

Physical Literacy in Later Life: One-Year Changes in Older Women Participating in Community-Based Exercise

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Abstract

Physical literacy (PL) is recognized as an important concept in maintaining physical activity even in older individuals, but studies have rarely examined the changes in PL as a result of structured exercise programs in older participants. The aim of this pilot study was to examine changes in PL among older women over a one-year period of participation in a community-based exercise program and to determine whether baseline sociodemographic characteristics were associated with the magnitude of these changes. The participants were 51 women (71.3 ± 5.9 years) involved in a community outdoor-exercise program in southern Croatia. Sociodemographic variables (age, educational level, living environment, socioeconomic status) were assessed at baseline, while data on the regularity of participation in the exercise program were assessed at the end of the study (one year later). PL status was assessed at baseline and follow-up via a validated questionnaire (Perceived Physical Literacy Questionnaire for South Eastern Europe). The overall PL improved over the one-year period, with the most pronounced improvements observed in the motivation and confidence domains (5.4%, 7.4%, and 11.8% for the overall PL, motivation-, and confidence-domain, respectively, all at $p < 0.05$). Baseline sociodemographic characteristics were not associated with the magnitude of these changes. More consistent participation in exercise program was associated with greater improvements in PL. This pilot study provides evidence that PL can be improved even in older age, with most evident improvements in the motivation and confidence domains of PL. Furthermore, a controlled study design is needed to confirm this preliminary evidence.

Keywords: *physical literacy, sociodemographic factors, aged, female, exercise, motivation, self-efficacy*

Introduction

The concept of physical literacy (PL) integrates physical competence, motivation, confidence, knowledge, and understanding needed for lifelong engagement in physical activity (Carl et al. 2026, Geets Kesic et al., 2023.). Therefore, PL is increasingly recognized as an important component of a healthy and active lifestyle. Its relevance may become particularly pronounced in older age, when maintaining the ability and willingness to move can contribute to functional independence (Jones et al., 2018; Jukic et al. 2026; Petrusovski et al., 2022). Supportively, higher levels of PL have been associated with greater participation in physical activity, better physical functioning, and more favorable indicators of health and well-being in older adults (Lloyd et al., 2024). The affective and cognitive components of PL, including confidence, motivation, and under-

standing of one's own capabilities, may be especially important because they can influence older adults' willingness to initiate and maintain an active lifestyle. Older adults with higher levels of PL may be more likely to maintain mobility, independence in everyday activities, and quality of life, all of which are central aspects of healthy aging (Groessl et al., 2019). From this perspective, maintaining and developing PL later in life may represent an important pathway toward sustained physical activity, functional independence, and overall well-being.

Despite the growing recognition of PL as an important component of healthy aging, considerably less is known about the extent to which it can be modified in later life. This represents an important gap, particularly because most opportunities for structured development of PL are traditionally associated with formal educational settings that occur during

childhood and adolescence (Rajkovic Vuletic et al., 2026.) In older adulthood, such formal opportunities are not common. Therefore, any development of PL in later life stages (late adulthood and older age) is more likely to occur through informal or nonformal experiences embedded in everyday life and community settings.

Community-based initiatives may be particularly valuable in this regard, as they provide accessible and socially meaningful opportunities for continued engagement in movement and physical activity. For such purposes, structured exercise programs are especially relevant because they allow older adults to develop physical competence, confidence, and practical understanding through repeated participation and direct experience rather than through formal instruction alone (Skundric et al., 2021). This type of experiential, “learning-by-doing” process is conceptually consistent with the multidimensional nature of PL, which develops through ongoing interaction between the individual, movement experiences, and the surrounding environment (Jones et al., 2018; Petrusovski et al., 2022). The intervention studies suggest that at least some domains of PL can improve in older adults following structured exercise participation, although the available evidence remains limited, and longitudinal findings are still scarce (Campelo et al., 2023; Sum et al., 2024; Yu et al., 2025).

