The exercises in the program were demonstrated by a licensed instructor in practice, and the participants were asked to repeat the exercises. In order for the exercises to be perfectly performed, the corrections were performed by the instructor when necessary. Each training unit included 4–8 exercises and the scope, severity, and the resting time of the exercises were determined according to the characteristics of the training group, such as their age and gender. Exercises were performed with 20–60 second load and rest cycle and, depending on the difficulty level of exercise and the age, the resting periods were at times prolonged up to 90 seconds.

In total, 12 live-online exercise groups were established and 8–15 participants were assigned to each group. In accordance with the data collection tool, the groups were established by gathering people of similar ages in the same group. Physical performance improvements were evaluated using pretest and posttest. Pretest data were collected on 1st March 2020, three weeks before the general lockdown, whereas the posttest data were collected since 30th July after the end of lockdown.

The *Control group* was given no program, and they were asked to maintain their normal daily lives. All the patients participated in trainings on regular basis and their attendance was followed by the instructor, using a signature list. Weight, height, and BMI measurements were performed using Seca 769 digital weight7height scale.

*Data Collection Tools***:** Senior Fitness Test (SFT) consisting of six parameters addressing lower body strength, upper body strength, aerobic endurance, lower body flexibility, upper body flexibility, and agility/balance measurements was used in the present study. *SFT* was developed by the physiotherapists Dr. Roberta Rikli and Dr. Jessie Jones by considering the difficulties arising from aging (Rikli & Jones 1999) and after application on 7183 healthy individuals aged between 60 and 94 years in the USA, the results were published in 2001 (Rikli & Jones, 2001). In the second edition published in 2013, the fitness standards were established (Rikli & Jones, 2013). SFT includes important physical activity factors, which elderly individuals need in their daily lives and which are not included in other tests. The current physical deficiencies are determined on time and undesired movement habits can be appropriately modified. Determining the elderly individuals' performance statuses, successfully applying the tests, and simply analysing the test results are the key points. For this reason, the test parameters were organized in order to be applied in a limited space or home, so that the test can easily be applied by any individual aged between 60 and 94 years without any assistance. The test parameters can be applied by many elderly individuals safely and in a short time, without the need for any medical examination. Based on these ideas, six test parameters addressing the lower body strength, upper body strength, aerobic endurance, lower body flexibility, upper body flexibility, and agility/balance (DOSB, 2016; Rikli & Jones, 1999; Rikli & Jones, 2013) were developed:

- Lower body strength is measured using a 30-sec chair stand test,
- Upper body strength is measured using hand weights (2.5kg for women and 3.5kg for men) in 30-sec Biceps-Curl test (original weights are 3.6kg for men and 2.3kg for women),
- Aerobic endurance is measured using a 6-min walk test (the alternative is a 2-min step test)
- Lower body flexibility is measured using chair sit-and-reach test,
- Upper body flexibility is measured using back scratch test,
- Agility/dynamic balance is measured using 2.4m up-and-go test.

The metric characteristics of cited SFT test have been defined by Rikli and Jones (1999; 2013) in detail.

Data Analysis: The data analyses (IBM SPSS 26-for Mac) were performed using descriptive statistical analysis (mean, standard deviation, minimum, and maximum) in order to define the characteristics of the study group. The skewness-kurtosis values were used in order to determine if the data were normally distributed. Since the normality test (Skewness-Kurtosis) yielded a result between -2 and +2 (George & Mallery, 2010), the data distribution was accepted to be normal and the difference between experiment and control groups was analysed

using independent sample Student-t test, whereas dependent sample Student-t test was used in examining the intragroup pretest-posttest difference. One-way variance analysis was used in assessing the standard norm values of age groups. The statistical significance was set at $p<0.05$ for the comparisons.

Results

In the present study, 357 individuals aged between 60 and 84 years (162 individuals experiment group [107 females and 55 males] and 195 individuals in control group [124 females and 71 males]) were involved in total.

