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Is There a Meaningful Association Between Physical Literacy and Health Literacy? A Cross-Sectional Study in Older Adolescents

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Abstract

Health literacy (HL) is hypothesized to be associated with physical literacy (PL), but studies have rarely examined this association in adolescents. This study aimed to investigate the possible relationships between PL and physical activity levels (PAL), with HL in high-school adolescents. The participants in this cross-sectional study were high school students (n=204; 100 females; 16 to 19 years of age). Variables included evaluation of the HL, PL, and PAL. The Physical Activity Questionnaire for Adolescents was used for analysis of the PAL. PL was assessed by the Canadian Assessment of Physical Literacy, and the Physical Literacy Assessment of Youth (PLAYself). HL was evaluated using the European Health Literacy Survey Questionnaire. Univariate and multivariate correlations were calculated for the total sample and stratified by gender. Boys had greater PAL than girls (t test =6.76, p<0.001), but no significant gender differences were found in PL and HL. The results showed no significant association between PL and HL in boys. PL was significantly associated with HL in girls (17% of the explained variance, p<0.001), with PLAYself being a significant partial regressor (Beta =0.38, p<0.001). Due to the established gender-specific associations between HL and PL, in developing and implementing educational strategies aimed at improving PL and HL in adolescents, a gender-specific approach is warranted.

Keywords: *physical activity levels, physical literacy assessment, health literacy survey, adolescents, physical education*

Introduction

Health literacy (HL) is the ability to obtain, read, understand, and use healthcare information to make appropriate health decisions and follow instructions for treatment (Schulenkorf, Krah, Dadaczynski, & Okan, 2021). It involves a range of skills, including (i) reading and comprehension (i.e., understanding health-related materials such as prescription labels, appointment slips, medical brochures, doctor instructions, and consent forms); (ii) numeracy (i.e., performing tasks requiring math skills, such as measuring medications, understanding nutrition labels, and interpreting blood sugar levels or other test results); (iii) communication (i.e., effectively communicating with healthcare providers, expressing needs, asking questions, and understanding responses); (iv) decision-making (i.e., evaluating options for treatment and prevention, understanding risks and benefits, and making informed decisions about health care); and (v) navigation (i.e., understanding how to access healthcare services, follow the healthcare system's administrative procedures, and utilize available resources) (Geets-Kesić, Maras, & Gilić, 2023). Today, it is generally accepted that HL is essential because it impacts individuals' ability to manage their health, navigate the healthcare system, prevent and manage disease, and adhere to treatment plans. Low health literacy can lead to poorer health outcomes, higher rates of hospitalization, less frequent use of preventive services, and overall higher healthcare costs. Improving health literacy can empower individuals to take control of their health, enhance the quality of care, and pro-

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mote better health outcomes (Francis-Oliviero et al., 2023).

The importance of HL is especially highlighted in adolescents since improving HL in this period of life can lead to healthier, more informed individuals who are better prepared to manage their health throughout their lives (Francis-Oliviero et al., 2023). Therefore, schools, healthcare providers, and community programs play a vital role in fostering HL among young people. Indeed, studies have shown that higher HL in adolescents is associated with better health-promoting behaviors, body mass index, oral health, osteoporosis prevention, self-efficacy, self-care, hair and skincare, breakfast consumption, and nutrition behaviors (Olyani & Peyman, 2021). However, there are gaps in the general understanding of HL in this age group, including the lack of prevalence data and developmental frameworks (Okan, Pinheiro, Zamora, & Bauer, 2015). Factors such as general knowledge, infectious disease knowledge, health ideas, and school performance have been identified as predictors of better health literacy in adolescents, while the role of media-based HL in preventing noncommunicable diseases in adolescents has also been highlighted (Hidayatullaili, Musthofa, & Margawati, 2023). One of the insufficiently described areas is the association between HL and physical literacy.

