

Physical Literacy Levels in the Croatian Adult Population; Gender Differences and Associations with Participation in Organized Physical Activity

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SVEUČILIŠTE U SPLITU
KINEZIOLOŠKI FAKULTET
SVEUČILIŠNI DIPLOMSKI STUDIJ KINEZIOLOGIJE

BRUNO MAJIĆ

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**Physical Literacy Levels in the Croatian Adult
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ZNANSTVENI RAD/DIPLOMSKI RAD

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SAŽETAK

Većina prijašnjih istraživanja bila je usmjerena na ispitivanje tjelesne pismenosti (TP) u mlađim skupinama, dok je takvih istraživanja malo u odrasloj populaciji. No, ova je populacija jednako važna jer TP oblikuje cjeloživotne navike sudjelovanja u tjelesnoj aktivnosti. Ovo istraživanje imalo je za cilj utvrditi razine TP kod odrasle hrvatske populacije. Također, cilj je bio istražiti imaju li osobe koje se duže bave organiziranim sportom višu razinu TP te razlikuju li se muškarci i žene u razini TP. Uzorak se sastojao od 561 osobe (321 žena, 240 muškaraca) u dobi od $27,65 \pm 12,13$ godina. Razine TP procijenjene su hrvatskom verzijom Upitnika percipirane tjelesne aktivnosti (PPLQ-Cro). Demografske karakteristike uključivale su dob, spol i godine bavljenja organiziranom tjelesnom aktivnošću. Spolne razlike izračunate su pomoću Mann-Whitney U testa i veličine učinaka. Spearmanovi korelacijski koeficijenti korišteni su za određivanje povezanosti između varijabli studije. Muškarci su imali značajno više razine TP u odnosu na žene ($83,10 \pm 16,17$ za muškarce i $74,27 \pm 20,07$ za žene, $Z = -6,88$, $p = 0,001$). Godine organizirane tjelesne aktivnosti povezane su s razinama TP ($R = 0,40$, $p = 0,001$). Nalaz da su godine organizirane tjelesne aktivnosti povezane s ukupnom TP podupire teoriju da je TP kamen temeljac za sudjelovanje u cjeloživotnoj tjelesnoj aktivnosti. Rezultati ovog istraživanja naglašavaju važnost uvođenja koncepta PL u brojne institucije i organizacije povezane s organiziranom tjelesnom aktivnošću.

KLJUČNE RIJEČI: Fizička aktivnost, zdravo ponašanje, medicina životnog stila, psihofizičko zdravlje, starije osobe

ABSTRACT

Physical literacy (PL) is the foundation for lifelong participation in physical activity. Most previous research concentrated on PL examinations in younger groups, while such research is

scarce in the adult population. This study aimed to determine the PL levels of the Croatian adult population. Also, the aim was to investigate whether individuals with longer participation in organized physical activity have higher PL levels and do males and females differ in PL levels. The sample comprised 561 individuals (321 females, 240 males) aged 27.65 ± 12.13 years. PL levels were assessed by the Croatian version of the Perceived Physical Activity Questionnaire (PPLQ-Cro). Demographic characteristics included age, gender, and years of involvement in organized physical activity. Gender differences were calculated using the Mann-Whitney U test and effect sizes. Spearman correlation coefficients were used to determine associations between study variables. Males had significantly higher PL levels compared to females (83.10 ± 16.17 for males and 74.27 ± 20.07 for females, $Z = -6.88$, $p = 0.001$). Years of organized physical activity were associated with PL levels ($R = 0.48$, $p = 0.001$) in the total sample as well in males ($R = 0.55$, p

Keywords: physical exercise, health behaviors, lifestyle medicine, well-being, older individuals

ORIGINAL SCIENTIFIC PAPER

Physical Literacy Levels in the Croatian Adult Population; Gender Differences and Associations with Participation in Organized Physical Activity

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Abstract

Physical literacy (PL) is the foundation for lifelong participation in physical activity. Most previous research concentrated on PL examinations in younger groups, while such research is scarce in the adult population. This study aimed to determine the PL levels of the Croatian adult population. Also, the aim was to investigate whether individuals with longer participation in organized physical activity have higher PL levels and do males and females differ in PL levels. The sample comprised 561 individuals (321 females, 240 males) aged 27.65 ± 12.13 years. PL levels were assessed by the Croatian version of the Perceived Physical Activity Questionnaire (PPLQ-Cro). Demographic characteristics included age, gender, and years of involvement in organized physical activity. Gender differences were calculated using the Mann-Whitney U test and effect sizes. Spearman correlation coefficients were used to determine associations between study variables. Males had significantly higher PL levels compared to females (83.10 ± 16.17 for males and 74.27 ± 20.07 for females, $Z = -6.88$, $p = 0.001$). Years of organized physical activity were associated with PL levels ($R = 0.48$, $p = 0.001$) in the total sample as well in males ($R = 0.55$, $p < 0.001$) and females ($R = 0.24$, $p < 0.01$) separately. The finding that years of organized physical activity are associated with total PL supports the theory that PL is the cornerstone for participating in lifetime physical activity. The results of this study emphasize the importance of introducing the concept of PL in numerous institutions and organizations connected with organized physical activity.

