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Analysis of the Associations between Physical Literacy and Health Literacy in Older Females; Cross Sectional Study

Ante Sestan[1], Ivana Cerkez Zovko[2], Damir Sekulic[1]

[1]University of Split, Faculty of Kinesiology, Split, Croatia, [2]University of Mostar, Faculty of Science and Education, Mostar, Bosnia and Herzegovina

Abstract

Physical literacy (PL) and health literacy (HL) are important concepts known to be related to health behavior in all age groups, but studies rarely have examined the possible associations between them in older persons. This study aimed to evaluate the associations between HL and PL in older females, emphasizing the associations between specific facets of studied concepts. The participants were females from urban center in southern Croatia (n=45, 60-80 years of age). They were tested on HL (via the European Health Literacy Survey Questionnaire), and PL (via the Perceived Physical Literacy Questionnaire) in controlled and supervised settings. In addition to total scores (PL-total and HL-total), five subdomains of PL (PL-physical competence, PL-understanding, PL-motivation, PL-confidence, and PL-knowledge) and 12 HL-subscores were observed as variables. There was no correlation between HL-total and PL-total (Pearson's R =0.16, p>0.05). Canonical analysis calculated between PL-subdomains and HL-subscores indicated a nonsignificant multivariate association between concepts (Can R =0.67, p>0.05). However, specific domain-level analysis revealed that PL-understanding subdomain was a significant correlate of HL across several subscores, and the HL total. The results suggest that understanding the PL concept may serve as a bridge between PL and HL, potentially being important for promoting autonomy and informed health behavior in older females.

Keywords: *physical competence, physical activity, health behavior, adults, correlations*

Introduction

Physical literacy (PL) encompasses the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engaging in physical activities for life (Gilic, Sekulic, Munoz, Jaunig, & Carl, 2025). In older adults, PL assumes heightened significance, as it directly impacts their ability to maintain independence, quality of life, and overall well-being (Galan-Arroyo et al., 2023). By fostering a diverse range of movement skills, promoting active lifestyles, and enhancing awareness of the benefits of physical activity, PL acts as a protective factor against age-related decline. Improved balance, strength, and coordination resulting from enhanced PL can significantly reduce the risk of falls, a leading cause of morbidity in older populations. Furthermore, consistent engagement in physical activity, driven by PL, contributes to better cardiovascular health, muscle mass preservation, and cognitive function, all of which are crucial for healthy aging (Ding et al., 2024).

Health literacy (HL), defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and the services needed to make appropriate health decisions, is paramount for older adults (Kulakci-Altintas & Ayaz-Alkaya, 2025). As individuals age, they often face increasingly complex health challenges, including chronic disease management, medication adherence, and the ability to navigate healthcare systems. Adequate HL empowers older adults to effectively manage these challenges, enabling them to make informed choices about their health. For example, understanding medication instructions, interpreting health-related infor-

Correspondence:

Ivana Cerkez Zovko
University of Mostar, Faculty of Science and Education, Matice hrvatske bb, 88000 Mostar, Bosnia and Herzegovina
E-mail: ivana.cerkez.zovko@fpmoz.sum.ba

mation from various sources, and communicating effectively with healthcare providers are all essential components of HL. Furthermore, strong HL promotes preventive behaviors, such as engaging in recommended screenings and adopting healthy lifestyle habits, which can significantly reduce the burden of age-related illnesses. Ultimately, HL is a critical determinant of health outcomes and quality of life in older populations, facilitating proactive self-management and informed decision-making (Kulakci-Altintas & Ayaz-Alkaya, 2025; Pigazzini, Wieczorek, Meier, & Maurer, 2024).

Both PL and HL are essential for promoting healthy aging and improving the overall well-being of older adults. Not surprisingly, it is theorized that these concepts are correlated and, in some cases, are observed as the same concept, but the results more often do not confirm such observations. For example, in studies dealing with older adolescents, the authors reported a weak relationship between PL and HL (Blažević, Blazevic, & Sekulic, 2024; Kesic, Peric, et al., 2022). Research examining the associations between HL and PL in adults has focused primarily on the relationship between HL and physical activity (as one of the PL facets), and some studies have reported a positive association between higher HL and increased physical activity levels in older adults, but others reported no significant associations (Buja et al., 2020; Lim, van Schooten, Radford, & Delbaere, 2021). However, physical activity, although being an important determinant of overall PL, is only one of the PL domains and, more importantly, is strongly influenced by different contextual factors (i.e., health status, mobility, gender, cultural background, and living environment). On the other hand, the associations between HL and other domains of PL (physical competence, understanding, motivation, and knowledge) have rarely been investigated for older adults.

