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EFFECTS OF DIFFERENT PHYSICAL EXERCISES ON GENERAL SELF-EFFICACY AND GLOBAL SELF-ESTEEM IN OLDER ADULTS

UČINKI TELESNE VADBE NA SAMOUČINKOVITOST IN SAMOPODOBO PRI STAREJŠIH ODRASLIH

ABSTRACT

Maintaining a high quality of life and robust health as one grows older may be associated with higher general self-efficacy (GSE) and self-esteem (SEM). This study compares the effects of three types of exercise interventions (resistance training, proprioceptive training, and Nordic walking) on GSE and SEM. The final analysis included results of 34 adults (aged ≥ 65 years) who were not engaged in regular physical activity at least one year. Results indicate that physical exercise significantly positively affected GSE only in the resistance training group. No significant change of SEM occurred. The negative correlation between the initial level of GSE and the effect of physical exercise suggests that physical exercise may have a greater effect on people with low GSE. The positive correlation between the initial levels of GSE and SEM indicates the link between them. However, no association between changes in GSE and SEM over the intervention was found.

Keywords: Aging; Mental Health; Physical Activity; Self-Perception; Strength Training

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IZVLEČEK

Ohranjanje visoke kakovosti življenja in zdravja je lahko povezano tudi z višjo samoučinkovitostjo (GSE) in samozavestjo (SEM). Ta študija primerja učinke treh vrst vadbenih treningov (trening odpornosti, proprioceptivni trening in nordijska hoja) na GSE in SEM. Končna analiza je vključevala rezultate 34 odraslih (starih ≥ 65 let), ki se vsaj eno leto niso ukvarjali z redno telesno dejavnostjo. Rezultati kažejo, da je telesna vadba značilno pozitivno vplivala na GSE le v skupini za usposabljanje z odpornostjo. Do pomembnejše spremembe SEM ni prišlo. Negativna korelacija med začetno stopnjo GSE in učinkom telesne vadbe kaže, da ima lahko telesna vadba večji učinek na ljudi z nizko GSE. Pozitivna korelacija med začetnimi ravnmi GSE in SEM kaže na povezavo med njima. Vpliv vadbe na spremembe GSE in SEM ni bil značilen.

Ključne besede: Staranje; Duševno zdravje; Telesna dejavnost; Samozaznavanje; Trening moči

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INTRODUCTION

The demographic profile of Europeans is evolving rapidly, with the number of older people expected to expand in the next couple of decades. This development will have a significant impact on individuals and on other areas, such as the health and social care system, business, public finance, etc. (European Commission and Statistical Office of the European Union 2019). The life expectancy of a newborn in the European Union was 81.0 years (women 83.7 years, men 78.2 years) in 2018 (Anon 2020). This information has increased interest on the quality of life of older people. Aside from good nutrition, physical activity can have powerful benefits on human health and well-being (World Health Organization 2015). There is accumulating evidence regarding the efficacious role played by physical activity and fitness in the maintenance of cognitive health and quality of life (McAuley and Morris 2007) or psychological well-being (Bragina and Voelcker-Rehage 2018). This study focuses on the effects of physical exercise intervention (PEI) on general self-efficacy (GSE) and self-esteem (SEM) in older people.

SEM is one of the most well-known indicators of mental health, which is connected to the importance of maintaining a positive view of the self (Ogihara and Kusumi 2020). It is an important component of psychological well-being and life satisfaction (Rosenberg 1965). SEM is defined by how much value people place on themselves, so it is more of a perception than a reality (Baumeister et al. 2003). In different theoretical models, aging is considered to be a process in which positive self-perception is challenged by the decline of abilities (Atchley 1989; Baltes and Baltes 1990; Markus 1977), as cited in (Amesberger et al. 2019). In the same vein, research shows that self-esteem declines during the transition into old age (Robins and Trzesniewski 2005; Trzesniewski, Donnellan, and Robins 2003). However, this development in a person’s lifespan may differ among cultures (Ogihara and Kusumi 2020). Notably, PEI may have a positive effect on self-esteem in older adults (Borbón-Castro et al. 2020; Oliveira et al. 2019; Opdenacker, Delecluse, and Boen 2009). This contention has given rise to questions about the degree of influence of different PEI. Thus, the present study will focus on this subject matter.