An important step toward advancing PL research in Southeastern Europe was the development and validation of a culturally adapted version of the Perceived Physical Literacy Questionnaire for adults. The PPLQ-SEE was specifically translated, culturally adapted, and psychometrically evaluated in a Croatian adult population, thereby addressing an important limitation of applying instruments developed in different linguistic and sociocultural settings. Its validation demonstrated an acceptable factorial structure, satisfactory composite reliability across most retained domains, and moderate-to-good test–retest reliability, supporting its use in applied research (Gilic et al., 2025). Importantly, the instrument provides a context-sensitive approach to assessing perceived PL and allows researchers to examine this multidimensional construct using terminology and content that are culturally meaningful to participants in the region. Such adaptation is particularly relevant because perceptions of competence, motivation, confidence, and engagement in physical activity may be shaped by sociocultural experiences and local patterns of physical activity participation. Therefore, the availability of a reliable and valid instrument creates an opportunity to investigate PL in populations that have previously been underrepresented in the literature.

Although PL is theoretically considered a lifelong and potentially modifiable construct, studies performed thus far have not been oriented toward evaluating longitudinal changes in the PL of older adults (Petrusevski et al., 2022). Because of the lack of longitudinal and intervention-based studies on a problem, it is difficult to determine the extent to which PL can be changed in later life. However, it seems that the physical and affective domains of PL can be improved as a result of structured exercise participation, providing preliminary support for the modifiability of the construct even in older age (Campelo et al., 2023). In parallel, recent intervention

protocols have begun to explicitly target PL in older adults, reflecting growing interest in this population (Sum et al., 2024). However, these studies remain relatively few, often involve short-term or highly structured interventions, and do not yet provide a clear picture of how PL develops over longer periods in real-world settings. Evidence is particularly limited regarding long-term changes occurring within community-based exercise programs, where participation is embedded in everyday life rather than delivered under strict controlled experimental conditions.

Therefore, the aim of this pilot study was to examine changes in PL among older women over a one-year period of participation in a community-based outdoor exercise program and to determine whether baseline sociodemographic characteristics were associated with the magnitude of these changes. Initially, we hypothesized that (i) PL will be improved over the study period, and (ii) sociodemographic factors will be of significant influence on changes in PL.

Materials and methods

Participants

The study included 51 older women, aged 71.3 ± 5.9 years (all older than 60 years), residing in southern Croatia, Split-Dalmatia County. The participants were drawn from the same community-based population previously involved in studies examining physical and health literacy among older women in this sociocultural setting. The participants represented a heterogeneous group with regard to health status, including women without diagnosed chronic conditions as well as those living with age-related or chronic health conditions. Eligibility criteria included female sex, age above 60 years, residence in Split, sufficient functional independence and mobility to participate in the exercise program and attend testing sessions, and adequate cognitive ability to understand and complete the study questionnaires. Women with substantial cognitive impairment or functional limitations that prevented independent participation in the program or testing procedures were excluded.

At baseline, 78 women were assessed and entered the one-year community-based exercise program. During the follow-up period, 21 participants discontinued participation or were unavailable for the final assessment, resulting in 57 women completing the one-year follow-up. Of these, 51 participants had complete PL data at both baseline and follow-up and were therefore included in the final longitudinal analysis.

All participants were informed about the study procedures, potential benefits and risks, and the voluntary nature of participation and provided written informed consent prior to inclusion. The study was approved by the Ethics Committee of the Faculty of Kinesiology, University of Split, and all procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Variables

Variables in this study included sociodemographic characteristics, data on regularity of participation in community physical exercise program, and PL status.

Sociodemographic characteristics were collected at baseline using a self-report questionnaire. Age was recorded in years. Educational attainment was categorized into three levels: elementary school, high school, and college/university degree. Self-perceived socioeconomic status was assessed by asking participants to classify their socioeconomic position as below average, average, or above average. Place of residence was categorized as urban or rural, reflecting the participants' primary residential environment. These variables were considered baseline characteristics potentially associated with subsequent changes in PL over the one-year observation period. In addition, the regularity of participation in the community-based exercise program was evaluated by the program instructor and categorized into four levels: rarely participated, moderately participated, often participated, and regularly participated over the study period.