Understanding the association between PL and HL is crucial for promoting overall well-being, especially in older adults. First, both PL and HL contribute to a holistic view of health. The PL focuses on the ability, confidence, and motivation to engage in physical activity, whereas the HL focuses on the ability to understand and utilize health information (Geets-Kesić, Maras, & Gilić, 2023; Kesic, Peric, et al., 2022). Second, both PL and HL are important from the perspective of preventive health since both literacies play a vital role in preventing chronic diseases (Kesic, Savicevic, Peric, Gilic, & Zenic, 2022). For example, by understanding health information (facet of HL) and engaging in regular physical activity (facet of PL), individuals can reduce their risk of conditions such as heart disease, diabetes, and obesity. Therefore, developing both PL and HL empowers individuals to take control of their health. This leads to better decision-making, improved self-management of health conditions, and increased overall well-being.

Despite growing recognition of the importance of both HL and PL in promoting well-being, their relationship remains underexplored—particularly in older adults. While some theoretical frameworks suggest that these constructs are closely interconnected or even overlapping, empirical evidence supporting this linkage is generally in disagreement with such hypotheses, while studies dealing with this issue in older adults are lacking. Understanding how these literacies interact later in life is essential, as both are critical to maintaining autonomy, health behavior, and quality of life in aging populations. The purpose of this study was to address this research gap by examining the associations between PL and HL in older females, offering insight into how integrated approaches to health promotion might be developed. Therefore, the aim of this study was to evaluate the associations that may exist between different facets of PL and different domains of HL in older females from Croatia. It was hypothesized that HL and PL would be significantly positively correlated but with a moderate magnitude of this association, indicating a limited level of shared variance between the constructs in older females (<30% of the shared variance).

Materials and methods

Participants

The sample of participants in this study included 45 females, 60-80 years of age, from the city of Split in southern Croatia. Given the significant influence of sociocultural factors on both HL and PL, we intentionally targeted only one geographical region and sampled participants accordingly in order to reduce sociocultural differences between them. The participants varied in health conditions, and the sample included those with no health problems, as well as those with serious health issues (diabetes, cardiovascular issues, arthritis, etc.). However, all of them were physically capable of visiting the testing center individually (please see later for variables and testing), meaning that they were independent and motorically functional, whereas more than 60% of them were involved in certain types of recreational physical exercise. They were personally invited to participate in the study, which was organized as a part of the research project at the Faculty of Kinesiology, University of Split. Prior to testing, they were informed that their participation was voluntary, that they could refuse to participate. The investigators explained the benefits and risks of their participation, and the participants provided informed consent for study participation. The inclusion criteria included being female older than 60 years, being a resident of the city of Split in southeastern Croatia, having the necessary level of independence and movement/motor functionality to visit the testing center individually, and having an appropriate level of cognitive functionality to clearly understand and respond to questionnaire items evaluating HL and PL. The exclusion criteria were being younger than 60 years, lacking the cognitive ability to respond to questionnaires, and having insufficient motor functionality and independence in visiting the testing center. The study was approved by the Ethical Committee of the Faculty of Kinesiology.

Variables

The sample of variables in this study included participants' age (self-reported, in years), HL status, and PL status. The HL and PL were gathered over a single testing session via a digital platform under the supervision and instruction of the first author of the study.

The PL was evaluated via the Perceived Physical Literacy Questionnaire for South Eastern Europe (PPLQ-SEE) (Gilic et al., 2025). The instrument originally comprises 24 items structured in six domains: (i) physical competence, (ii) understanding, (iii) motivation, (iv) confidence, (v) knowledge, and (vi) physical activity behavior. The items of the first four domains are evaluated on a six-point Likert scale (strongly agree–strongly disagree) ranging from 5 to 0, and the PL-knowledge is composed of items with closed response categories (dichotomous true–false scale). In this study, we observed the first five subdomains (PL-competence, PL-understanding, PL-motivation, PL-confidence, and PL-knowledge) and the total score (PL-total) as variables representing the participants' PL status.