Bandura’s concept of self-efficacy has been defined as “beliefs in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Albert Bandura 1995). According to him, self-efficacy beliefs influence how people think, feel, motivate themselves, and act (Bandura 1995). Self-efficacy affects behavior and motivation through its impact on goals, outcome expectations, and perception of sociostructural facilitators and impediments (Bandura 1997, 2012). Bandura stated that people harbor different beliefs in their efficacy across various domain functions, and even across various facets within an activity domain. According to him, there is no single all-purpose measure of self-efficacy and that all measurements should be task-related (Bandura 2012). Nevertheless, the GSE may explain a broader range of human behaviors and coping outcomes when the context is less specific (Luszczynska, Scholz, and Schwarzer 2005). The GSE scale developed by Schwarzer and Jerusalem (1995) is the most commonly used tool to measure GSE (Lazić, Jovanović, and Gavrilov-Jerković 2018) as "it assesses the strength of an individual's belief in his or her own ability to respond to novel or difficult situations and to deal with any associated obstacles or setbacks" (Schwarzer and Jerusalem 1995). The correlation of GSE with positive expectations, subjective well-being, physical activity, or life satisfaction (e.g., (Bowling and Iliffe 2011; Gavrilov-Jerković et al. 2014; Kempen et al. 2009; Lazić et al. 2018; Qin et al. 2020)) supports the convergent validity (Lazić et al. 2018). In addition, GSE and SEM are negatively correlated with fear of falls in older adults (Hajek, Bock, and König 2018; Kempen et al. 2009). Fear of falls could lead to avoidance of physical activity and social contact or to a decline in self-confidence which, in turn, could lower the quality of life (Delbaere et al. 2010; Hajek et al. 2018; Kempen et al. 2009; Schoene et al. 2019). Wang et al. (2019) posited that enhancing GSE is highly significant for improving the quality of life of older people. Furthermore, GSE can improve self-confidence and sense of achievement; it also plays role in individual behavior changes.

The Conceptual Model of the Physical Activity and Quality of Life Relationship predicates that physical activity influences self-related functions (e.g., self-efficacy, SEM), which could influence the quality of life (global well-being, satisfaction with life) via physical and mental health statuses (McAuley and Morris 2007). Research indicates that physical activity is positively associated with self-efficacy (Elavsky et al. 2005) and confirms the moderating role of self-efficacy in improving the SEM of the older population (Awick et al. 2017; Kangas et al. 2015). Therefore, increasing GSE through PEI may positively affect not only physical but also psycho-social well-being. It has been suggested that PEI for older people should integrate activity experiences that are designed to enhance efficacy (Awick et al. 2017). Considering the foregoing belief system in intervention planning may be beneficial in creating such interventions (Sales, Levinger, and Polman 2017).

Implementation of such a suggestion can be rather difficult. The composition of an exercise program aimed at increasing GSE and SEM may be problematic as there is a lack of studies dealing with the impact of PEI on these global concepts in older adults. Although the approaches related to improving GSE and SEM—specifically goal setting, positive feedback, and monitoring of progress—may be included in most types of PEI, the various types of exercises differ significantly in their nature (e.g., in physiological response, voluntary effort, social interaction, and environment). A systematic review of meta-analyses dealing with PEI in older adults reports that the most frequently included exercises are 1) strength, power, and resistance training; 2) endurance training; 3) meditative movement, mind-body exercises, and psychomotor exercises; 4) balance and coordination; and 5) walking or mobility, followed by other types (see Di Lorito et al. 2020). Therefore, this paper focuses on these interventions because their protocols are the most verified.