The mean values, standard deviation, minimum and maximum values of the participants' age, height, weight, and BMI values are presented in Table 1.

It was determined that mean age and height values of women in the experiment group were found to be lower than in control group, weight values were equal, and mean BMI values of women in experiment group were higher than in control group. On the other hand, mean age and BMI values of men in the experiment group were found to be higher than in control group but the mean height and weight values in the experiment group were lower (Table 1). In general, it can be stated that, in comparison to the men, women are shorter and heavier and have higher mean BMI values.

Table 1: Mean, standard deviation, minimum, and maximum height, weight, age, and BMI values of participants in experiment and control groups

		Experiment group (Female n=107, Male n=55)			Control group (Female n=124, Male n=71)		
Items	Gender	Mean±SD	Minimal	Maximal	Mean±SD	Minimal	Maximal
Age (years)	Female	67,4±6,48	60	84	68,3±7,12	60	84
	Male	69,8±7,30	60	84	69,3±7,31	60	84
Height (c)	Female	165,3±5,84	153	178	165,5±6,62	151	181
	Male	173,7±6,73	159	187	174,7±7,69	159	189
Weight (kg)	Female	66,8±4,71	55	77	66,8±5,75	55	80
	Male	70,9±5,98	60	84	71,2±6,53	58	86
BMI	Female	24,45±1,13	22,39	27,48	24,38±1,28	22,28	28,76
	Male	23,49±1,21	21,01	26,61	23,39±1,17	20,90	26,61

SD: standard deviation, BMI: Body mass index (weight/height^2)

The mean and standard deviation values of the pretest and posttest data of experiment and control groups are presented in Table 2. According to the results obtained from statistical analyses conducted after 20 weeks of Live-Online Exercise Program, there were statistically significant differences between pretest and posttest values of men and women in experiment group in all of six subtests (chair stand, arm curl, aerobic endurance, up-and-go, chair sit-and-reach, and upper body flexibility) ($p<0.05$).

Table 2: Experiment and control groups' pretest and posttest results in chair stand, arm curl, aerobic endurance (6-min walk), up-and-go, chair sit-and-reach, and back scratch tests (Paired Sample t-Test)

		Experiment group (n=183)				Control group (n=171)			
		pretest	posttest			pretest	posttest		
Items	G	Mean±SD	Mean±SD	t	p	Mean±SD	Mean±SD	t	p
Chair stand (n)	F	13,6±1,58	15,0±1,28	-21,4	,000**	13,8±1,73	13,7±1,85	1,30	,193
	M	14,0±1,63	15,6±2,28	-10,0	,000**	14,5±1,55	14,3±1,64	2,25	,027*
Arm curl (n)	F	15,1±1,24	16,84±1,51	-28,1	,000**	14,7±1,35	14,9±1,35	-3,99	,000**
	M	17,0±1,33	18,2±1,72	-9,84	,000**	16,5±1,36	16,7±1,46	-1,87	,068
Aerobic endurance (6-min walk)	F	574,6±34,9	599,2±47,1	-10,4	,000**	569,1±37,1	568,7±37,3	1,55	,118
	M	585,0±46,6	622,4±68,2	-10,7	,000**	590,3±45,8	588,7±46,6	3,72	,000**
2,45 m up-and-go (s)	F	5,90±,60	5,48±,61	12,9	,000**	5,90±,60	5,88±,58	2,25	,026**
	M	5,80±,74	5,42±,75	14,4	,000**	566±,71	5,63±,75	2,11	,038*
Chair-sit-and-reach (cm)	F	4,67±3,90	5,51±3,70	-15,5	,000**	4,43±3,71	6,62±3,57	-1,65	,100
	M	,50±4,63	1,39±4,78	-13,0	,000**	1,53±4,22	1,38±4,32	,826	,411
Back scratch (cm)	F	-2,70±4,17	-1,78±3,77	-13,2	,000**	-2,92±4,10	-2,94±4,08	,155	,877
	M	-7,90±5,02	-6,45±5,02	-7,29	,000**	-6,47±4,75	-6,23±4,36	-2,45	,016*