Physical literacy was assessed using the Perceived Physical Literacy Questionnaire for South Eastern Europe (PPLQ-SEE), a culturally adapted and psychometrically validated instrument developed for adults in the Southeastern European context (Gilic et al., 2025). The questionnaire consists of 24 items organized into six domains: physical competence, understanding, motivation, confidence, knowledge, and physical activity behavior. Items within the physical competence, understanding, motivation, and confidence domains are rated on a six-point Likert scale ranging from 0 ("strongly disagree") to 5 ("strongly agree"), whereas the knowledge do-

main consists of dichotomous true/false items. In the present study, five physical literacy domains were analyzed: PL-competence, PL-understanding, PL-motivation, PL-confidence, and PL-knowledge, together with the overall physical literacy score (PL-total), consistent with previous studies conducted in the same population. Higher scores indicated higher levels of perceived physical literacy. Physical literacy was assessed at baseline and after one year of follow-up, allowing the evaluation of within-participant changes over time.

Study protocol

Participants were assessed at baseline and again after one year of follow-up using the same standardized study procedures. At baseline, sociodemographic characteristics and PL were recorded, while the follow-up assessment repeated the PL evaluation after the observation period. During this period, all participants continued to take part in the community-based exercise program according to its regular schedule and usual organizational format, with the pause in the summer period due to unfavorable weather conditions (high temperatures). Assessments were conducted under supervised and standardized conditions in the laboratory of the Faculty of Kinesiology, University of Split, with participants receiving the same instructions at both measurement points. A schematic overview of the study design and participant flow is presented in Figure 1.



Figure 1. Study protocol

Statistics

Means and standard deviations were calculated for continuous variables. Changes in PL over the one-year observation period were evaluated by t test for dependent samples by comparing baseline and follow-up scores for PL variables, specifically PL-total, and the five PL subdomains (PL-competence, PL-understanding, PL-motivation, PL-confidence, and PL-knowledge).

For further analyses, change scores (PL-delta scores) were calculated for the PL-total and each PL subdomain by subtracting the baseline (pre) score from the corresponding follow-up (post) score, with positive values indicating an increase in PL over the observation period.

To analyze the associations between PL-delta scores and participant characteristics, analyses were chosen on the basis of measurement characteristics of the predictor variables.

Specifically, a t test for independent samples was calculated to evaluate the association between living environment (urban vs. rural) and PL-delta scores. Analysis of variance (ANOVA) was used to establish the association between multinomial variables (educational level, socioeconomic status, regularity of participation in exercise program) and PL-delta values. Finally, Pearson's correlations were calculated between participants' age and PL-delta values.

Statistical analyses were performed using Statistica version 14.5 (Tibco Inc., Palo Alto, CA, USA), and statistical significance was set at $p < 0.05$.

Results

The results of the changes in PL variables are presented in Table 1. As evident, PL motivation, PL confidence, and PL to-

tal significantly ($p < 0.05$) improved from pre- to postmeasurement, with relative improvements of 7.4%, 11.8%, and 5.4% for

PL motivation, PL confidence, and PL total, respectively.

Table 1. Descriptive statistics and t test differences between pre- and post-measurement of the physical literacy (PL) variables

	Pre		Post		t test		Delta changes	
	Mean	Std. Dev.	Mean	Std. Dev.	t test	p	Absolute	%
PL-competence (score)	63.4	26.1	65.1	25.8	0.85	0.399	1.7	2.7
PL-understanding (score)	96.7	8.01	97.2	7.5	0.78	0.439	0.5	0.5
PL-motivation (score)	88.0	24.1	94.5	18.8	2.7	0.009	6.5	7.4
PL-confidence (score)	73.41	26.9	82.1	22.2	2.65	0.011	8.7	11.8
PL-knowledge (score)	81.7	16.5	84.9	16.0	0.82	0.416	3.2	3.9
PL-total (score)	81.02	11.1	85.4	10.2	3.11	0.003	4.4	5.4

The correlations between PL-delta scores and participants' age are presented in Figure 1. As is evident, no signifi-

cant correlation between age and PL-delta was found.