While the positive effect of PEI on physical self, physical fitness, and health in older adults has been widely investigated (Di Lorito et al. 2020), the influence of PEI on global concepts of self has been examined only occasionally. Previous research has demonstrated that PEI relevant to this study (resistance training [Katula et al. 2006; Singh et al. 2005; Vizza et al. 2016] balance and agility training [Halvarsson, Franzén, and Ståhle 2015; Rochat et al. 2008] walk [Rochat et al. 2008]) may positively affect task-specific self-efficacy. Nevertheless, the transition to GSE was not examined in those studies. These results suggest that this PEI could have a positive impact on GSE. In comparison with habitual physical activity or home-based exercise, this impact may be amplified by social interaction and supervision.

Understanding how frequently used PEI is linked to GSE and SEM will aid evaluation of the effectivity of these interventions or exercise programs for the physical and psycho-social well-being of older adults Therefore, this study set out to compare the effects of the interventions—resistance training, proprioceptive training, and Nordic walking (endurance training and walking)—on GSE and SEM and find out whether they could be used to enhance either of these belief systems.

METHODS

Participants

Volunteers were gathered through an information leaflet posted on the university website. A total of 39 older people, who were randomly assigned into three groups, participated. Five participants discontinued the intervention. No injury was recorded. Thirty-four participants were included in the final analysis (aged 70.4 ± 4.4 years): a) resistance training group (RTG), n = 10 (aged 70.3 ± 4.3 years); b) proprioceptive training group (PTG), n = 13 (aged 70.7 ± 5.2 years); and c) Nordic walking group (NWG), n = 11 (aged 70.1 ± 3.8 years). The inclusion criteria were over 65 years of age and at least one year of non-engagement in regular physical activity. After the initial contact, participants with a history of malignant disease, restrictions on physical activity (e.g., pacemaker), and with an athletic background were excluded. The detailed information are presented in Figure 1 and Table 1.

Training programs

We compared three types of exercise training programs: resistance training, proprioceptive training, and endurance training – Nordic walking. The interventions were performed twice a week for 12 weeks, with a total of 24 sessions (each session lasted 60 minutes). The three interventions programs were preceded by three two weeks of familiarization with proper technique and equipment. Each session was composed of a 10-minute general warm-up, including fast walking and dynamic stretching exercises, and a 10-minute cooldown consisting of stretching and relaxation exercises. All training sessions were held between 9:00 and 11:00 am.

Resistance training program

The maximum eight-repetition load for each participant was determined using Baechle et al.'s (2008) formula based on the maximum strength testing described below. In this study, the repetition maximum (RM) is understood as "the maximum amount of weight able to be lifted with good form" (Phillips et al. 2004). The design of the protocol was based on previous research in older adults (Ribeiro et al. 2018; Yoon et al. 2019). The main part of a training session consisted of nine exercises targeting each of the major muscle groups: leg press (the horizontal machine was used), bench press, seated cable row, knee extension, dumbbell overhead press, two arms triceps push down, lying knee curl, crunches, and lat pull-down. These were performed in three sets of eight-repetition maximum (except crunches, 3 sets of 20 repetitions with bodyweight). The machine weight training was used except for the bench press, dumbbell overhead press (free weights), and crunches (body weight). The participants were required to have 1–2 minutes of rest interval between sets. The exercise load was individually adjusted over the research period to approximately match the 8 RM condition. This means exercise up to momentary muscular failure (i.e., they cannot continue) or to volitional fatigue (i.e., they do not wish to continue) (Phillips et al. 2004). All training sessions were directly supervised by the research crew members to ensure the application of proper technique and safe performance.

Maximum strength testing

One repetition of maximum strength test followed the practice and familiarization session. Emphasis was placed on proper technique, correct breathing, and body positions, aspects that were necessary for the safety and effectiveness of the maximum strength tests. Testing for upper- and lower-body strengths took place on the same day and time of day in two consecutive weeks (two times per week/ four exercise in one day). All 1RM tests were performed according to the previously described procedure (Phillips et al. 2004).