In most common terms, physical literacy (PL) is the ability to move with competence and confidence in a wide variety of physical activities in multiple environments that benefit the healthy development of the whole person (Geets-Kesić et al., 2023; Sunda et al., 2022). It involves a combination of physical, cognitive, and emotional components. Similar to HL, the PL also involves several aspects/subdomains, including (i) physical competence (i.e., developing fundamental movement skills and patterns such as running, jumping, throwing, catching, and balancing), (ii) confidence and motivation (i.e., having self-assurance and enthusiasm to participate in physical activities), (iii) knowledge and understanding (i.e., understanding the principles of movement and the health benefits of physical activity and knowledge about how the body moves, the importance of fitness, and how to engage in different physical activities safely and effectively), and (iv) engagement in physical activities (i.e., being regularly active in a variety of physical pursuits). In general, PL is considered important because it lays the foundation for a healthy, active lifestyle that contributes to overall physical, mental, and social well-being (Carl et al., 2023). Not surprisingly, HL and PL are considered to be interconnected concepts.

For example, while HL provides individuals with knowledge about the benefits of physical activity, the risks of sedentary behavior, and the importance of maintaining a healthy lifestyle, this knowledge can motivate individuals to develop and maintain PL. On the other hand, through regular participation in physical activities, PL reinforces the practical application of HL since engaging in physical activities can provide experiential learning opportunities that enhance the understanding of health concepts. Furthermore, individuals with high HL are more likely to make informed decisions regarding their physical activities, such as choosing appropriate exercises, understanding the significance of warm-ups and cool-downs, and recognizing the need for rest and recovery. On the other hand, PL fosters a positive attitude toward physical activity, encouraging individuals to integrate movement into their daily routines, which in turn promotes better health outcomes, which are often associated with greater HL (Kesic, Savicevic, Peric, Gilic, & Zenic, 2022).

According to the previous literature overview, it is clear that HL and PL are both important concepts in modern life, and especially in adolescence when life-long habits and behaviors are formed. Additionally, the relationships between HL and PL and between HL and physical literacy are synergistic. Therefore, it could be expected that HL and PL are intercorrelated, but there is an evident lack of studies that have specifically investigated the associations that may exist between HL and PL in adolescence. One of the rare investigations of such examined the correlations between HL and PL in older adolescents (medical school students) and reported a relatively poor correlation between HL and PL and theorized that the established level of correlation could be characteristic of the study sample (adolescents who were directly interested and specifically educated in health/medicine areas), indicating the necessity of further research in "nonselected" samples of participants (Kesic et al., 2022). Therefore, the aim of this study was to evaluate the associations between PL and HL in older adolescents. Since PL generally develops earlier in life than does HL, in this study, we used HL as a criterion variable and applied a gender-specific approach to study possible associations between PL and physical activity (predictors) and between PL and HL (criterion). We hypothesized that PL would be significantly associated with HL irrespective of gender.

Materials and methods

Participants and study design

The participants in this cross-sectional study were high school students from Split, Croatia (n=204; 100 females; all 16 to 19 years of age). All participants were in good health and regularly participated in physical education classes. Since the study involved analysis of physical activity levels (PAL), in this report, we did not include those participants who reported illness and/or injury that did not allow them to be regularly physically active during the last week (please see later on study variables, specifically analysis of PAL). Participants voluntarily participated in the investigation after being informed about the risks and benefits of the study and after their parents (or themselves if they were older than 18 years) signed informed consent for the study participation. The study was approved by the Ethical Board of the Faculty of Kinesiology (EBO: 2181-205-02-01-21-0011; date of approval, 23-10-2021). The study was performed in early 2024.

Variables and measurement

Apart from gender (male, female, none) and age (in years), the variables in this study included evaluation of the HL, PL, and PAL. All data were collected online through the Survey Monkey platform (SurveyMonkey Inc., San Mateo, CA) provided by the Faculty of Kinesiology, University of Split, Croatia during the physical education classes taught by first two authors of the paper.