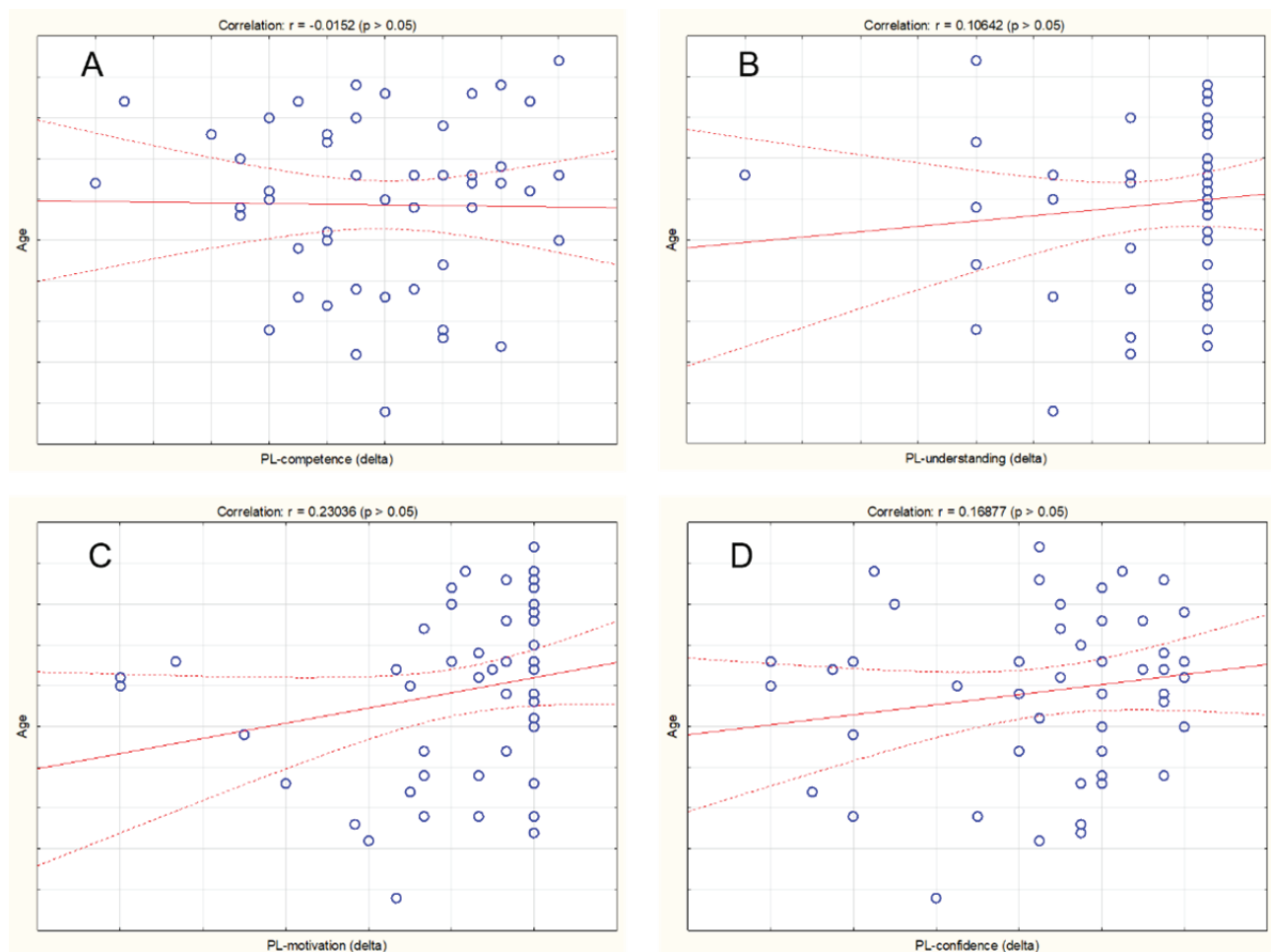
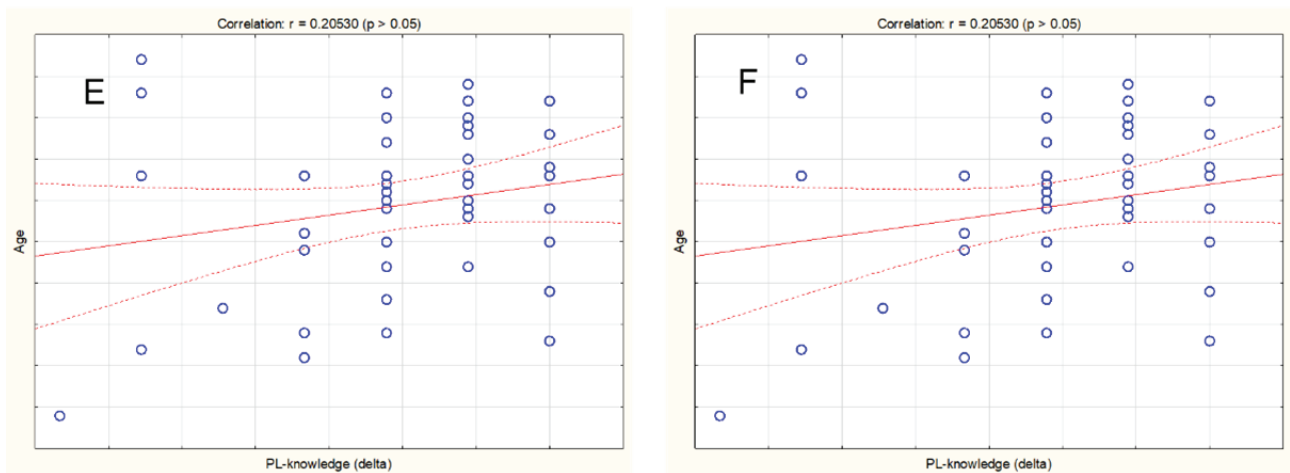