Proprioceptive training program

The intervention programs consisted of specific proprioceptive exercises that were conducted in static and dynamic positions with the bossu and gym ball as unstable training tools, which were designed to program proprioceptive training. The current study adopted the previously used training protocol (Martínez-Amat et al. 2013). The training was progressively structured in three phases according to the exercise: initial stage at weeks 1–5, intermediate phase at weeks 5–8, and advanced phase at weeks 8–12. The exercise program consisted of three sets of 10–15 repetitions with 1 minute of rest between sets. The exercise sessions were carefully supervised by a fitness specialist.

Endurance training program

Before the intervention, a certified Nordic walking trainer taught the proper technique. The intervention included standard Nordic walking exercise in the surrounding forest. During the training, the participants were instructed to walk as fast as it was comfortable. The training intensity was based on the subjective perception of exertion. The aerobic zone was checked through the Talk Test, which is a simple way to measure relative intensity. In general, during moderate-intensity activity, people are able to talk but not sing. The employed test has been confirmed as a valuable tool for monitoring (and controlling) exercise intensity (Foster et al. 2018).

Measures

SEM was measured using Czech version (Blatný and Osecká, 1994) of the Rosenberg Self-Esteem Scale (Rosenberg 1965), which measures both positive and negative feelings about the self. The scale includes 10 items to which the participants responded in a four-point Likert scale format ranging from strongly agree to strongly disagree. Responses were scored 0–3 points and summed for a total score ranging from 10 to 30 points. Cronbach's alpha in the pre-intervention was $\alpha = 0.769$ and $\alpha = 0.853$ in the post-intervention measurement.

GSE was assessed using a 10-item general self-efficacy scale developed by Schwarzer and Jerusalem (Schwarzer and Jerusalem 1995). Responses were made in a four-point scale format. The responses to all 10 items were summed to yield the final composite score ranging from 10 to 40. The used Czech version (Blatný and Osecká, 1994) version was slightly modified because it contained some older verb forms and word order. The measurements demonstrated high internal consistency, with pre-intervention Cronbach alpha = 0.915 and post-intervention Cronbach alpha = 0.911.

The entry questionnaire included questions on demographic information, physical activity history, social situation, and basic medical history.

Statistics

Statistical analysis was performed using IBM SPSS software (version 25). Kruskal-Wallis test, Wilcoxon signed-rank test, and Spearman rank-order correlation were used where the variables were not normally distributed (tested with Shapiro-Wilk's test, $\alpha = .05$). Based on the result comparison with the Wilcoxon signed-rank, paired samples t-test was used to evaluate the pre- to post-intervention changes in RTG and NWG despite the several outliers detected by visual inspection of the boxplot. The effect size for paired t-test was assessed using Cohen's d (Cohen 1988). Confidence intervals in the 95% level were reported where the difference of means was used. The inter-group comparison of pre- to post-intervention differences in GSE and SEM was done by visual inspection of the boxplot given the small sample size.

Blinding

The research crew members who directly supervised the PE interventions (i.e., instructors) were blinded as to the purpose of this study.

Ethics

The participants provided written informed consent before the study began. The study design and all procedures were approved by the ethical committee of Masaryk university (Approval No. EKV-2018-088-R1) in accordance with the Declaration of Helsinki.

RESULTS

The participants were randomly divided into three groups. Table 1 presents the descriptive statistics of each group. Based on a Kruskal-Wallis test, there were no significant intergroup differences in age ($\chi^2(2) = 0.071$, $p = .965$), initial GSE ($\chi^2(2) = 0.164$, $p = .921$), initial SEM ($\chi^2(2) = 1.652$, $p = .438$), income ($\chi^2(2) = .768$, $p = .681$), and degree of education ($\chi^2(2) = .404$, $p = .817$). Table 2 shows the Spearman rank order correlation of the observed values for the whole sample.

Table 1. Description of the research sample.

	RTG	PTG	NWG	Full Sample
	N	N	n	n
Female	7	7	5	19
Male	3	6	6	15
Highest educational level				
Middle school	1	0	0	1
High school/some college	4	4	4	12
University or postgraduate degree	5	9	7	21
Income*				
Low	0	1	1	2
Low-average	6	7	4	17
High-average	1	4	3	8
High	2	1	3	6
Relationship status*				
Single	8	8	5	21
In a relationship	2	5	6	13

* Missing one value. Financial income: low, < 70% of average income; low-average, 70%–105% of average income; high-average, 105%–138% of average income; high, >138% of average income. Due to a specific research sample in this study, the financial categories in the questionnaire were rounded to logical amounts for better understanding.