The European Health Literacy Survey Questionnaire (HLS-EU-Q) was used to evaluate HL (Sorensen et al., 2012). The HLS-EU-Q comprises 47 questions indicating an individual's ability to access, understand, appraise, and apply health-related information. The general index of HL was constructed using a 4-point Likert scale, with responses ranging from very difficult – 1 to very easy – 4. The score was calculated using the following formula: index = (mean – 1) × (50/3). The HL scale (from 0 to 50) was used, where 0 represented the lowest score and 50 represented the highest score. Four levels of HL

were defined: inadequate (from 0 to 25), problematic (26–33), sufficient (34–42), and excellent (43–50). The Croatian version of the HLS-EU-Q was checked for reliability and validity, and the results are presented elsewhere (Kesic et al., 2022).

To evaluate the PL, we applied two widely used questionnaires, namely, (i) the second/shorter version of the Canadian Assessment of Physical Literacy (CAPL-2) and (ii) the Physical Literacy Assessment of Youth (PLAYself). Croatian versions of both tools were studied for reliability and validity in this age group, and the results are presented previously (Sunda et al., 2022). The CAPL-2 knowledge and understanding questionnaire included 12 questions aimed at evaluating the participants' knowledge of the necessity and importance of daily PA, the problem of sedentarism, the importance and definition of cardiorespiratory fitness and muscular strength, the concept of fitness and its impact on a physically active lifestyle, ways of improving one's motor skills, and the components of overall fitness. Each correct answer was assigned 1 point, while each incorrect answer received a score of 0, resulting in a total score ranging from 0 to 12. The PLAYself questionnaire establishes the perceived level of PL and includes four subsections: (i) environment, assessing the degree of movement confidence in different environments (i.e., gym, water, snow); (ii) affective and cognitive aspects related to PL that determine individuals' self-efficacy with respect to their participation in PA; (iii) relative ranking of literacy, numeracy, and physical literacy in different settings, including school, home, and social life with friends, examining how much an individual values each literacy type; and (iv) fitness. The final score consists of the subtotals from the first three subsections divided by the number of questions (27 in total). The maximum PLAYself score is 100, representing a high self-perceived PL.

The Physical Activity Questionnaire for Adolescents (PAQ-A) was used for analysis of the PAL. This questionnaire consists of nine items asking participants to complete a seven-day recall. The theoretical score ranged from 0 (minimal) to 5 (maximal physical activity level). The first 8 items were scored on a 5-point scale and included questions on different types of physical activity (i.e., activity during sports, physical education, active transportation, and free play); the ninth item did not contribute to the overall score, and it was only used for the selection of participants whose results should not be observed as reliable and valid (e.g., evidencing participants who suffered a sort of injury/illness and whose physical activity was therefore reduced).

Statistics

Data were checked for normality of the distributions by the Kolmogorov–Smirnov test, and descriptive statistics included calculations of the frequencies (for gender), and means and standard deviations (for remaining variables).

Differences between boys and girls in study variables were established by t-tests for independent samples, which consequently allowed us to identify possible associations between gender and study variables (note that two participants defined gender as "none", which did not allow us to calculate statistics for this subsample). To determine the associations between PL, PAL and HL, Pearson's correlations were calculated. Next, multiple regression calculations were applied to evaluate possible multivariate associations between measures of PL and PAL (observed as predictors) and HL (observed as criterion).

Statistica ver. 14.0 (Tibco Inc., Palo Alto, CA) was used for all calculations, and a p value of 0.05 was applied.

Results

Differences in the study variables between boys and girls are presented in Figure 1. In brief, boys achieved greater PAL than girls did (2.79±0.73 vs. 2.18±0.65; t test =6.76, p<0.001) (Figure 1A). Further, total PL scores of boys and girls did not differ according to the PLAYself (65.11±13.21 and 63.7±11.23 for boys and girls, respectively; t test =1.02, p=0.30) (Figure 1B) or CAPL-2 (7.91± 2.12 and 8.11±1.93 for boys and girls, respectively; t test =1.60, p=0.10) (Figure 1C). Finally, no significant difference was found in HL as obtained by HLS-EU-Q (31.62±9.29 and 33.52±7.44 for boys and girls, respectively; t test =1.66, p=0.10) (Figure 1D). However, with the average HLS-EU-Q score of 32.11±6.72 HL level of the studied adolescents is "problematic".