*p<0.05, **p<0.001, SD: standard deviation, F: Female, M: Male, G: Gender

It was found that there was a statistically significant difference between pretest and posttest results in biceps curl and up-and-go tests of women in control group ($p<0.05$), whereas there was no statistically significant difference between chair stand, aerobic endurance, chair sit-and-reach, and back scratch tests ($p>0.05$). Among the men in the control group, there was a statistically significant difference between pretest and posttest values in chair stand, aerobic endurance, up-and-go, and back scratch tests ($p<0.05$) but no statistically significant difference in arm curl and chair sit-and-reach tests ($p>0.05$).

In Table 3, there are mean values and standard deviations of experiment and control groups' pretest and posttest values in independent samples t-test. The results obtained show that there were no statistically significant differences between pretest values of women in experiment and control groups in chair stand, aerobic endurance, up-and-go , chair sit-and-reach, and back scratch tests ($p>0.05$), but there were statistically significant differences between posttest values in all of the tests except for chair sit-and-reach test ($p<0.05$).

Among the men, there was no statistically significant difference between pretest values in all six subtests ($p>0.05$), but statistically significant differences were found between posttest values in chair stand, arm curl and aerobic endurance subtests ($p<0.05$).

Table 3. Experiment and study groups' pretest and posttest values in independent sample t-test (female/male)

			Experiment group F n=107, M n=55	Control group F n=124, M n=71		
Items	Gender		Mean±SD	Mean±SD	t	p
	Female	pretest	13,6±1,58	13,8±1,7	-,784	,434
		posttest	15,0±1,28	13,7±1,85	6,45	,000**
Chair stand (n)	Male	pretest	14,0±1,63	14,5±1,55	-1,69	,092
		posttest	15,6±2,28	14,3±1,64	3,60	,000**
	Female	pretest	15,1±1,24	14,75±1,35	2,27	,024*
		posttest	16,8±1,51	14,9±1,35	10,0	,000**
Arm curl (n)	Male	pretest	17,0±1,33	16,5±1,36	1,83	,070
		posttest	18,2±1,72	16,7±1,46	5,16	,000**
	Female	pretest	574,6±34,9	569,1±37,1	1,12	,249
Aerobic endurance		posttest	599,2±47,1	568,7±37,3	1,49	,000**
(6-min walk)	Male	pretest	585,0±46,6	590,3±45,8	-,644	,521
		posttest	622,4±68,2	588,7±46,6	3,28	,001*
	Female	pretest	5,90±,601	5,91±,604	-,101	,919
		posttest	5,48±,616	5,88±,582	-5,06	,000**
2,45 m up-and-go	Male	pretest	5,80±,740	5,66±,719	1,11	,269
(s)		posttest	5,42±,757	5,63±,750	-1.52	,136
	Female	pretest	4,67±3,90	4,43±3,71	,490	,624
		posttest	5,51±3,70	6,62±3,37	1,86	,064
Chair-sit-and-reach	Male	pretest	,50±4,63	1,53±4,22	-1,30	,193
(cm)		posttest	1,39±4,78	1,38±4,32	,004	,996
	Female	pretest	-2,70±4,17	-2,92±4,10	,415	,679
Back scratch (cm)		posttest	-1,78±3,77	-2,94±4,08	2,21	,028*
	Male	pretest	-7,90±5,02	-6,47±4,75	-1,66	,103
		posttest	-6,45±5,02	6,23±4,36	-,257	,798

*p<0.05, **p<0.001, SD: standard deviation, F: Female, M: Male

In Table 4, the percentage decreases in the last 30 years and the mean standard norm values reported by Rikli and Jones (2012) can be seen. Since Rikli and Jones did not establish norm values for the flexibility tests, the flexibility norm values are not presented in Table 4. Despite that, flexibility is considered an important characteristic for maintaining functional mobility and physical independence.