Table 2. Spearman rank order correlation of the measured variables for the whole sample.

	1	2	3	4	5	6
1. Age	-					
2. Financial income	-,430*					
3. Degree of education	-0.306	0.076				
4. GSE_1	-0.067	0.167	0.215			
5. $GSE_{1 \text{ to } 2}$	-0.058	0.025	-0.285	-,508**		
6. SEM_1	0.181	0.287	-0.036	,475**	-0.066	
7. $SEM_{1 \text{ to } 2}$	-0.120	0.057	0.111	0.266	0.153	-0.152

Financial income categories have been transferred to an ordinal scale 1–4 (1 = low income; 4 = high income). The highest education level categories have been transferred to an ordinal scale 1–3 (1 = middle school; 3 = university or postgraduate degree). GSE1 to 2 and SEM1 to 2 represent the pre- to post-intervention difference in the measured scales. * Two-tailed p < 0.05; ** two-tailed p < 0.01

The GSE score significantly increased (3.5 at 95% CI [0.910, 5.558], t(9) = 3.3847, p = .004, d = 1,217) in RTG, whereas the increase in NWG was insignificant (0.818 at 95% CI [-2.511, 4.148], t(10) = .548, p = .596, d = 0.165). The assumption of normal data distribution of GSE in PTG was not met (as assessed with the Shapiro–Wilk test, post-intervention GSE_2 p = .038), so a Wilcoxon signed-rank test was conducted to determine the effect of PEI. The difference scores were approximately symmetrically distributed, as assessed using a histogram with a superimposed normal curve. GSE increased in seven participants, whereas three saw no improvement and three manifested a decrease in GSE. Nevertheless, there was a median decrease from the pre-intervention (median = 35) to the post-intervention (median = 33), but this difference was not statistically significant (z = 1.125, p = 0.261). The contradiction between the median change and the frequency of positive change in the participants is attributed to the limitation of the small sample size. To complete this result, we report the positive mean change of 1.385 CI [-1.442, 4.192]. A visual inspection of Figure 1 underscores the clear positive trend of GSE in RTG compared with PTG and NWG.

The assumption of normality was violated for the SEM data (as assessed with the Shapiro–Wilk test, in the RTG post-intervention SEM_2 p = .049, in theNWG pre-intervention SEM_1 p = .032, and there were two significant outliers in the PTG SEM_1). The difference scores were approximately symmetrically distributed in all groups. There was no significant change in SEM in either group, as assessed by the Wilcoxon signed-rank test (RTG, z = 0.493, p = 0.622; PTG, z = 1.043, p = 0.297; NWG, z = 0.535, p = 0.592). There was no disparity among the groups in the pre- to post-intervention differences in SEM, based on a visual inspection of Figure 2.

Figure 1. Boxplot of GSE score difference from pre- to post-intervention by group.