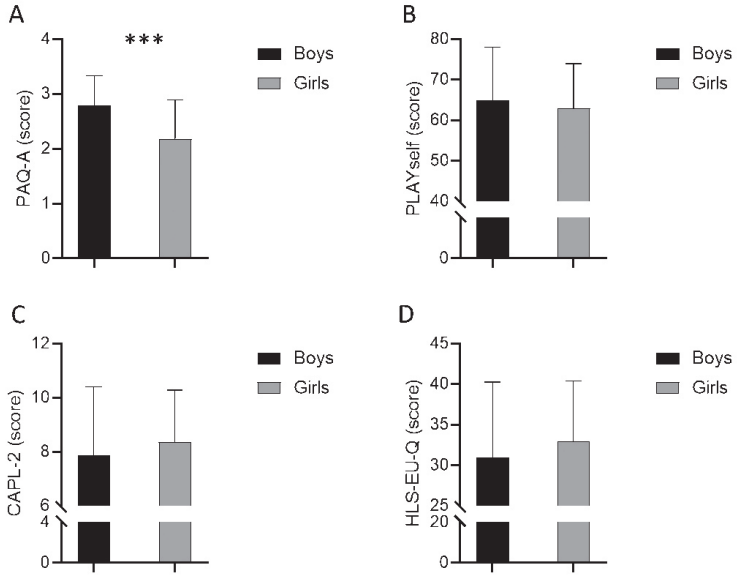

FIGURE 1. Descriptive statistics (results are presented as Means ± Standard Deviations), and t-test differences between genders in PAQ-A (Figure 1A), PLAYself (Figure 1B), CAPL-2 (Figure 1C), and HLS-EU-Q (Figure 1D), *** indicates t-test significance of p < 0.001.

Table 1 presents univariate correlations between study variables for the total sample and stratified by gender. The PLAYself score was positively correlated with the PAL obtained by the PAQ-A (Pearson's R=0.48, p<0.001) and the HL score (Pearson's R=0.19, p<0.01). When gender was stratified, no significant correlation between HL and PL measures was detected among boys, while PLAYself was significantly correlated with HL among girls (Pearson's R=0.40, p<0.001). PLAYself scores were significantly correlated with PAL in boys (Pearson's R=0.52, p<0.001) and in girls (Pearson's R=0.45, p<0.001).

Table 1. Pearson's correlation coefficients between study variables

	Total (n = 204)			Boys (n = 104)			Girls (n = 100)		
	PLAYself	**CAPL-2**	**PAQ-A**	**PLAYself**	**CAPL-2**	**PAQ-A**	**PLAYself**	**CAPL-2**	**PAQ-A**
PLAYself	-			-			-		
CAPL-2	-0.02	-		0.01	-		-0.05	-	
PAQ-A	0.48***	-0.04	-	0.52***	0.09	-	0.45***	-0.10	-
HLS-EU-Q	0.19**	0.06	0.08	0.07	0.11	0.10	0.40***	-0.06	0.22**

Legend: PAQ-A – Physical Activity Questionnaire for Adolescents, PLAYself - Physical Literacy Assessment of Youth, CAPL-2 - Canadian Assessment of Physical Literacy, HLS-EU-Q - European Health Literacy Survey Questionnaire, *** p < 0.001, ** p < 0.01

Multiple regression calculations between PAL and PL scores observed as predictors and the HL criterion are presented in Table 2. In the total sample, predictors explained 5% of the criterion variance (p<0.05), and the PLAYself score was identified as the only significant predictor (Beta =0.21, p<0.01). When multiple regression was calculated for boys, no significant association was found between predictors and criterion (<2% of the explained variance). In girls, predictors explained 17% of the common variance (p<0.001), with PLAYself being a significant partial regressor of HL (Beta =0.38, p<0.001).

