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Effect Of Weight Bearing Exercise On Physical Performance And Disability Among Institutionalised Elderly

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Abstract

Background: Reduce in physical performance is associated by age and health condition. Geriatric especially will presence with reduce lower limb muscle strength, balance and irregular gait pattern. Weight bearing exercise consist of strengthening for lower limb as well as mild aerobic exercise. By practicing these exercise mode on geriatric will either improve of reduce their physical performance and disability. **Aim:** To rule out the Effect of Weight Bearing Exercise on Physical Performance and Disability among Institutionalised Elderly .**Design:** Pre-experimental research design. **Method:** A total of 37 geriatric in from age of 65-90 years old will be grouped into the same group from Cheras Rehabilitation Hospital and old folk's home, Malaysia .The group will received the same intervention which is weight bearing exercise. Before exercise given, the participant will be assess their rate of physical performance and disability .After that weight bearing exercise will be given. Finally after 6 week, their physical performance and disability will be reassess. **Result**: There is difference in mean value for SPPB and IADL with highly significance. Sing, talk and gasp show Cramer's V value (0.492) with strong associated between pre and post.SPPB versus IADL shows high correlation as well as 30 second sit to stand versus age with $p<0.01$ using bookstrap result. **Conclusion:** The finding of this study demonstrates that weight-bearing exercise by using patient own body weight is effective and has significant in increasing the SPBB and IADL value.

Keywords: Geriatric, weight bearing, disability, physical performance, balance

Introduction

Reduce in physical performance is associated by age and health condition. Geriatric especially will presence with reduce lower limb muscle strength, balance and irregular gait pattern. Weight bearing exercise consist of strengthening for lower limb as well as mild aerobic exercise. By practicing these exercise mode on geriatric will improve their physical performance and reduced disability. (Littbrand et al., 2006) mention that weight bearing exercise can activate upper leg muscle and improve strength in senior woman group while (Yeung et al., 2019) states that physical activity improved muscular strength, quality, and function towards geriatric when compared to inactive control groups .(Kushkestani et al.2022) also mention that physical activity and exercise training reduce the occurrence of malfunctioning capacity, cardiovascular and metabolic disease, and the rate of early death in older people. (Yang et al., 2020) mention that physical activity and exercise enhanced the prevention of aging-related

diseases. This study aimed to determine the effect of weight-bearing exercise on physical performance and disability in the elderly by using SPBB and LIADL outcome measure with weight bearing exercise intervention

Methodology

Pre-experimental research design used in this research, involved 37 participant age ranging from 65 to 90 years old from Cheras Rehabilitation Hospital and old folks home in northern region, Malaysia. It encounter 1 year study duration with 6 weeks intervention timeframe for each participant. Convenient non-probability sampling method was used because it is quick, inexpensive and convenient. Inclusion criteria are Age 65-90 years old , participant that is independent but with reduced lower limb strength, Sedentary lifestyle ,participant who is literate while exclusion are Age less than 65 years old, dementia , terminally ill, high risk of fall, participant who is not willing to join the exercise program, and participant with a mental health problem Pre intervention will be analysed using 2 outcome measure which SPBB and LIADL.After 6 weeks of weight bearing exercise intervention given, post intervention reading for SPBB and LIADL will be measured. Subject privacy will be protected by just publishing their data without exposing their name or picture. The data will be solely seen and analysed by the principal investigator itself. The data will be stored using Microsoft Excel and the data will be stored for a month right after it is being analysed by using SPSS version 26. Before the initiation of any study-related activity, the Medical Research and Ethics Committee, Ministry of Health (MREC), and other appropriate clearances will been sought with reference number **NMRR-21-1823-61179 (IIR)** dated on 29 September 2021- 29 September 2022 and Asian **Institute of Medicine, Science and Technology** (AIMST) **FAHP/FEC/2021/01**, dated on 22 September 2021. The principles of the Declaration of Helsinki and the Malaysian Good Clinical Practice Guidelines will be followed in this research.