Table 4. Norm values to be achieved in order to maintain functional mobility and physical independence according to Rikli & Jones (2012) (female/male)

		Age groups (years)							
Items	Gender	60-64	65-69	70-74	75-79	80-84	85-89	>90	% *
Chair stand (n)	Female	15	15	14	13	12	11	9	40,0
	Male	17	16	15	14	13	11	9	47,1
Arm curl (n)	Female	17	17	16	15	14	13	11	35,3
	Male	19	18	17	16	15	13	11	42,1
Aerobic endurance (6-min	Female	97	93	89	84	78	70	60	38,1
walk)	Male	106	101	95	88	80	71	60	43,4
2,45 m up-and-go (s)	Female	5,0	5,3	5,6	6,6	6,0	7,1	8,0	37,5
	Male	4,8	5,1	5,5	5,9	6,4	7,1	8,0	40,0

*Of decline over 30 years

In Table 5, the pretest-posttest values for the age groups for comparing the standard norm values of experiment group (female-male) are presented. In order to achieve a statistical consistency, five age groups (60–64, 65–69, 70–74, 75–79, and 80–84 years) were established as in the original study.

In *pretests,* it was observed that the experiment group women in all the age groups remained below the mean norm values in chair stand, arm curl, aerobic endurance, and up-and-go tests, whereas men at all the age groups (except for 70–74 and 75–79 years) remained below the mean norm values in all tests.

Table 5. Pretest–posttest values for the age groups for comparing the standard norm values of experiment group (female/male)

			Age groups (years)				
			60-64	65-69	70-74	75-79	80-84
			F n=53	F n= 27	F n=14	F n=16	F n=14
			M n=16	M n=13	M n=9	M n=8	M n=90
Items	Gender		Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
	Female	pretest	14,3±1,26	13,9±1,05	13,0±1,38	12,0±1,56	11,2±1,49
Chair stand		posttest	15,7±,81	15,5±,58	14,3±1,38	13,5±1,16	13,0±1,15
(n)	Male	pretest	15,3±,70	14,8±,80	13,5±1,42	12,8±1,24	12,1±1,61
		posttest	17,75±,93	16,9±1,18	14,7±1,09	13,3±,51	12,7±1,85
	Female	pretest	15,7±,95	15,4±,91	14,5±,87	13,8±1,11	13,4±1,39
Arm curl		posttest	17,7±,93	17,2±,79	15,3±,75	15,2±1,13	14,2±1,3
(n)	Male	pretest	17,8±,71	17,6±,96	17,3±1,11	16,5±,53	14,88±,78
		posttest	19,2±1,12	19,0±,75	18,8±1,53	16,8±,83	15,5±,52
Aerobic	Female	pretest	595,5±12,4	592,6±14,2	548,9±20,1	520,0±9,12	502,7±12,6
endurance		posttest	625,7±27,8	621,8±22,5	567,6±22,6	528,7±9,19	509,1±12,2
(6-min walk)	Male	pretest	622,8±11,1	619,0±14,8	586,3±21,7	538,1±13,2	509,2±8,08
		posttest	687,9±16,6	666,7±26,2	606,3±21,8	557,0±18,0	516,1±6,43
	Female	pretest	5,44±,42	6,08±,39	6,18±,24	6,62±,31	6,72±,36
2,45 m up-		posttest	5,03±,26	5,34±,27	6,01±,13	6,45±,26	6,54±,34
and-go (s)	Male	pretest	5,10±,30	5,43±,34	6,12±,20	6,27±,32	6,86±,62
		posttest	4,71±,23	5,10±,31	5,50±,17	5,90±,20	6,68±,57
Chair-sit-and-	Female	pretest	6,84±1,91	5,70±3,95	1,57±2,70	1,16±1,62	-2,62±2,42
reach (cm)		posttest	7,39±1,91	6,70±3,94	2,53±2,89	2,16±1,69	-,85±2,03
	Male	pretest	3,96±2,81	2,76±2,19	,61±2,44	-1,37±1,18	-7,38±3,10
		posttest	4,87±2,75	3,61±2,21	1,94±2,15	-,18±1,46	-7,16±2,92
	Female	pretest	,29±2,48	-2,84±2,90	-5,11±2,48	-7,83±1,07	-10,2±1,34
Back scratch		posttest	,79±2,38	-1,80±2,64	-3,84±2,54	-6,16±,83	-8,85±1,21
(cm)	Male	pretest	-2,96±2,74	-5,42±2,92	-11,6±3,45	-11,1±1,53	-13,6±2,63
		posttest	-1,87±2,84	-3,30±3,01	-9,77±2,81	-10,0±1,06	-12,6±2,54