To evaluate HL, we used the validated Croatian version of the original European Health Literacy Survey Questionnaire (HLS-EU-Q) (Geets-Kesić et al., 2023; Kesic, Savicevic, et al., 2022; Sørensen et al., 2013). The assessment covered an individual's capacity to collect and comprehend basic health information and to obtain health services. It also assesses the ability of individuals to use the latter to make appropriate health decisions or to access, comprehend, evaluate and apply information regarding their health. The following subscores were observed in this study: (i) accessing healthcare-related information (HC-AC), (ii) understanding healthcare-related information (HC-U), (iii) appraising healthcare-related information (HC-AP), (iv) applying healthcare-related information (HC-APPL), (v) accessing information related to disease prevention (DP-AC), (vi) understanding information related to disease prevention (DP-U), (vii) appraising information related to disease prevention (DP-AP), (viii) applying information related to disease prevention (HP-APPL), (ix) accessing information related to health promotion (HP-AC), (x) understanding information related to health promotion (HP-U), (xi) appraising information related to health promotion (HP-AP), and (xii) applying information related to health promotion (HP-APPL). A general index of HL (HL-total) was created by applying a 4-point Likert scale comprising response options ranging from very difficult—1 to very easy—4. To calculate the score, indexing was applied according to the following formula: index = (mean-1) × (50/3). Scaling was applied to the HL range, with 0 representing the lowest score and 50 representing the maximum score. The range was then divided into four separate ranking bands as follows: inadequate (from 0-25), problematic (26-33), sufficient (34-42), and excellent (43-50) (Sørensen et al., 2013).

Statistics

The Kolmogorov–Smirnov test was applied to check the normality of the distributions for all the variables. Since all variables met the normality assumption, the means, minimum, maximum, and standard deviations were calculated as descriptive statistical parameters.

Univariate and multivariate analyses were applied to determine the associations between HL and PL. The univariate associations between five subdomains of PL and PL-total (first set), with all subscores of HL and HL-total (second set), were evaluated by calculating Spearman's correlation coefficients (Spearman's R). The multivariate associations between HL and P were checked by canonical correlation analysis. The canonical correlation analysis was applied with all subscores of PL included in the first set and all subscores of the HL included in the second set. Since PL-total and HL-total are essentially collinear with corresponding subscores (i.e., total scores are calculated on the basis of subscores; please see variables for details), PL-total and HL-total were not included in the calculation of the canonical correlation analysis.

Statistica version 13.5 (Tibco Inc. Palo Alto, CA, USA) was used for all analyses, and a p-level of 95% was applied.

Results

The results of the descriptive statistics for all the variables observed in this study are presented in Table 1. With an average score of 36.8±7.07, the HL of the tested participants was sufficient.

Table 1. Descriptive statistics of the studied variables

	Mean	Minimum	Maximum	Std.Dev.
Age (years)	70.80	61.00	80.00	5.57
PL-competence (score)	63.44	0.00	100.00	26.50
PL-understanding (score)	96.44	60.00	100.00	7.99
PL-motivation (score)	87.04	0.00	100.00	24.31
PL-confidence (score)	73.44	0.00	100.00	27.13
PL-knowledge (score)	82.72	44.44	100.00	16.51
PL-total (score)	80.62	40.56	95.00	11.49
HC-AC (score)	37.13	8.33	50.00	10.95
HC-U (score)	39.54	16.67	50.00	9.55
HC-AP (score)	32.04	12.50	50.00	9.35
HC-APPL (score)	40.46	20.83	50.00	7.62
DP-AC (score)	39.44	12.50	50.00	10.46
DP-U (score)	42.53	25.00	50.00	7.99
DP-AP (score)	35.85	20.00	50.00	8.11
DP-APPL (score)	31.11	16.67	50.00	10.35
HP-AC (score)	33.93	6.67	50.00	10.52
HP-U (score)	34.56	4.17	50.00	12.27
HP-AP (score)	41.54	22.22	50.00	8.51
HP-APPL (score)	36.93	16.67	50.00	9.99
HL-total (score)	36.86	24.11	48.23	7.07