Data analysis

Table 1: Demographic and clinical characteristics of study samples

	Frequency	Percentage (%)	p
Gender			
Male	16	43.2	0.411
Female	21	56.8	
Ethnicity			
Malay	11	29.7	0.828
Chinese	14	37.8	
Indian	12	32.4	
Age category			
<75	25	67.6	0.000**
76 – 85	10	27.0	
>86	2	5.4	
Body weight			
<50	3	8.1	
51 – 60	13	35.1	0.033*
61 – 70	14	37.8	
>71	7	18.9	
History of falls			
Yes	8	21.6	0.001**
No	29	78.4	
Mobility			
Independent	32	86.5	0.000**
Dependent	5	13.5	

Note: *p<0.05; **p<0.01

	Mean	SD	Percentiles		Z	p[a]
			25th	75th		
SPPB						
Pre-intervention	5.43	1.54	4.00	7.00	-5.321	0.000**
Post-intervention	6.97	1.50	6.00	8.00		
LIADL						
Pre-intervention	4.59	0.99	4.00	5.00	-5.184	0.000**
Post-intervention	5.92	1.04	5.50	7.00		
GS						
Pre-intervention	1.84	0.65	1.00	2.00	-4.146	0.000**
Post-intervention	2.35	0.75	2.00	3.00		
CS						
Pre-intervention	1.49	0.61	1.00	2.00	-4.025	0.000**
Post-intervention	1.97	0.65	2.00	2.00		
SB						
Pre-intervention	2.11	0.66	2.00	2.00	-3.771	0.000**
Post-intervention	2.54	0.65	2.00	3.00		

Note: SPPB: Short physical performance battery; LIADL: Lawton instrumental activities of daily living; GS: Gait speed; CS: chair stand; SB: Standing balance; a: Wilcoxon signed ranks test; *p<005; **p<0.01

Table 2: Results of paired differences in SPPB, LIADL, GS, CS and SB for pre and post-intervention among institutionalized elderly.

	Frequency (%)	Cramer's V	df	χ^2	p
Pre-intervention					
Sing	12 (32.4)				
Talk	22 (59.5)				
Gasp	3 (8.1)	0.492	2	9.959	0.011*
Post-intervention					
Sing	27 (73.0)				
Talk	10 (27.0)				
Gasp	0				

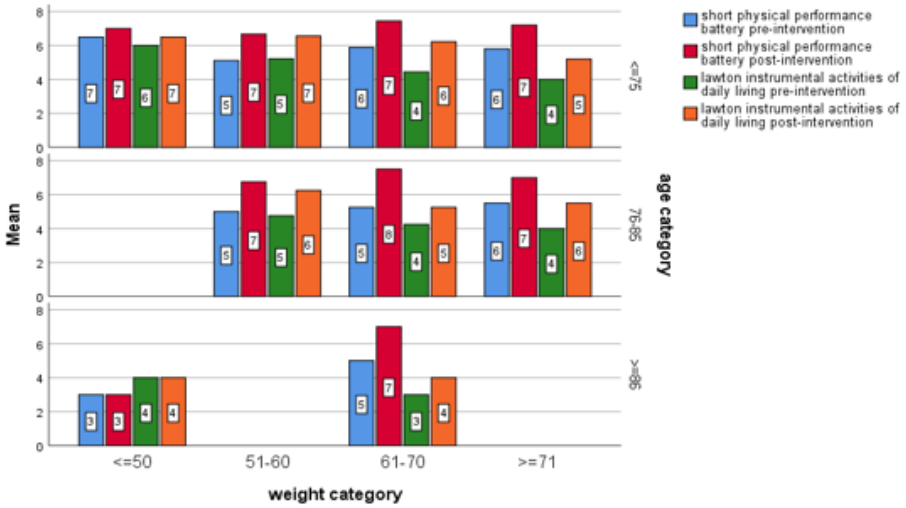
Note: df: degrees of freedom; χ^2= Chi square; *p<0.05

Table 3: Results of sing, talk and gasp test for pre and post-intervention among institutionalized elderly

	Mean	SD	[c]BCa95% CI Lower/ Upper	1	2	3	4	5
1. Age	73.49	6.66	71.43/75.59	-				
2. Body weight	63.54	8.82	60.65/66.68	-.068	-			
3. 30 second sit to stand	8.86	1.40	8.38/9.27	-.628**	.259	-		
4. SPPB difference	1.54	0.65	1.35/1.71	.169	.219	.083	-	
5.LIADL difference	1.32	0.82	1.08/1.57	-.142	.141	.137	.497**	-