SD: Standard deviation, F: Female, M: Male

In *posttests,* women achieved the norm values in chair stand test (in all the age groups) and arm curl and aerobic endurance tests (in 60–64 and 65–69 years of age) and up-and-go tests (in 60–64, 65–69, and 80–84 years of age) and remained below the norm values in all other age groups. However, men were found to achieve the chair-stand and aerobic endurance tests (in 60–64 and 65–69 years of age), in arm curl tests (in all the age groups), and up-and-go tests (all age groups other than 80–84 years of age).

The results obtained show that men performed better than women in chair stand, arm curl, aerobic endurance, and skill/balance tests, whereas women were found to be more flexible. In all the tests, it was determined that the performance of women and men in strength, endurance, skill/balance, and flexibility decreased with age.

Discussion

The benefits of exercise for the elderly adults have always been investigated in the literature and it was reported that regularly performed exercise and physical activities might minimize the physiological effects of sedentary lifestyle and prolong the active life expectancy (Mason et al., 2016; Wessel, 2019; Witte, 2016)

Similarly, it was also determined that regularly performed physical activity and exercise increased the quality of life by decreasing the possible age-related medical and dependency risks, strengthened the immune system, decreased the risk of diabetes, hypertension, and age-related risk of fall, positively affected mental health (Wettstein, 2020), and positively influenced the aerobic performance (Chmelo et al., 2015) and skill and balance development (Wessel, 2019) among the elderly adults with physical and functional insufficiency.

Considering all these points, the present study aimed to investigate the effects of the 60-min Live-Online Exercise Program, which was applied once every week for a 20-week period, on the physical performance and functional skills of elderly adults.

The results obtained here showed that the Live-Online Exercise Programs applied for elderly adults improved the physical performance levels and functional skills in all the age groups. Men showed better performance than women in lower body strength, upper body strength, aerobic endurance, and skill tests, whereas women were observed to be more flexible. This can be considered an important result as, especially before the program, women and men were found to have values lower than estimated standard norm values.

In their studies, Langhammer and Stanghalle (2018), Langhammer and Stanghalle (2011), and Kostić et al., (2011) reported results that were similar to those reported for the USA sample. In the present study, the German elderly adult sample showed similar results in all the pretests in comparison to the USA sample, which showed higher results in all the posttests (Jones & Rikli 2002).

Aksay (2021), Dunn et al., (2017), Pandey (2016) report in their studies that the performance is expected to decrease with increase in age. Parallel to the previous studies, the present study shows that, as expected, performance decreased in all the strength, aerobic endurance, skill, and flexibility tests and the performance losses started, especially after the age of 70 years. The decrease in the upper body and lower body strengths and aerobic endurance together with the advancing age was especially remarkable. Although the arms are more frequently used in daily life, they do not carry loads as heavy as legs do. As a result of this, it can be estimated that the decrease in upper body strength is more possible (Langhammer & Stanghalle, 2011).