Legend: PL – physical literacy, HC-AC - accessing healthcare-related information, HC-U - understanding healthcare-related information, HC-AP - appraising healthcare-related information, HC-APPL - applying healthcare-related information, DP-AC - accessing information related to disease prevention, DP-U - understanding information related to disease prevention, DP-AP - appraising information related to disease prevention, HP-APPL - applying information related to disease prevention, HP-AC - accessing information related to health promotion, HP-AP - appraising information related to health promotion, HP-U - understanding information related to health promotion, HP-APPL - applying information related to health promotion

The correlations between PL-total and HL-total are presented in Figure 1. The variables accounted for less than 3% of the common variance (p>0.05) (Figure 1).

The results of the canonical correlations between the PL subscores and the HL subdomains are presented in Table 4. In general, no significant multivariate correlation was found between sets of variables, with the first pair of canonical roots explaining 45% of the common variance (p>0.05).

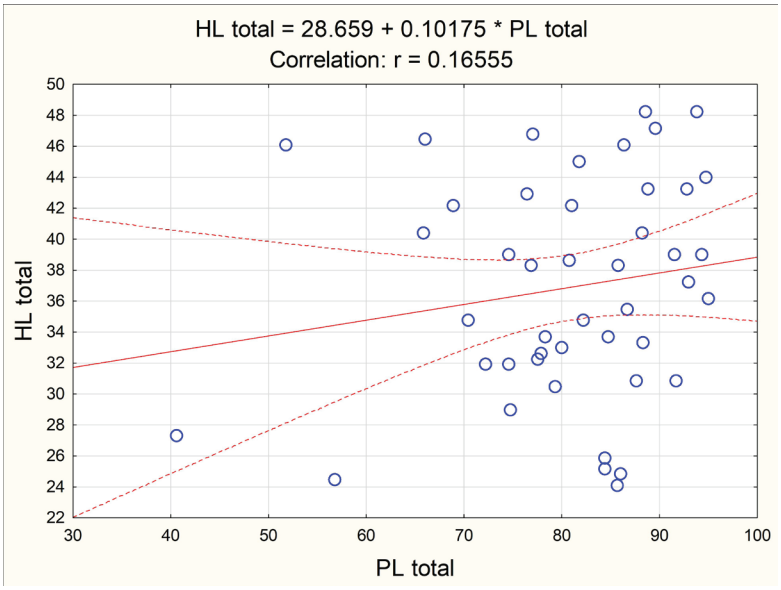

FIGURE 1. Correlation between total scores of health literacy and physical literacy

Table 2. Multivariate associations between health literacy subdomains (left set) and physical literacy subscores (right set) in older women—results of the canonical correlation analysis (Can R – canonical correlation

Roots removed	Canonical R	Canonical R^2	Chi-square	p-level
0	0.67	0.45	70.40	0.17
1	0.53	0.28	38.84	0.69
2	0.40	0.16	21.44	0.87
3	0.37	0.13	12.47	0.82
4	0.30	0.09	4.96	0.76

Note that factor structure of the roots is not presented due to nonsignificant canonical correlations

Table 3. Pearson's correlations between health literacy and physical literacy

	PL-competence	PL-understanding	PL-motivation	PL-confidence	PL-knowledge	PL-total
HC-AC	0.04	0.33*	0.01	0.02	-0.05	0.06
HC-U	0.20	0.06	-0.04	-0.05	-0.29	-0.02
HC-AP	0.18	0.21	-0.18	0.12	-0.11	0.07
HC-APPL	0.18	0.08	-0.03	0.12	-0.22	0.09
DP-AC	0.16	0.27	-0.04	0.07	-0.03	0.13
DP-U	0.09	0.32*	-0.07	0.18	0.05	0.17
DP-AP	0.02	0.31*	-0.03	0.27	0.06	0.19
DP-APPL	-0.14	0.16	-0.16	0.18	-0.03	-0.04
HP-AC	0.06	0.22	-0.16	0.04	-0.06	-0.01
HP-U	-0.01	0.23	-0.14	-0.11	-0.12	-0.13
HP-AP	0.17	0.24	0.01	0.00	-0.26	0.03
HP-APPL	0.06	0.21	0.13	0.16	-0.19	0.14
HL-total	0.11	0.30*	-0.09	0.10	-0.14	0.16