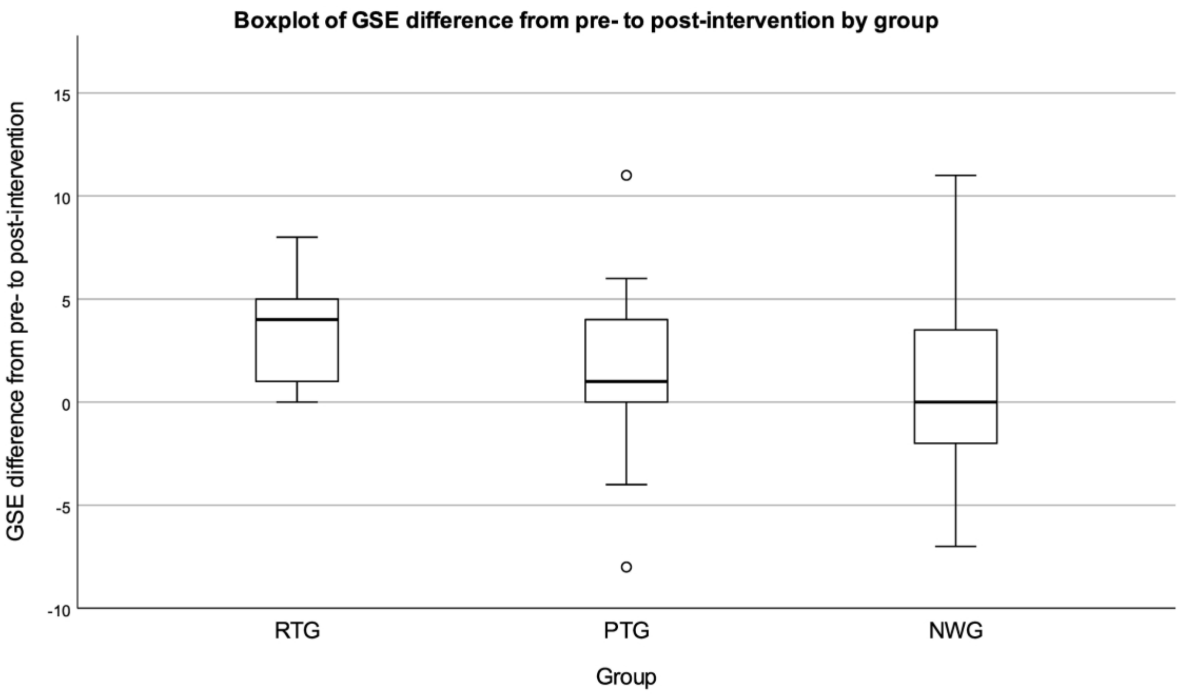
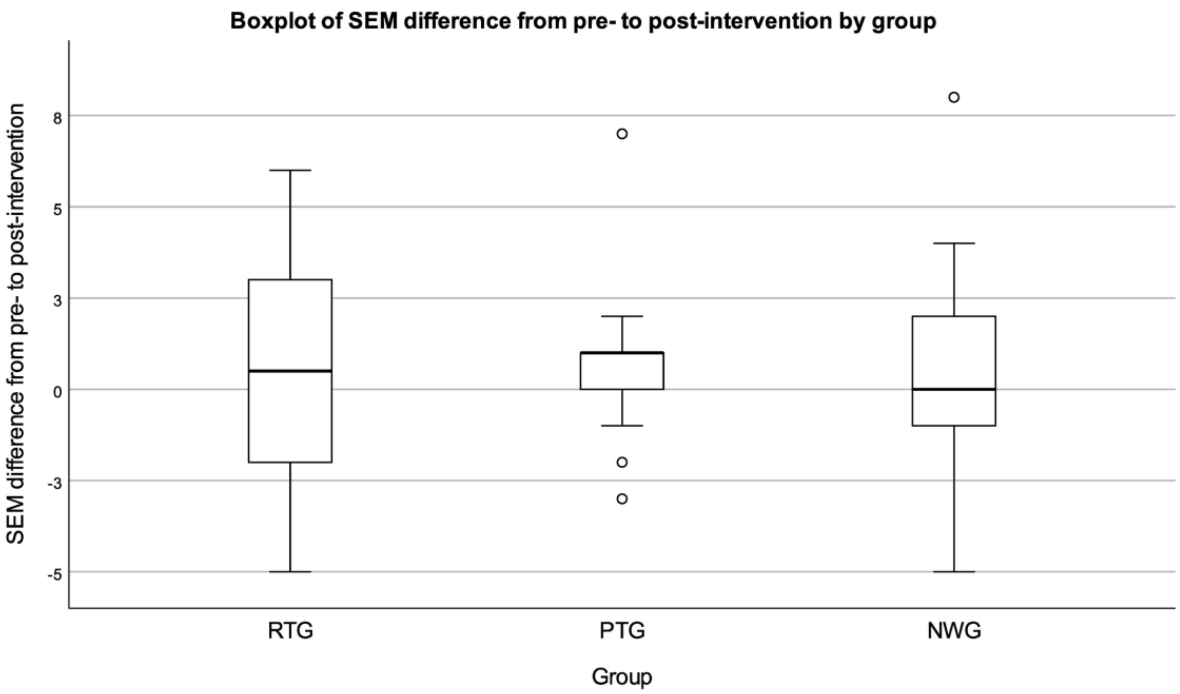


Figure 2. Boxplot of SEM score difference from pre- to post-intervention by group.