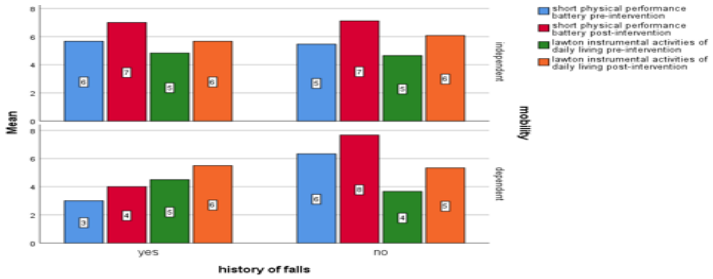
Note: BCa: Bias-corrected and accelerated; *p<0.05; **p<0.01; [c] bootstrap results are based on 1000 bootstrap samples

Table 4: Correlation between SPPB, LIADL, Age, Weight and 30 second sit to stand



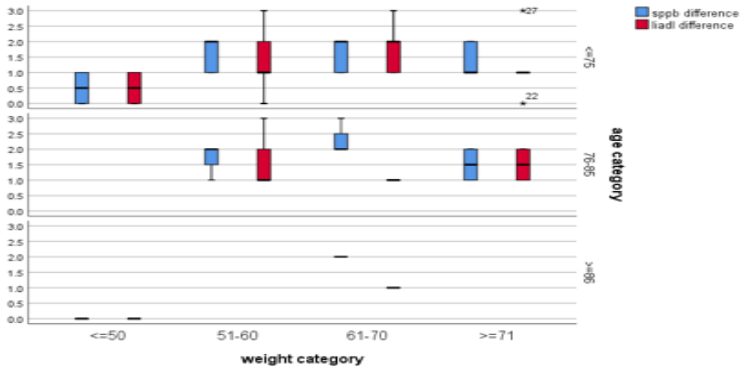
Note: SPPB: Short physical performance battery; LIADL; Lawton instrumental activities of daily living

Graph 1: Distribution of SPPB and LIADL for pre and post-intervention by weight and age category



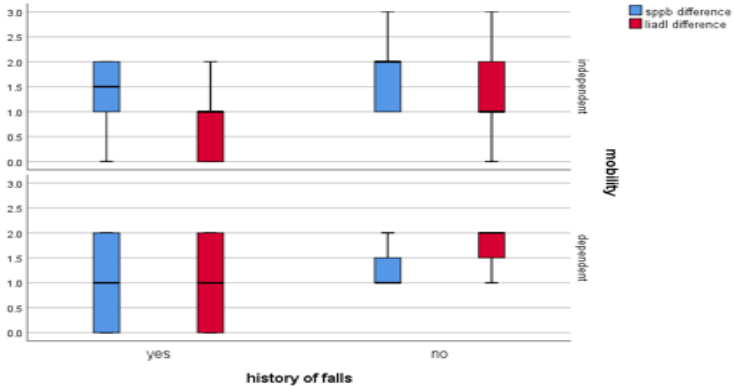
Note: SPPB: Short physical performance battery; LIADL; Lawton instrumental activities of daily living

Graph 2: Distribution of SPPB and LIADL for pre and post-intervention by history of falls and mobility.



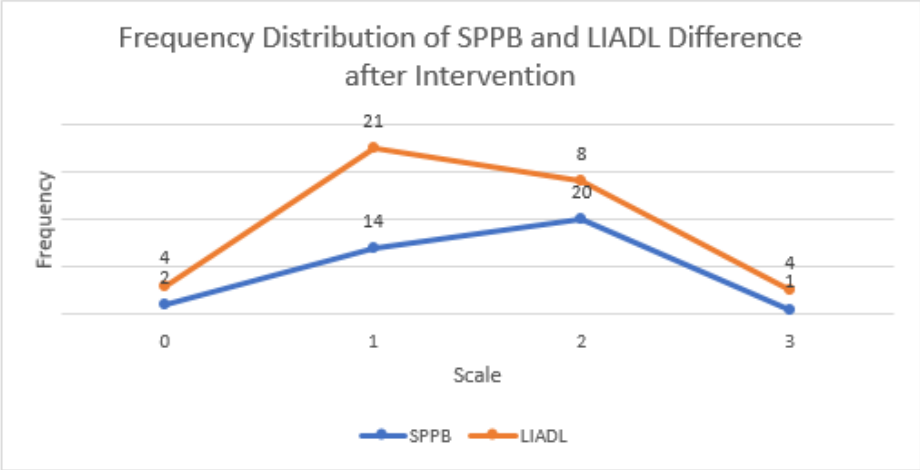
Note: SPPB: Short physical performance battery; LIADL; Lawton instrumental activities of daily living