Table 2. Multiple regression results for criterion - health literacy (obtained by HLS-EU-Q

	Total			Boys			Girls		
	Beta	**b**	**p**	**Beta**	**b**	**p**	**Beta**	**b**	**p**
Intercept		21.90	0.001		24.63	0.00		17.42	0.001
PLAYSELF	0.21	0.14	0.01	0.04	0.03	0.74	0.38	0.26	0.001
CAPL-2	0.06	0.23	0.37	0.10	0.36	0.32	-0.04	-0.16	0.65
PAQ-A	-0.02	-0.23	0.81	0.06	0.85	0.59	0.04	0.54	0.70
R	0.21			0.14			0.40		
Rsq	0.04			0.01			0.16		
p	0.03			0.58			0.001		

Legend: PAQ-A – Physical Activity Questionnaire for Adolescents, PLAYself - Physical Literacy Assessment of Youth, CAPL-2 - Canadian Assessment of Physical Literacy, HLS-EU-Q - European Health Literacy Survey Questionnaire, R – coefficient of multiple correlation, Rsq – coefficient of determination, p – level of significance

Discussion

This study aimed to investigate the possible relationships of PL with HL in high school adolescents. With regard to the study aim, we may highlight several important findings. First, boys and girls did not differ in HL or total PL score, but boys had greater PAL than girls. Second, we found no significant correlation between PL (and PAL) and HL in boys, while PL was significantly associated with HL in girls. Therefore, our initial study hypothesis may be partially accepted.

No significant difference in health literacy between boys and girls

Studies have investigated gender differences in HL, and our findings of nonsignificant differences between boys and girls are not in accordance with the majority of previous studies in which authors mostly noted higher HL in girls. In brief, studies have shown that girls generally have higher HL levels, particularly in areas such as numeracy, use, communication, and self-efficacy (Karimi et al., 2019). Additionally, girls are more likely to seek health information from school, parents, and medical personnel (Brown, Teufel, & Birch, 2007).

However, girls also report more smoking and less exercise (Cohen, Brownell, & Felix, 1990), which consequently could decrease the total HL score (note that in this study, we observed total HL as the final score). These differences may be influenced by factors such as age, with junior high school being a critical period for the development of health habits (Cohen et al., 1990). Additionally, in previous studies, the authors reported that social disparities, including income and education, contribute to differences in health literacy (Fleary & Ettienne, 2019). However, in our study, such differences between genders are not expected due to the similar socioeconomic statuses of boys and girls.

In explaining the lack of significant differences in HL between boys and girls, we can highlight several factors, both inherent and environmental. The first factor that should be highlighted is the fact that all the students we assessed had equal access to education. Therefore, irrespective of their gender and possible interests, boys and girls received the same school health-related programs. It means that both genders were exposed to the same information, skills, and resources related to health. The second factor is parental influence. It is regularly confirmed that parental health literacy and behavior signifi-

cantly influence children's understanding of health (de Buhr & Tannen, 2020). From their own experience, authors can witness that parents equally share their health knowledge and practices with their children, regardless of gender, and parents typically model health behaviors without gender bias, which develop similar levels of health literacy for both boys and girls.

Third, public health campaigns and initiatives in Croatia are generally designed to be inclusive, targeting broad audiences without gender discrimination (Geets-Kesić et al., 2023; Kesic et al., 2022). Additionally, many general- and community-based health programs and resources are equally accessible to both boys and girls. Also, the widespread availability of health information through digital media, including websites, social media, and online forums, offers equal access to health information for both genders. This democratization of information helps level the playing field in all areas, including the terms of HL.

In addition to the previously explained similar opportunities, it must be highlighted that boys and girls of adolescent age follow the same cognitive development (Choudhury, Blakemore, & Charman, 2006). It logically includes the ability to understand and process all information (including health information), which follows a similar trajectory for boys and girls. Both genders develop critical thinking and comprehension skills at comparable rates, contributing to similar levels of health literacy. However, while individual learning styles may vary, there is no clear evidence to suggest that boys and girls differ significantly in their ability to learn health-related information. In other words, it is clear that educational strategies designed to cater to diverse learning styles benefit all students, irrespective of gender.