DISCUSSION

This study shows that PEI could positively influence GSE, but this may not be applicable for all types. A significant difference between GES_1 and GSE_2 (pre- to post-intervention) was found only in RTG. Due to the small sample size and the range of the pre- to post-intervention differences, group comparison was done using boxplot. Visual checks revealed the differences among the PEI groups, with RTG rising above the rest (Figure 1). One of the possible explanations for this result may be Bandura's theory of self-efficacy sources. He defined four main sources of influence, namely, mastery experience, vicarious experience, verbal / social persuasion, and physiological feedback (somatic and emotional states) (Bandura 1977). We assume that resistance training with a load of 8RM and testing of 1RM brings more intensive mastery experience than Nordic walking or proprioceptive training due to the nature of such training. In almost every training session, participants from the RTG increased the load to match 8 RM in at least one exercise. This may be due to fact that setting a RM in a sample of older adults is impinged by their lack of sufficient technique or volitional fatigue rather than muscle failure. The rapid increase in muscle strength is typical for untrained individuals, which is often caused more by the influence of motor learning (Ribeiro et al. 2018) and improving ability to generate maximal voluntary force than muscle hypertrophy. Borde et al.'s (2015) review of resistance training in elderly adults aged ≥ 60 years described the substantial enhancement in muscle strength (13%–90%) but significantly lower increase in muscle hypertrophy (1%–21 %). Therefore, mastery of the exercise and improvements in performance are much more perceived by the participants because of the clear measurability, although this may not be accompanied by somatic changes. In the NWG and PTG, mastery of the exercise and improvements are more subjective and, therefore, more affected by self. This premise also holds true in vicarious experiences. Participants in RTG could see people like themselves mastering the PEI better than those in PTG or NWG. In addition, verbal / social persuasion in resistance training is probably more focused on the individuals than in Nordic walking or group exercise of proprioceptive training. Resistance training with older adults often requires one-on-one technique correction or even one-on-one supervision, which was obligatory for exercise with free weight (dumbbell overhead press, bench press) in this study. Although individual encouragement and correction were also applied in PTG and NWG, it can be assumed that more instruction or feedback was delivered in group format. However, this explanation is limited by the absence of control in the physiological changes in response to PEI (e.g., emotions).

Recent systematic reviews of meta-analyses have identified resistance training as one of the most effective PEI type in terms of physical health or functioning abilities (Di Lorito et al. 2020). This may also be a possible explanation for why GSE significantly changed only in RTG. Research shows an increase in domain-specific self-efficacy after various PEI: balance training with dual- and multi-task (Halvarsson et al. 2015), Tai Chi (Li et al. 2001), resistance training (Katula et al. 2006), resistance training and home exercise (Vizza et al. 2016), and engagement in the Vital Aging program (Mendoza-Ruvalcaba and Fernández-Ballesteros 2016). However, even in specific self-efficacy, a positive change may not always be evident. A study on Tai Chi intervention did not reveal any significant change in Tai Chi exercise self-efficacy (among beginners). It was suggested that beginners in the study may not experience the feeling of mastering the moves (Leung et al. 2019). Nevertheless, the transfer of domain-specific self-efficacy to GSE was not investigated in those studies. Therefore, future research should deal with the effect of PEI on GSE to investigate whether PEI affects an individual's generalized belief in coping with difficult life situations. There is also a question about the motive behind the changes in GSE, namely, whether it is the conditioning effect of the PEI or its nature from the perspective of self-efficacy sources, as defined by Bandura. In terms of the second case, such knowledge could shed light on interesting ways by which various PEI could be upgraded, as experiencing success or social / verbal persuasion in them may be inspired by conditions typical for resistance training. However, before quality conclusions can be drawn, it will be necessary to obtain more data from different types of exercises. We believe that starting with the most frequent types of interventions will enable us to find practical applications for the results in the shortest amount of time.