Legend: * indicates statistical significance of p<0.05, PL – physical literacy, HC-AC – accessing healthcare-related information, HC-U – understanding healthcare-related information, HC-AP – appraising healthcare-related information, HC-APPL – applying healthcare-related information, DP-AC – accessing information related to disease prevention, DP-U – understanding information related to disease prevention, DP-AP – appraising information related to disease prevention, HP-APPL – applying information related to disease prevention, HP-AC – accessing information related to health promotion, HP-AP – appraising information related to health promotion, HP-U – understanding information related to health promotion, HP-APPL – applying information related to health promotion.

The univariate correlations between all the HL and PL variables are presented in Table 3. The PL understanding was significantly correlated with HC-AC (10% of the shared variance), DP-U (<10% of the shared variance), DP-AP (<10% of the shared variance), and HL-total (9% of the shared variance).

Discussion

There are several important findings of our study. First, PL-total and HL-total are nonsignificantly correlated, sharing less than 10% of the common variance. Therefore, our initial study hypothesis cannot be accepted. However, (second), PL understanding is significantly correlated with several HL subscores and the HL-total score.

Contrary to our initial expectations, the total HL and PL scores were not significantly correlated. As already mentioned in the introduction, studies that have investigated this problem in the adult population are generally scarce; however, to the best of our knowledge, no investigations have examined the associations between HL and PL among older persons in the territory of southeastern Europe. Therefore, further discussion of findings will, in some cases, lack direct scientific evidence, but some theoretical and practical explanations of the results will be offered.

One reason for the poor correlation between HL and PL may be the distinct nature of these constructs, particularly in the context of older adulthood. In brief, HL focuses on cognitive competencies, such as processing health-related information, understanding medical instructions, and making informed decisions within healthcare systems (Geets-Kesić et al., 2023; Sørensen et al., 2013). These abilities often develop through accumulated life experience, healthcare interactions, or formal education and may remain stable or even improve with increasing age. In contrast, PL emphasizes embodied capacities such as physical competence, motivation for movement, and confidence in performing physical tasks (Gilic et al., 2025). All of these factors tend to decrease with age due to physiological, psychological, and environmental barriers. For many older individuals, especially women, declining mobility, fear of injury, or chronic conditions may inhibit physical engagement, regardless of their understanding of its benefits (Cohen-Mansfield, Shmotkin, & Goldberg, 2010). This disconnect between knowing and doing highlights how the cognitive strengths associated with HL may not translate into higher PL in aging populations. Moreover, it is possible that divergence in these literacy domains becomes more pronounced with age, helping to explain the weak overall correlation observed in our study.

Another factor that may explain the weak correlation between H1 and PL is the reliance on compensatory health strategies, particularly among older adults. Individuals with high HL are often able to engage in alternative health-promoting behaviors that do not necessarily involve physical activity. For example, they may adhere strictly to medication regimens, follow dietary guidelines, or attend preventive health checkups—all of which contribute to better health outcomes without requiring high levels of physical competence or activity (Glass, Bellettiere, Jain, LaMonte, & LaCroix, 2021; Sørensen et al., 2021). In older women, this pattern may be even more pronounced due to age-related physical limitations, chronic conditions, or pain, which can restrict mobility and reduce motivation for movement (Glass et al., 2021). As a result, maintaining health may become more about managing illness than engaging in movement, leading to "health literacy without physical literacy". Consequently, their HL scores may remain high, whereas their PLs may remain low, contributing to the observed disconnect between the two constructs.