Lack of correlation between physical literacy and health literacy in boys

As said previously, studies rarely examined the associations between PL and HL in high school adolescents. On the basis of some previous studies in which similar associations were examined (i.e., associations between PL and PAL), we decided to examine this association using the gender stratified approach. (Sunda et al., 2022). Evidently, this was the right decision due to the evident gender-specific correlation. In brief, the correlations between PL and HL did not reach statistical significance among boys, while the correlations were significant among girls of the same age. Several reasons could explain such findings.

The first factor that could contribute to gender-specific associations is related to personal interest and motivation toward physical activities (i.e., sports). More precisely, adolescent boys are generally more inclined toward physical activities, such as sports and games, than girls. These activities develop PL but do not necessarily involve learning about health topics such as nutrition, disease prevention, and personal health management. Therefore, the PL of boys increases as a result of sport participation, but it is not followed by HL. Indeed, studies in Croatia and the region regularly confirmed greater participation of adolescent boys in sports, which directly supports previous considerations (Gilic, Zenic, Separovic, Jurcev Savicevic, & Sekulic, 2021).

The lack of correlation between PL and HL in boys is aggravated by the fact that some adolescent boys may perceive health information as less relevant or interesting compared to physical activities. This perception can lead to lower engagement with health education and a weaker development of HL (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005). Additionally, the authors can see that schools and communities often offer a wide range of extracurricular activities that focus on sports and physical fitness but fewer opportunities that specifically address HL. By all means, HL programs do not receive the same level of attention or resources as physical activities and sports, and this imbalance almost certainly results in higher PL and increased PAL without a corresponding increase in HL.

Boys might be more focused on immediate, tangible activities such as sports rather than abstract concepts related to HL (Choudhury et al., 2006). Adolescence is a critical period for identity formation, and many boys might develop identities centered around physical competence and athleticism. This identity formation process might not prioritize health knowledge and literacy. This is additionally supported by social and cultural influences. Media portrayals and role models for boys often emphasize physical prowess and athletic success rather than health knowledge. This cultural emphasis can lead to a stronger development of physical skills without a corresponding focus on HL. Altogether, this can result in a discrepancy between boys' PL and HL.

Finally, health education is generally taught through theoretical subjects, while physical education is thought to be a mostly practical subject, with abilities and skills being the most important and relevant topics (Forte, Pugliese, Ambretti, & D'Anna, 2023). Despite recent efforts to equalize course topics, health education emphasizes knowledge about nutrition, disease prevention, and general health practices, while physical education focuses on developing physical skills and promoting physical activity (Hrg, Lončar, Zelanto, Novak, & Podnar, 2023). There is no doubt that such separation results in developing skills and knowledge in one area without a corresponding increase in the other.

Positive correlation between physical- and health-literacy in girls

Apart from previously described factors that can contribute to the lack of correlation between HL and PL in boys, some additional explanations can be offered to explain the positive correlation between HL and PL in girls. First, and probably the most important explanation can be found in the fact that adolescent girls who have a high level of HL are more likely to understand the importance of physical activity for their overall health (Rutkauskaitė & Kuusinen, 2019). This understanding can translate into increased participation in physical activities, enhancing individuals' PL. While this is a general consideration, its background also deserves attention.

As discussed previously, boys are more interested in sports because of play and fun, which consequently increases their PL with little or no influence on HL. Meanwhile, girls' motives for being physically active are different, and those girls who are educated about how physical activity can improve their health and well-being are more likely to be interested in being physical active (Litt, Iannotti, & Wang, 2011). Additionally, girls are generally more interested in psychological well-being and therefore are better informed about the mental health benefits of physical activity, such as stress relief and improved mood. Therefore, a substantial number of girls are physically active while seeking the psychological benefits of such practices (Litt et al., 2011).