This study was unable to demonstrate a positive effect of different types of PEI on SEM and did not find any difference between the investigated training programs. It has been established that physical activity could indirectly affect SEM by enhancing physical self-worth (e.g., (Moore et al. 2012)). Interestingly, the effect of PEI on SEM has been investigated only occasionally (in comparison to physical self-worth, physical self-perception, or other concepts that may be considered as sub-components of global SEM). The association between SEM and physical activity has been mostly assessed through correlational studies, which are limited in determining causality, rather than investigating PEI. The absence of an effect of PEI on SEM in this study can be ascribed to the relatively short intervention durations. To wit, a positive effect was previously observed in an 11-month intervention (Opdenacker et al. 2009) or in PEI with the same duration but composed of 60 sessions (Borbón-Castro et al. 2020) (in comparison to 24 in this study). A recent study of 10 elderly women who took part in a swimming intervention showed an increase in SEM, but their initial SEM score was low, with 13.54 ± 1.50 mean and standard deviation (the score was adjusted by subtracting 10 points from the mean due to the different scoring on the Likert-scale; the authors scored the scale in the range of 10–40) (Oliveira et al. 2019). An effect of the initial levels of SEM was previously suggested (Awick et al. 2017) and is a possible factor that could have played a role in the absence of a positive effect of PEI on SEM in this study, as lower SEM gives more space for improvement. Aside from the different types of physical exercise, future research should focus on these factors in more detail (i.e., initial levels of SEM, duration of PEI, number of sessions in intervention).

Analysis of the data was limited by the small sample size in this study. Therefore, we did not evaluate the association between the variables for each group, as such analysis could yield false positive results. Nevertheless, the correlations for the entire sample confirm the previously described association between GSE and SEM (McAuley et al. 2005) in older adults, given that medium to large correlations was noted between their initial levels. Such result indicates that changes in GSE could affect SEM, which has already been hypothesized and demonstrated (Awick et al. 2017; McAuley et al. 2005). No association between change in SEM and GSE was found in connection to PEI in this study, but this could be due to the limitation of the small sample and the fact that only RTG affected GSE significantly. In terms of GSE, there was a moderate to strong correlation between the initial levels and the pre- to post-intervention changes. In this light, the PEI could be made more effective for older adults with low GSE if we aim to improve it. Another limitation is that due to the small sample, we merged the males and females in the analysis. As a positive point, we want to highlight that age had no correlation with either GSE or SEM in any time point.

We strongly encourage researchers to conduct follow-up measurements in their PEI studies to investigate the stability of the changes associated with interventions. In the present study, the follow-up measurement had to be canceled due to the government’s restrictions connected to the COVID-19 pandemic.

CONCLUSION

The results of the comparison of the effects of resistance training, proprioceptive training, and Nordic walking on GSE and SEM in older adults demonstrated that resistance training is the most effective approach. Despite the limitation of the small research sample, the findings are in line with previous research that similarly identified resistance training as the most beneficial strategy in various domains of physical condition in older adults. The present research showed that PEI could positively affect GSE, which has been theorized in correlational studies (in this case, the effect is significant only in RTG). However, research on PEI has mainly focused on task- or domain-specific self-efficacy. The results obtained in this study warrant replication, as higher GSE is associated with higher positive expectations, subjective well-being, physical activity, life satisfaction, and quality of life; it even plays a role in changed behavior. Therefore, including resistance training in programs for older adults may be advantageous. Moreover, the results suggested that individuals with low GSE may experience a greater benefit. Herein, a question about the source of change in GSE arises: should it be ascribed to changes in physical abilities or to the nature of the resistance training itself? Future research should investigate the second possibility. Finally, this study was unable to demonstrate any effect of the prescribed PEI protocols on SEM.

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