An additional reason for the poor correlation between HL and PL may lie in what can be described as lifestyle segmentation in aging populations. In older adults, particularly in older women, HL and PL often develop along divergent pathways. HL can continue to improve through interactions with healthcare providers, participation in educational programs, or exposure to health information via community centers, clinics, or media (Lima, Maximiano-Barreto, Martins, & Luchesi, 2024). In contrast, PL requires life-long engagement in physical behaviors, such as regular movement, the practice of motor skills, and the reinforcement of physical confidence (Gilic et al., 2025; Kesic, Peric, et al., 2022). As a result, HL may be high or stable, while PL was not sufficiently developed simply because of a lack of physical competence as a result of poor participation in physical activities earlier in life. This divergence in lifestyle experiences leads to a natural decoupling of the two literacies, which could explain the weak overall correlation between them.

From the perspective of our research, another key explanation for the observed weak correlation between total HL and PL scores is particularly possible and is related to the masking effect of composite scoring. Both HL and PL are multidimensional constructs, each composed of several distinct but interrelated domains (Blažević et al., 2024; Geets-Kesić et al., 2023). When these domains are averaged into a single total score, nuanced relationships between specific subdomains may be obscured. For example, health-related knowledge or critical appraisal skills may correlate strongly with PL components such as motivation or understanding but not necessarily with physical competence or activity behavior. This is even more possible in the older women we observed here because of their limited physical mobility. By aggregating all the domains, the statistical "noise" from unrelated subdomains dilutes the strength of meaningful interdomain connections, resulting in a weak overall correlation. This highlights the importance of conducting domain-level analyses, which in our case revealed stronger and more interpretable relationships, offering a clearer picture of how HL and PL interact within the aging female population.

Although the total scores of the HL and PL groups were weakly correlated, domain-level analysis revealed substantially greater intercorrelations, underscoring the importance of a multidimensional analytical approach. Specifically, the understanding component of PL emerged as the most robust correlate of HL across all domains. This suggests that the cognitive grasp of physical activity — its purpose, benefits, and safe application — is closely aligned with an individual's ability to navigate health information more broadly. Unlike more embodied or emotional aspects of PL, understanding may represent a cognitive intersection between the two literacies, especially between PL understanding and different facets of HL.

One of the possible explanations for the significant association between PL understanding and HL is related to shared cognitive dimensions. Specifically, the understanding of the PL reflects an individual's cognitive grasp of physical activity, including the reasons why it is important, how to perform it safely, and how it contributes to overall well-being (Gilic et al., 2023).

This domain closely aligns with several components of HL, particularly comprehension and appraisal of health information (i.e., interpreting medical advice, understanding disease risk factors, and evaluating preventive health strategies). The HL in general acknowledges conceptual awareness and informed decision-making rather than direct action or physical skill. In older women, this overlap may be especially important, as both types of understanding support autonomy, safety, and informed health behavior without necessarily requiring high levels of physical exertion. Unlike other PL components (e.g., competence or confidence), which may decline with age, the PL-understanding domain can remain robust and grow through health education or life experience. This may explain why understanding in PL showed the strongest and most consistent associations with HL. This finding actually suggests that cognitive understanding may act as a bridge between HL and PL in general.

Other possible explanations are specific for the participants in this study. Specifically, in older women, both HL and PL understanding may be shaped by similar educational influences, whether formal (e.g., structured health education programs, clinical consultations) or informal (e.g., community talks, media exposure, conversations with peers or family). These forms of learning contribute to a deeper awareness of health-related information, including both general health behaviors and physical activity principles. As a result, cognitive domains such as PL understanding tend to align more closely with HLs than do emotionally or behaviorally driven PL components (i.e., PL confidence or PL competence), which often require regular practice or engagement to develop and maintain. In aging populations, where physical activity may decline due to health limitations, education becomes a primary avenue through which individuals stay informed and make health-conscious decisions (Sardareh et al., 2024). This shared educational foundation reinforces the idea that some aspects of PL, particularly those tied to knowledge and understanding, are more cognitively proximal to HL than others are.