Finally, we cannot neglect certain biological factors that

could contribute to the correlation between PL and HL in girls. Namely, physical development during adolescence can affect interest in and participation in physical activities. More specifically, girls may experience changes in their bodies that affect their comfort and interest in certain types of activities. Logically, they will be more oriented toward activities that are more efficient in modifying body composition, which is logically followed by their interest in some topics directly connected to HL (i.e., nutrition, metabolism) (Niven, Fawkner, Knowles, Henretty, & Stephenson, 2009). Therefore, it is no surprise that this will be directly translated to a simultaneous increase in PL and HL in girls. Taken together, these factors probably contributed to finding that HL and PL are positively correlated in girls.

Limitations and strengths of the study

The first limitation of the study is its cross-sectional design, which did not allow clear interpretation of the causality between the study variables. However, it is generally known that PL develops beginning in early childhood, even nonformally, which allows us to make some contextual interpretations of these relationships. Future studies should explore this problem through prospective or intervention approaches to evaluate cause–effect relationships more specifically. Additionally, this study included adolescents from one urban center. Therefore, the generalizability of the findings is limited to similar samples of participants.

The main strength of the study is the use of a gender-specific approach, which allowed us to identify the context of the studied associations more clearly. Additionally, the fact that the authors were able to observe the problem from a real-world professional perspective (note that first two authors are teachers in schools where the sample was drawn from, and therefore are were well informed about the situation and context of the research), is a significant strength of the study.

Conclusion

The lack of significant differences in HL between boys and girls can be attributed to equal access to health education, similar parental influences, inclusive public health campaigns, and widespread digital information. This equality suggests that HL initiatives and educational programs are equally effective in reaching both genders, promoting a uniform level of HL among studied adolescents from Croatia.

The positive correlation between HL and PL in girls and the lack of a significant correlation in boys can be attributed to several factors, with basic motives for physical activity (and sports) likely being the most important. Namely, boys participate in physical activity because of fun, play and competition, which logically increases their PL but not their HL. On the other hand, the health benefits of physical activity are more important motives for being active among girls, which simultaneously increases their PL and HL.

Both PL and HL are important concepts and should be developed, especially during adolescence. Therefore, specific efforts are needed to design specific educational programs aimed at the development of PL and HL in adolescents. However, our results suggest that in developing and implementing educational strategies aimed at improving PL and consequently HL in this age group, a gender-specific approach should be applied.

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Conflict of interest:
The authors declare that there are no conflicts of interest.

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References

Brown, S. L., Teufel, J. A., & Birch, D. A. (2007). Early adolescents perceptions of health and health literacy. *Journal of School Health, 77*(1), 7-15. https://doi.org/10.1111/j.1746-1561.2007.00156.x

Carl, J., Bryant, A. S., Edwards, L. C., Bartle, G., Birch, J. E., Christodoulides, E., . . . & Elsborg, P. (2023). Physical literacy in Europe: The current state of implementation in research, practice, and policy. *Journal of Exercise Science & Fitness, 21*(1), 165-176. https://doi:10.1016/j.jesf.2022.12.003

Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience, 1*(3), 165. https://doi.org/10.1093/scan/nsl024

Cohen, R. Y., Brownell, K. D., & Felix, M. R. (1990). Age and sex differences in health habits and beliefs of schoolchildren. *Health Psychology, 9*(2), 208. https://doi.org/10.1037//0278-6133.9.2.208

de Buhr, E., & Tannen, A. (2020). Parental health literacy and health knowledge, behaviors and outcomes in children: a cross-sectional survey. *BMC Public Health, 20*, 1-9. https://doi.org/10.1186/s12889-020-08881-5

Fleary, S. A., & Ettienne, R. (2019). Social disparities in health literacy in the United States. *HLRP: Health Literacy Research and Practice, 3*(1), e47-e52. https://doi.org/10.3928%2F24748307-20190131-01

Forte, P., Pugliese, E., Ambretti, A., & D'Anna, C. (2023). Physical Education and Embodied Learning: A Review. *Sport Mont, 21*(3). https://doi.org/10.26773/smj.231020

Francis-Oliviero, F., Loubieres, C., Grove, C., Marinucci, A., Shankland, R., Salamon, R., . . . & Montagni, I. (2023). Improving Children's Mental Health Literacy Through the Cocreation of an Intervention and Scale Validation: Protocol for the CHILD-Mental Health Literacy Research Study. *JMIR Research Protocols, 12*, e51096. https://doi:10.2196/51096