Graph 3: Distribution showing changes in SPPB and LIADL after intervention by weight and age category



Note: SPPB: Short physical performance battery; LIADL; Lawton instrumental activities of daily living

Graph 4: Distribution showing changes in SPPB and LIADL after intervention by history of falls and mobility



Note: SPPB: Short physical performance battery; LIADL; Lawton instrumental activities of daily living

Graph 5: Frequency distribution of changes in SPPB and LIADL after intervention

Result and discussion

Data collected has been analysed by using SPSS version 26.0. The above mentioned shows the distribution of demographic variable related to the frequency and Percentage Distribution of Demographic Variables of geriatrics who resides at chosen old folks' home. Table 1 shows the age of participants can be divided into three groups from a range of 65 to 90 years old. The first group is in the range of <75 years old. They encounter the highest percentage among these 3 groups which is 67.6% with N=25. The second group is 75-85 years old with N=9 with 24.3%, while the third group (85 >) above with least number of the participant which is just 3 participants with 8.1%.

According to gender, there was more female which is 21(56.8%) and male 16(43.2%) which consist of 3 main ethnic which is Malay, Chinese, and Indian. Among 37 participants, N=8 (21.6%) of them have a once or twice history of fall in a year, and the rest which is N=29 (78.4%) not experienced fall before. This eventually affects their mobility. Based on the analysis, 32 participant is independent while 5 of them with 13.5% is dependent. Dependency means of using an assistive device to ambulate throughout daily life such as walker and tripod.

Meanwhile, the weight of participants varies in the range of 45 kilogram to 90 kilograms. In this study, it divide the weight into 4 category which is <=50 kg with N=4 (10.81%), 51-60 kg with N=12 (32.43%), 61-70kg with N=14 (37.83%)

and >=71kg with N=7(18.92%). Mobility plays an important role in the study as our outcome measure which is SPBB encounters more mobile lower limb activity. It is reported that both genders show independence compared to dependent. Male independent with N=13 (40.6%) and female is N=19 (59.4%). Meanwhile, only a few dependent participants were noted here. Male with N=3 (60%) and female N=2 (40%).

The first objective of the study was to assess the pre and post-test level of physical performance and disability among institutionalized elderly.

In table 2, Wilcoxon signed ranks test was used to compare 2 paired observations from the same individual or match the individual. Used mainly to test for the pre and post-test design. The mean of LIADL and SPPB shows a significant difference with P^a is 0.001(p^a <0.01). It means that after 6 weeks of weight-bearing exercise applied to the participant, the mean value shows a positive difference due to the mean difference is not 0. Pre and post-intervention mean shows improvement in the value. Participants' physical performance and ability to perform in their daily activity show some improvement.

The second objective is to check the result for sing, talk, and gasp for pre and post-intervention among institutionalized elderly.

The chi-square test, which includes Cramer's V, is used in this investigation. In this analysis, Cramer's V value is 0.492 which is considered a relatively strong associated value is 0.011 which is P<0.05, by means we reject Ho (there is no association between pre and post of sing talk and test) and accept Ha (there is the correlation between pre and post of the test of sing, talk, and test) being seen in table 3.

The third objective correlates the pre and post-test scores of physical performance and disability among institutionalized elderly.

The results of correlation analysis (table 4) showed a negative relationship between the 30-second sit-to-stand score and age. This was explained by the negative correlation at r = -0.628 which was statistically significant at a 95% level of confidence as p = 0.000 is p < 0.01. This means the 30-second sit-to-stand test reduces as the age increases and there is a relation between two of the factor. SPBB had insignificant positive relationship r= 0.169 with age while there are insignificant negative relationship with body weight (r= -0.068) and LIADL (r= -0.142).