Figure 2. Correlations between participants' age and physical literacy (PL) variables (2A – PL-competence, 2B – PL-understanding, 2C – PL-motivation, 2D – PL-knowledge, 2E – PL-knowledge, 2F – PL-total)



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Figure 2. Correlations between participants' age and physical literacy (PL) variables (2A – PL-competence, 2B – PL- understanding, 2C – PL-motivation, 2D – PL-knowledge, 2E – PL-knowledge, 2F – PL-total)

ANOVA calculated for differences among groups of participants based on their educational level revealed no significant association between educational level and changes in

PL-delta scores, with no significant difference among groups for any of the observed PL-delta variables (Table 2)

Table 2. Descriptive statistics for the delta scores of the physical literacy (PL) variables and differences among groups based on educational level (analysis of variance – ANOVA)

	Elementary school		High school		College/University degree		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F test	p
PL-competence (delta)	1.6	0.7	1.7	0.7	1.8	0.7	0.34	0.71
PL-understanding (delta)	0.5	0.0	0.5	0.0	0.5	0.1	0.71	0.49
PL-motivation (delta)	6.2	1.8	6.5	1.8	6.7	1.8	0.22	0.80
PL-confidence (delta)	8.1	3.2	8.6	3.2	9.2	3.2	0.58	0.56
PL-knowledge (delta)	3.1	0.6	3.2	0.6	3.3	0.6	0.41	0.66
PL-total (delta)	4.25	0.6	4.4	0.6	4.5	0.6	0.76	0.47

When ANOVA for PL-delta variables was calculated between groups based on socioeconomic status, no significant difference between groups was found, indicating no signifi-

cant association between socioeconomic status and changes in PL-variables during the study course (Table 3.)

Table 2. Descriptive statistics for the delta scores of the physical literacy (PL) variables and differences among groups based on socioeconomic status (analysis of variance – ANOVA)

	Below average		Average		Above average		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F test	p
PL-competence (delta)	1.7	0.7	1.6	0.6	1.7	0.7	0.34	0.71
PL-understanding (delta)	0.5	0.0	0.4	0.1	0.5	0.1	0.71	0.49
PL-motivation (delta)	6.5	1.7	6.1	1.6	6.5	1.8	0.22	0.80
PL-confidence (delta)	8.6	3.1	8.2	3.0	8.6	3.3	0.58	0.56
PL-knowledge (delta)	3.2	0.6	3.0	0.6	3.2	0.6	0.41	0.66
PL-total (delta)	4.3	0.6	4.2	0.5	4.3	0.6	0.76	0.47

Table 4 presents the results of the t test differences between groups based on living environment (urban vs. rural). Again, no significant difference between groups was found,

indicating no association between living environment and PL-delta values.