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., Zenic, N., Separovic, V., Jurcev Savicevic, A., & Sekulic, D. (2021). Evidencing the influence of prepandemic sports participation and substance misuse on physical activity during the COVID-19 lockdown: a prospective analysis among older adolescents. *International Journal of Occupational Medicine and Environmental Health, 34*(2), 151-163. https://doi:10.13075/ijomeh.1896.01733

Gray, N. J., Klein, J. D., Noyce, P. R., Sesselberg, T. S., & Cantrill, J. A. (2005). Health information-seeking behavior in adolescence: the place of the internet. *Social Science & Medicine, 60*(7), 1467-1478. https://doi.org/10.1016/j.socscimed.2004.08.010

Hidayatullaili, N. A., Musthofa, S. B., & Margawati, A. (2023). Media Health Literacy on Prevention of Noncommunicable Diseases in Adolescents (Systematic Review). *Jurnal Promkes: The Indonesian Journal of Health Promotion and Health Education, 11*(2), 229-236. http://dx.doi.org/10.20473/jpk.V11.I2.2023.229-236

Hrg, K., Lončar, P., Zelanto, W. H., Novak, D., & Podnar, H. (2023). Attainment of the Health Outcomes by Implementing Educational Videos During the Final Part of the Physical Education Lesson. *Montenegrin Journal of Sports Science & Medicine, 12*(2). https://doi.org/10.26773/mjssm.230902

Karimi, N., Saadat-Gharin, S., Tol, A., Sadeghi, R., Yaseri, M., & Mohebbi, B. (2019). A problem-based learning health literacy intervention program on improving health-promoting behaviors among girl students. *Journal of Education and Health Promotion, 8*(1), 251. http://dx.doi.org/10.4103/jehp.jehp_476_19

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

Litt, D. M., Iannotti, R. J., & Wang, J. (2011). Motivations for adolescent physical activity. *Journal of Physical Activity and Health, 8*(2), 220-226. https://doi.org/10.1123/jpah.8.2.220

Niven, A., Fawkner, S., Knowles, A.-M., Henretty, J., & Stephenson, C. (2009). Social physique anxiety and physical activity in early adolescent girls: The

influence of maturation and physical activity motives. *Journal of Sports Sciences, 27*(3), 299-305. https://doi.org/10.1080/02640410802578164

Okan, O., Pinheiro, P., Zamora, P., & Bauer, U. (2015). Health literacy in childhood and adolescence: An overview and current state of research. *Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz, 58*, 930-941. https://doi.org/10.1007/s00103-015-2199-1

Olyani, S., & Peyman, N. (2021). Health literacy and health outcomes in Iranian adolescents: A systematic review. *Journal of Health Literacy, 6*(3), 78-85. https://doi.org/10.22038/jhl.2021.56218.1155

Rutkauskaitė, R., & Kuusinen, K. (2019). Links between adolescents' health literacy and their physical activity and body mass index. *Baltic Journal of Sport and Health Sciences, 3*(114). https://doi.org/10.33607/bjshs.v3i114.805

Schulenkorf, T., Krah, V., Dadaczynski, K., & Okan, O. (2021). Addressing Health Literacy in Schools in Germany: Concept Analysis of the Mandatory Digital and Media Literacy School Curriculum. *Front Public Health, 9*, 687389. https://doi:10.3389/fpubh.2021.687389

Sorensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., . . . & Consortium Health Literacy Project, E. (2012). Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health, 12*, 80. https://doi:10.1186/1471-2458-12-80

Sunda, M., Gilic, B., Sekulic, D., Matic, R., Drid, P., Alexe, D. I., . . . & Lupu, G. S. (2022). Out-of-School Sports Participation Is Positively Associated with Physical Literacy, but What about Physical Education? A Cross-Sectional Gender-Stratified Analysis during the COVID-19 Pandemic among High-School Adolescents. *Children (Basel), 9*(5). https://doi:10.3390/children905075