Additionally, for older women, understanding health and physical activity often plays a central role in maintaining self-care and independence, two priorities that become increasingly important with age. As daily functioning becomes more challenging, the ability to make informed decisions about medication, physical limitations, exercise safety, and disease prevention becomes essential to sustaining autonomy (Petrusevski, Morgan, MacDermid, Wilson, & Richardson, 2022). In this context, the cognitive dimension of understanding acts as a shared anchor between HL and PL, allowing older women to stay actively engaged in their health management even if their physical ability declines. Understanding fosters confidence in navigating health systems but also in recognizing the value of a physically active lifestyle, choosing appropriate activities, and avoiding injury. Unlike physically demanding components of PL, such as physical competence, or emotionally driven components, such as confidence and motivation, PL understanding remains relatively resilient to aging and can even be strengthened through lived experience. This makes it a particularly accessible and empowering resource for older women, who may face age- or gender-specific barriers to physical activity.

This study has several limitations that should be acknowledged. First, its cross-sectional design prevents conclusions from being drawn about causality between HL and PL. Additionally, the research was conducted in a specific regional and cultural context (urban center in southern Croatia), where traditional gender roles, health behaviors, and physical activity norms may differ from those of other populations, limiting generalizability. Finally, the lack of physical activity assessment prevents a fuller understanding of how actual movement behaviors are related to the PL and HL outcomes.

On the other hand, this study represents one of the first investigations into the relationship between HL and PL among older women and is likely the first conducted in Croatia and the broader territory of the former Yugoslavia. It addresses a notable research gap in an underrepresented demographic, offering culturally relevant insights.

Conclusion

This study examined the association between HL and PL in older women, revealing a weak correlation between the total scores of the two constructs. This suggests that, despite their shared relevance to health behavior, HL and PL may function as distinct domains, particularly in later life. Differences in cognitive versus embodied components, lifestyle patterns, and compensatory strategies likely contribute to this divergence.

However, domain-level analysis offered deeper insight, with the PL understanding emerging as the strongest correlate of HL across all subdomains. This finding highlights a shared cognitive foundation between the literacies, suggesting that understanding may serve as a key cognitive bridge — especially important for promoting autonomy and informed health behavior in older women.

Future research should expand on these findings by exploring HL–PL relationships in more diverse populations, including men, rural or less-educated groups, and different age segments across the life course. Longitudinal designs would help clarify how these literacies develop over time and interact in the presence of changing health conditions or physical limitations. In addition, intervention studies could test whether improving one form of literacy has meaningful effects on the other, particularly when understanding is targeted as a mediating domain.

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Conflict of interest
The authors declare that there is no conflict of interest.

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References

Blažević, J., Blazevic, M., & Sekulic, D. (2024). Is There a Meaningful Association Between Physical Literacy and Health Literacy? A Cross-Sectional Study in Older Adolescents. *Sport Mont, 22*(2), 85-91. https://doi.org/10.26773/smj.240712

Buja, A., Rabensteiner, A., Sperotto, M., Grotto, G., Bertoncello, C., Cocchio, S., . . . Baldo, V. (2020). Health literacy and physical activity: a systematic review. *Journal of Physical Activity and Health, 17*(12), 1259-1274. https://doi.org/10.1123/jpah.2020-0161.

Cohen-Mansfield, J., Shmotkin, D., & Goldberg, S. (2010). Predictors of longitudinal changes in older adults' physical activity engagement. *Journal of Aging and Physical Activity, 18*(2), 141-157. https://doi.org/10.1123/japa.18.2.141.

Ding, D., Van Buskirk, J., Partridge, S., Clare, P., Giovannucci, E., Bauman, A., . . . Nguyen, B. (2024). The association of diet quality and physical activity with cardiovascular disease and mortality in 85,545 older Australians: A longitudinal study. *Journal of Sport and Health Sciences, 13*(6), 841-850. https://doi.org/10.1016/j.jshs.2024.05.011

Galan-Arroyo, C., de Los Rios-Calonge, J., Rojo-Ramos, J., Parraca, J. A.,

Fonseca, C., Castillo-Paredes, A., & da Silva Batista, M. A. (2023). Physical literacy in older adults: a scoping review protocol. *Frontiers in Public Health, 11*, 1217773. https://doi.org/10.3389/fpubh.2023.1217773

Geets-Kesić, M., Maras, N., & Gilić, B. (2023). Analysis of the Association Between Health Literacy, Physical Literacy, and Scholastic Achievement; A Preliminary Cross-Sectional Study Among High-School Students From Southern Croatia. *Montenegrin Journal of Sports Science & Medicine, 12*(1). https://doi.org/10.26773/mjssm.230301