Table 4. Descriptive statistics for the delta scores of the physical literacy (PL) variables and differences between groups based on living environment (independent samples t test)

	Urban		Rural		t test	
	Mean	SD	Mean	SD	t test	p
PL-competence (delta)	1.6	0.7	1.7	0.7	0.32	0.75
PL-understanding (delta)	0.4	0.1	0.5	0.1	0.68	0.50
PL-motivation (delta)	6.2	1.7	6.7	1.7	0.91	0.36
PL-confidence (delta)	8.5	3.2	8.8	3.2	0.44	0.66
PL-knowledge (delta)	3.1	0.6	3.2	0.6	0.73	0.46
PL-total (delta)	4.3	0.6	4.4	0.6	0.57	0.57

When ANOVA calculation was performed to establish the differences in PL-delta values among groups based on the regularity of participation in the community exercise program, the results revealed two significant coefficients. Namely,

groups significantly differed in delta values for PL confidence (F test =4.54, $p<0.01$) and PL total (F test =3.02, $p=0.05$), indicating greater changes in PL variables among women who participated more regularly in the physical exercise program.

Table 5. Descriptive statistics for the delta scores of the physical literacy (PL) variables and differences among groups based on participants' regularity of participation in exercise program (analysis of variance – ANOVA)

	Rarely participated		Moderately participated		Often participated		Regularly participated		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F test	p
PL-competence (delta)	1.6	0.7	1.7	0.7	1.8	0.7	1.7	0.7	0.10	0.96
PL-understanding (delta)	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.31	0.82
PL-motivation (delta)	6.2	1.8	6.7	1.8	6.6	1.8	6.5	1.8	0.18	0.91
PL-confidence (delta)	7.2	2.9	7.4	2.9	9.3	2.9	10.9	2.9	4.54	0.01
PL-knowledge (delta)	3.1	0.7	3.3	0.7	3.2	0.7	3.2	0.7	0.31	0.82
PL-total (delta)	4.1	0.6	4.3	0.6	4.5	0.6	4.7	0.6	3.02	0.04

Discussion

The present pilot study revealed several main findings. First, overall PL improved over the one-year period, with the most pronounced improvements observed in motivation and confidence. However, baseline sociodemographic characteristics were not associated with the magnitude of these changes. Finally, more consistent participation in the exercise program was associated with greater changes in PL over the observation period. Therefore, our first study hypothesis could be accepted, while the second hypothesis should be rejected.

Improvement of physical literacy over the one-year period

Although PL is considered a concept that can continue to develop across the lifespan, most empirical work has focused on children, adolescents, or younger adults (Rajkovic et al., 2026). At the same time, evidence in older populations remains sparse. The consideration that PL could be modifi-

able even in older ages is supported by models emphasizing the continued interaction between physical competence, confidence, motivation, knowledge, and lived movement experiences, rather than viewing these capacities as fixed once formal education has ended (Jones et al., 2018; Petrusevski et al., 2022). However, most of the available literature remains cross-sectional, conceptual, or focused on measurement rather than actual developmental trajectories (Huang et al., 2020; Yu et al., 2025). Therefore, the observed increase in overall PL over one year in older females involved in recreational exercise program provides preliminary evidence that PL may remain responsive to change even in later life. The authors are of the opinion that this is particularly possible when older adults are continuously exposed to structured movement experiences in a community setting.

The improvement in PL-motivation is an encouraging finding. Namely, motivation represents a central affective component of PL and is essential for continued engagement in physical activity (Brunet & Sabiston, 2011). In older

adults, motivation to remain active is often closely related to the perceived benefits of exercise, enjoyment, improved well-being, and the belief that physical activity contributes meaningfully to health and everyday functioning. Studies of community-based exercise programs consistently show that older participants often report feeling better physically and psychologically, perceiving clear health benefits, and valuing the opportunity to remain active, all of which are closely linked to stronger exercise motivation (Dabkowski et al., 2021; Killingback et al., 2017). Therefore, the increase in PL motivation observed in the present study may reflect a growing recognition among participants that exercise is beneficial, enjoyable, and relevant to maintaining their health and independence in later life.