Different results were reported in the studies investigating the flexibility improvements of elderly adults aged 60+ years. Some of the studies reported significant improvements (Dunn et al., 2017; Pandey, 2016), whereas some others reported no enhancement (Aksay, 2021). In conclusion, flexibility improvement of joints and muscle groups may change depending on the type, scope, and frequency of exercises (Rogan et al. 2015; Verma et al. 2017). In the present study, the flexibility improvement was found to be limited.

Aksay (2021), Mason et al. (2016), and Rikli and Jones (2013) reported in their studies that men showed higher performance in strength, endurance, and skill tests, whereas women were found to be more flexible than men.

Conclusion

Nobody predicted that the Covid-19 pandemic that began in 2019 would adversely affect the lives of many people, regardless of social status, economic status, education level, gender, skin color, belief, age, and country, and would deprive people of an active life. The negativities brought about by the Covid-19 pandemic caused especially the elderly to stay in quarantine for weeks and interrupted their routines, and physical activities were transferred to the virtual environment. However, the inadequacy of technological opportunities or the lack of experience to use these technologies also prevented the transfer of activities to the virtual environment. Therefore, it is very unlikely that the physical activities of the elderly will be transferred to the virtual environment. Nevertheless, this study shows that exercise programs with the elderly in a virtual environment are viable during a pandemic where socialization, physical activity and human contact are greatly diminished.

The significant relationship between exercise programs applied for 20 weeks in the virtual environment during the Covid-19 pandemic and development in leg and arm strength, aerobic endurance, skill/dynamic balance, and flexibility in the elderly is an important finding.

Based on the results of functional fitness indicators of the elderly, after a 20-week exercise program in the virtual environment, there was a statistically significant difference in the pre-test and post-test comparisons in sit-stand, arm bending, aerobic endurance, sit-and-go, sit-reach, and shoulder flexibility tests. Based on the data obtained, there was a significant difference between the pre-test and post-test results in the sit-stand, arm bending, aerobic endurance and sit-and-go subtests of men and women in the experiment and control groups. However, there was no significant difference in the sit-and-reach subtest between the pre-test and post-test with respect to groups or gender. In the shoulder flexibility subtest, there was a significant difference between the pre-test and post-test results of female subjects.

Based on the available data, it was seen that men performed better in strength, endurance, skill/dynamic balance tests, while women were more flexible. As expected, performance decreased in terms of strength, endurance, dexterity, and flexibility as the age progressed, and it was observed that the performance loss started especially after the age of 70. It was determined that all of the pre-tests were below normal values. However, results higher than normal values were obtained in leg strength, arm strength, aerobic endurance, skill/balance tests in 60-64/65-69 age groups in women and 60-64/65-69/70-74 age groups in men.

In this context, by positively affecting the physical development and health of the elderly with functional ability deficiencies and need for movement at different levels, Live-Online-Exercise Programs are considered as an indicator that physical function can be maintained and improved. For this reason, we recommend the integration of Live-Online-Exercise Programs in the virtual environment into daily life in order to contribute to the fitness and socialization of the elderly during such curfews.

Covid-19 risk cannot be reduced with the Live-Online Exercise Program applied. However, we can provide people a better chance to fight against the infection by increasing the body's resistance.

In the present study, as in the original study, the upper body strengths were measured using 2.23kg hand weight weights for women and 3.67kg hand weights for men. However, considering the standards in Germany/Europe, it would not be easy to obtain these weights. At this point, the weight selection can be discussed and more easy-to-obtain weight can be chosen in further studies. Given the European standards, 2.0–2.5kg and 3.5–4kg weights can be more easily found.

High mean age made it difficult to participate in the Live-Online Exercise program. Although the elderly care centres housing 41 individuals have sufficient technical infrastructure (Internet and computer), the individuals did not participate since they had difficulties using this technology. In further studies, a short informative video or brochure can be prepared in order to involve all the adults, who have sufficient technical infrastructure.

Conflicts of interest - None

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