Gilic, B., Sekulic, D., Munoz, M. M., Jaunig, J., & Carl, J. (2025). Translation, cultural adaptation, and psychometric properties of the Perceived Physical Literacy Questionnaire (PPLQ) for adults in Southeastern Europe. *Journal of Public Health*. https://doi.org/10.1007/s10389-025-02428-x

Gilic, B., Sunda, M., Versic, S., Modric, T., Olujic, D., & Sekulic, D. (2023). Effectiveness of physical-literacy-based online education on indices of physical fitness in high-school adolescents: Intervention study during the COVID-19 pandemic period. *Children, 10*(10), 1666. https://doi.org/10.3390/children10101666

Glass, N. L., Bellettiere, J., Jain, P., LaMonte, M. J., & LaCroix, A. Z. (2021). Evaluation of light physical activity measured by accelerometry and mobility disability during a 6-year follow-up in older women. *JAMA Network Open, 4*(2), e210005-e210005. https://doi.org/10.1001/jamanetworkopen.2021.0005

Kesic, M. G., Peric, M., Gilic, B., Manojlovic, M., Drid, P., Modric, T., . . . Pajtler, A. (2022). Are Health Literacy and Physical Literacy Independent Concepts? A Gender-Stratified Analysis in Medical School Students from Croatia. *Children, 9*(8), 1231. https://doi.org/10.3390/children9081231.

Kesic, M. G., Savicevic, A. J., Peric, M., Gilic, B., & Zenic, N. (2022). Specificity of the associations between indices of cardiovascular health with health literacy and physical literacy; a cross-sectional study in older adolescents. *Medicina, 58*(10), 1316. https://doi.org/10.3390/medicina58101316

Kulakci-Altintas, H., & Ayaz-Alkaya, S. (2025). Health literacy and successful aging in older adults: A predictive correlational design. *Geriatric Nursing, 61*, 408-413. https://doi.org/10.1016/j.gerinurse.2024.12.003

Lim, M. L., van Schooten, K. S., Radford, K. A., & Delbaere, K. (2021). Association between health literacy and physical activity in older people: a systematic review and meta-analysis. *Health Promotion International, 36*(5), 1482-1497. https://doi.org/10.1093/heapro/daaa072.

Lima, A. C. P., Maximiano-Barreto, M. A., Martins, T. C. R., & Luchesi, B. M. (2024). Factors associated with poor health literacy in older adults: a systematic review. *Geriatric Nursing, 55*, 242-254. https://doi.org/10.1016/j.gerinurse.2023.11.016.

Petrusevski, C., Morgan, A., MacDermid, J., Wilson, M., & Richardson, J. (2022). Framing physical literacy for aging adults: an integrative review. *Disability and Rehabilitation, 44*(26), 8149-8160. https://doi.org/10.1080/09638288.2021.2012841.

Pigazzini, G., Wieczorek, M., Meier, C., & Maurer, J. (2024). Inadequate health literacy and higher healthcare utilisation among older adults in Switzerland: cross-sectional evidence from a population-based study. *Swiss Medical Weekly, 154*, 3515. https://doi.org/10.57187/s.3515

Sardareh, M., Matlabi, H., Shafiee-Kandjani, A. R., Bahreini, R., Mohammaddokht, S., & Azami-Aghdash, S. (2024). Interventions for improving health literacy among older people: a systematic review. *BMC Geriatrics, 24*(1), 911. https://doi.org/10.1186/s12877-024-05522-z.

Sørensen, K., Levin-Zamir, D., Duong, T. V., Okan, O., Brasil, V. V., & Nutbeam, D. (2021). Building health literacy system capacity: a framework for health literate systems. *Health Promotion International, 36*(Supplement_1), i13-i23. https://doi.org/10.1093/heapro/daab153.

Sørensen, K., Van den Broucke, S., Pelikan, J. M., Fullam, J., Doyle, G., Slonska, Z., . . . Brand, H. (2013). Measuring health literacy in populations: illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health, 13*, 1-10. https://doi.org/10.1186/1471-2458-13-948.