The observed increase in motivation can be interpreted within the framework of self-determination theory (SDT). The SDT proposes that motivation is strengthened when individuals experience autonomy, competence, and relatedness during an activity (Ryan & Deci, 2000). In our case, repeated participation in exercise programs may provide opportunities to feel more capable, to experience personal choice and control and to develop a sense of social connection with others involved in the activity. Over the observed period, these experiences may help transform initially external or weak motives for participation into more autonomous and personally meaningful forms of motivation. Although we could not find more direct support in the PL literature, the proposed interpretation is supported in more general studies. Specifically, studies have shown that the satisfaction of basic psychological needs is positively associated with more self-determined motivation and sustained physical activity participation, even in older adults (Tang et al., 2020; Teixeira et al., 2012). Thus, we may suppose that the increase in PL-motivation observed in this study may at least partially be associated with the motivational benefits of continued and meaningful engagement in the exercise program.

The increase in PL-confidence observed over the one-year period is also a plausible finding in the context of regular exercise participation among older women. With advancing age, confidence in one's own ability to move and exercise may be challenged by declining physical capacity, chronic conditions, fear of injury, or uncertainty regarding what activities can be performed safely. Evidence from community-based exercise and walking interventions indicates that participation can improve exercise-related self-efficacy, balance confidence, and perceived ability to remain physically active (Cyarto et al., 2008; Lee et al., 2007). Although exercise self-efficacy and the confidence domain of PL are not identical constructs, they share an important perception of capability, making the observed improvement in PL confidence consistent with the broader literature on exercise participation in later life. Supportively, studies reported improvements in self-efficacy following community-based programs specifically targeting older women and other older populations, suggesting that continued exercise experience may strengthen individuals' belief in their capacity to perform physical tasks successfully (Xiao et al., 2018).

Sociodemographic factors are not associated with changes in physical literacy

It was initially hypothesized that baseline sociodemographic characteristics would be associated with the magnitude of change in PL over the one-year period. However, this hypothesis was not supported, as no clear associations were observed between the examined sociodemographic factors and changes in PL. Several possible explanations for this finding are considered below.

Education as sociodemographic factor may reasonably be expected to influence the level of PL, particularly its cognitive components. Specifically, higher educational attainment is generally associated with greater access to information, stronger learning opportunities, and greater familiarity with health- and activity-related concepts. Recent work in older adults also suggests that educational attainment can be related to PL status, although the strength and consistency of these associations vary across populations (Mudrinic et al., 2025; Yu et al., 2025). However, education is a relatively stable background characteristic and does not necessarily determine an individual's capacity to improve PL once exposed to the same exercise environment. In the present study, all participants took part in the same community-based program and were exposed to comparable opportunities for movement, practice, and learning. Therefore, the absence of an association between baseline educational level and change in PL is actually logical. In other words, education may contribute to differences in PL at study baseline (where participants start), but it is not expected that education will have an influence on how much they can progress in PL over a one-year period in the case of the studied program (where all participants had the opportunity to be involved, no matter their initial education level).

Similar to educational background, socioeconomic status may influence opportunities to engage in physical activity and access health-promoting resources. Therefore, finances could influence the overall PL level. However, it is unlikely that socioeconomic status could determine the magnitude of improvement in PL once individuals are already participating in the same community-based program. Once again, in the present study, all participants had access to the same exercise setting and comparable opportunities for participation, which may have reduced the practical importance of financial differences for changes in PL. Moreover, socioeconomic status was assessed using a relatively broad self-perceived three-category measure (below average, average, above average), which provides only a general estimate of participants' financial circumstances. Such evaluation may not capture more subtle differences in income, wealth, or material resources. Therefore, limited measurement precision (low variance) could attenuate associations and may partly explain the absence of a relationship between socioeconomic status and changes in PL.

With regard to the lack of association between age and changes in PL over the study period, following explanation could be offered. First, there is no doubt that advancing age is known to be accompanied by declines in physical function, movement capacity, and confidence. Theoretically, older ages

could theoretically (negatively) influence the extent of change in PL simply because they may constrain opportunities for improvement (Jones et al., 2018; Yu et al., 2025). However, the present sample of participants consisted exclusively of older women, meaning that they were broadly comparable in terms of life stage and age-related functional context. This limited variability may have reduced the possibility of detecting age-related differences in PL change. In other words, age may be more relevant when comparing individuals across a broader span of adulthood, whereas within a comparatively homogeneous group of older women, its influence on the magnitude of change may be less pronounced.