There is a positive correlation between LIADL and SPPB. This was explained by a positive relationship at r=0.497 that was statistically significant at 95%level of confidence as p=0.000 is p<0.01.IADL and SPBB had an insignificant positive relationship towards the 30-second sit-to-stand test with r=0.083 for SPPB and r=0.137 for LIADL. By these means, there is an association between these two factors as SPPB increases, LIADL will also be increased after weight-bearing exercise intervention.

Graph 1 above shows the distribution of SPPB and LIADL for pre and post-intervention by weight and age category. For weight <=50, SPPB pre-intervention shows the higher value which is N=7 compared to age >=86, N=3 while IADL pre and post for age >=86 shows equal value pre and post and much lower value compared to age <=75 in the same weight group. The same phenomenon occurs for SPPB post-intervention. In the weight group 51-60 kilogram, age >=86 does not contain any value and the value comes from age 76-85 years old and >=75 years old. For pre and post SPPB shows no difference in value but for IADL shows an increasing value from N=6 to N=7. For the weight group 61-70 kilogram, SPBB pre-intervention shows the highest value N=6 compared to another weight group which is N=5 while post-intervention in the same weight group shows the highest value in the age group 76-85 years. Apart from that, post-intervention for LIADL in the same weight group shows descending value as the age grows older. This means old people tend to reduce in their functional activity daily living. In the weight group >=71, no changes in the score for pre and post SPPB while in post LIADL shows increasing value as the age get older. This is because most of the samples are from this age group.

Graph 2 above shows the distribution of SPPB and LIADL for pre and post-intervention by the history of falls and mobility. There is a higher value of SPPB pre and post-intervention in an independent group with a history of falls compared to dependent while LIADL shows no differences in value for

dependent and independent due to component in LIADL involving activity without much physical lower limb function needed. They just request to do a simple task such as picking up the phone, showering, and combing their hair. In absence of a history of falls, SPPB in the dependent group shows a higher value compared to independent. This might be due to the dependent group, they use an assistive device to ambulate and more exercise regime focus on them makes their lower limb stronger compared to the independent group while LIADL shows higher in the independent group due to component in the LIADL itself.

Graph 3 shows Figure above shows distribution showing changes in SPPB and LIADL after intervention by weight and age category. Age group <=75 shows the same distribution for SPPB and LIADL in the weight <=50 category, while age <=86 shows unseen distribution due to less sample in that group. In the weight 51-60 category, the value for SPPB and LIADL show almost the same value. For SPPB In the weight group 61-70, age group 76-85 shows a higher score compared to group <=75 while LIADL in the same weight group shows a higher score in age <=75.

Graph 4 shows distribution showing changes in SPPB and LIADL after intervention by the history of falls and mobility. For participants with a history of falls, SPPB shows a higher score which is 1.5 for independent compared to the dependent group. That means exercise intervention improved the SPPB score for the independent group. For no history of fall group, independent group shows higher score compared to dependent while for LIADL shows the higher score for dependent compared to independent. This shows that exercise will enhance the participation of the elderly in their daily routine activity.

Graph 5 shows the Frequency distribution of changes in SPPB and LIADL after the intervention. There is a significant increasing score for SPPB compared to LIADL. For score 1, there is the highest number of a participant in this group which is 21 compare to scale 0(N=4), 2(N=8), and scale 3(N=4). In terms of LIADL, 2 is the highest scale with N=20 compared to scale 0(N=2), scale 1(N=14), and scale 3 N=1).

Conclusion

The finding of this study demonstrates that weight-bearing exercise by using patient own body weight is effective and has significant in increasing the SPBB and IADL value. The effectiveness of pre-test and post-test weight for SPBB and IADL shows the difference in mean value and level of significance lead us to accept the alternate hypothesis and reject the null hypothesis. The result shows there is a difference in the mean value for SPPB and IADL with high significance. Sing, talk, and gasp show Cramer's V value(0.492) with a strong association between pre and post.SPPB versus IADL shows a high correlation, as well as 30 seconds, sit to stand versus age with $p<0.01$ using bootstrap result. In conclusion, weight-bearing exercises do enhance the score of SPPB and IADL after its intervention. They also have a correlation which is the higher the SPBB score, the higher the LIADL scores well as its correlation with the 30-second sit-to-stand and age of the participant.

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