Regularity of exercising and changes in physical literacy

Regularity in participation in exercise program was associated with superior improvement in PL. This finding provides an important link to the changes observed in motivation and confidence. There is no doubt that participants who attended the community-based exercise program more regularly were exposed more consistently to different factors that could positively impact their motivation to exercise. Among others, movement experiences, social interaction, and opportunities to experience success in exercise are all closely related to the development of confidence and more self-determined forms of motivation. Supportively, research in older adults consistently shows that sustained participation and adherence are associated with stronger exercise self-efficacy, perceived competence, and continued engagement, while community-based programs often derive much of their benefit from repeated rather than sporadic exposure (Collado-Mateo et al., 2021; Farrance et al., 2016). In this sense, it seems that attendance should not be observed simply as a behavioral indicator. In this context, attendance may reflect the degree to which participants are actually exposed to the experiences through which affective components of PL can develop.

A similar interpretation may be applied to the observed improvement in PL-confidence. Regular attendance provides repeated opportunities to perform exercises successfully, become familiar with movement tasks, and experience one's own capability in a relatively safe and supportive setting. Repeated successful experiences are known to be an important source of exercise self-efficacy and confidence even in older adults (Lee et al., 2008).

However, these associations should be interpreted cautiously because the direction of the relationship cannot be established from the present design. In other words, the starting point of the direction of influence "from attendance to better motivation and confidence" could be the opposite ("from higher motivation to regular attendance"). Logically, it could be that more motivated and confident women may have attended more regularly, while more regular attendance may also have contributed to further increases in motivation and confidence. In addition, the regularity of participation is influenced by numerous factors that are not necessarily related to PL itself, including health status, limitations in mobility, familiar responsibilities, accessibility of the program, and other important life demands. Therefore, "attendance" should be

viewed as a complex indicator of actual exposure to the program rather than as a direct predictor of higher motivation.

Limitations and strengths

Before reaching the conclusions, some important limitations of the investigation should be acknowledged. First, the absence of a control group limits the ability to attribute the observed changes in PL exclusively to participation in the observed exercise program. Second, the sample consisted of a relatively specific and homogeneous group of older women from one sociocultural setting, which may limit the generalizability of the findings to other populations. Finally, PL was assessed primarily through perceived domains, while some relevant physical components, including objectively measured physical fitness, were not included.

On the other hand, this is among the first longitudinal studies to examine changes in PL specifically among older women, thereby addressing an understudied area. In addition, all participants attended the same community-based exercise program, which reduced variability related to differences in program content, organization, and exercise setting. Finally, the program was provided free of charge, which almost certainly limited the financial barriers to participation.

Conclusion

The present study provides preliminary evidence that PL can be improved even in older individuals. The most pronounced changes were observed in PL-motivation and PL-confidence, suggesting that these components of PL may be particularly responsive to continued participation in structured physical activity. This supports the broader concept of PL as a lifelong and potentially modifiable construct rather than a capacity that becomes fixed after in life. In this respect, older adulthood should not be viewed as a period in which further development of PL is no longer possible.

Although the absence of a control group prevents firm conclusions about the causal effect of the exercise program on improvement in PL, the association between attendance regularity and improvements in PL is particularly informative. Participants who attended more consistently demonstrated greater changes in PL. This suggests that repeated exposure to movement experiences may contribute to PL development. This finding supports the potential relevance of a "learning-by-doing" process in older age, where regular participation itself may provide opportunities to strengthen confidence, motivation, and other components of PL.

Acknowledgement

This research was funded by the European Union (NextGenerationEU) under the Croatian Recovery and Resilience Plan 2021–2026 (NRRP) through the University of Split institutional project "Open space and closed years" (IP-UNIST-23) approved by the Ministry of Science, Education and Youth of the Republic of Croatia. The study is registered at clinicaltrials.gov (NCT07365228). Authors are particularly grateful to all participants for their voluntary participation.

Conflict of Interest

The authors declare that they have no conflict of interest.

Received: 14 August 2026 | **Accepted:** 18 September 2026 | **Published:** 01 October 2026

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