Keywords: *physical exercise, health behaviors, lifestyle medicine, well-being, older individuals*

Introduction

Physical activity (PA), defined as any motion generated by skeletal muscles resulting in the expenditure of energy, plays a pivotal role in promoting overall health and well-being (Caspersen et al., 1985; Peralta et al., 2021). The benefits of embracing a physically active lifestyle extend beyond individual well-being to encompass broader public health objectives, including weight management, the prevention of chronic diseases such as cardiovascular disease, type II diabetes, and cancer, as well as the enhancement of bone and muscle strength. Indeed, a broad review study reported that PA is the most effective prevention strategy for more than 25 chronic medical illnesses, with a 20-

30% risk reduction range (Rhodes, Janssen, Bredin, Warburton, & Bauman, 2017). However, there is a global problem of low PA levels in children and adolescents, and this problem tracks into adulthood (Telama et al., 2014; Vukelja, Milanovic, & Salaj, 2022).

According to the World Health Organization, adults should strive to engage in 150–300 minutes of moderate-intensity exercise, 75–150 minutes of vigorous-intensity PA, or a combination of both each week to optimize their physical health (DiPietro et al., 2020). However, despite these recommendations, a significant proportion of the global adult population fails to meet these guidelines. In 2016, 28% of adults aged 18 and older worldwide



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did not meet the recommended activity threshold, with 23% of men and 32% of women being inactive, which stands for more than 1.4 billion adults not being sufficiently active (Guthold et al., 2018). Therefore, as the problem of increased inactivity still has a rising trend, researchers have been investigating the concepts and determinants of this issue. The concept which emerged as very important for maintaining an optimal PA through life is called physical literacy (PL).

PL is most commonly defined as “the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for participation in lifelong physical activity” (Edwards et al., 2017). Individuals with greater PL are anticipated to achieve health benefits more readily and sustain PA throughout their lives (Whitehead, 2013). The International Physical Literacy Association (IPLA) outlines PL as comprising various elements including fitness level, daily habits, motivation, confidence, and knowledge (Shearer et al., 2018). These components collectively form a comprehensive framework that fosters lifelong engagement and enjoyment in PA (Longmuir & Tremblay, 2016). PL can be seen as a factor influencing health through a series of interconnected pathways: heightened PL fosters increased engagement in PA, which in turn prompts beneficial physiological, social, and psychosocial adjustments, ultimately leading to enhancements in physical, mental, and social well-being. This pathway is expected to persist and evolve throughout the lifespan, from early childhood to old age (Cairney, Clark, Dudley, & Kriellars, 2019).

The importance of organized PA on the PL level has been repeatedly reported in previous studies. Namely, a study on Croatian adolescents reported that individuals involved in out-of-school sports had better PL compared with those not involved in sports (Sunda et al., 2022). Also, this was indirectly shown in a study where children and adolescents who participated in sports had a greater likelihood of participating in sports as adults (Perkins, Jacobs, Barber, & Eccles, 2004). Moreover, as the importance of enabling a greater number of people to participate in sports and improve their PL, the Physical Activity and Sport Participation framework has been developed for stakeholders to follow for creating a policy model toward being physically active across the lifespan (Westerbeek & Eime, 2021). However, studies directly investigating the relationship between organized PA and PL are generally lacking.

Most studies examining the relationship between PL and PA have been conducted on younger individuals, while research on the adult population is lacking. However, this population is equally important because PL shapes lifelong habits and activities (Whitehead, 2013). Also, developing PL in adulthood is extremely important as lifelong participation in PA leads to lower risks of chronic illness and decreased odds of falls. Even though they are scarce, there are several studies which investigated PL in the adult population (Boldovskaia et al., 2023; Ryom et al., 2022). A study which gathered information regarding self-reported assessment of PL concluded that the existing instruments cover only affective and physical domains of PL, while there is no holistic assessment of PL (Ryom et al., 2022). Nevertheless, a recent study on the German and Austrian populations constructed the holistic PL questionnaire which covered all PL domains, which makes this instrument currently the best choice for assessing PL of adults (Holler, Carl, Poppel, & Jaunig, 2023).

Previous studies reported that there are gender differences in PA participation, with boys being more active than girls, which

could imply that males will have higher PL levels compared to females (Brown et al., 2020; Saffer et al., 2013). Therefore, as previous research noted the gender differences in both PA participation and PL levels, the aim of this study was to establish gender differences in the PL levels and associations with participation in organized PA. We hypothesized that males will have higher PA participation and higher PL levels compared to females. The results from this research would have practical implication for implementing public health recommendations and guidelines connected with PA participation.

Materials and methods

Participants

This research included 561 adult individuals (321 females, 240 males) from Croatia aged 27.65 ± 12.13 years. The study's inclusion criteria were: (a) Croatian citizenship, (b) age 18 or older, (c) ability to comprehend and speak Croatian, and (d) granting informed consent to participate. Exclusion criteria included: (a) having a medical or psychological condition that might impair one's ability to understand and answer survey questions, and (b) having previously taken the survey. The procedures were conducted according to the Declaration of Helsinki and were approved by the Ethical Board of the University of Split, Faculty of Kinesiology (ref.no 2181-205-02-05-23-029, Approved 6/12/2023).

Variables and procedures

The research included demographic information (age, gender), participation in organized physical activity and PL levels evaluated by the translated version of the Perceived Physical Literacy Questionnaire for adults (PPLQ-Cro).

The PPLQ has recently been developed and was used for holistically assessing PL levels (Holler et al., 2023). This study used the PPLQ-Cro version which has previously been translated into the Croatian language, culturally adapted and checked for psychometric properties (study in the publishing process). The Perceived Physical Literacy Questionnaire (PPLQ) assesses perceived PL levels and its six domains in the general adult population following the IPLA definition of PL (Shearer et al., 2018). Originally conducted in German and in Austria, it's also available in English (Holler et al., 2023). It's grounded in established PL theories, with 24 items organized into six domains: Physical competence, Understanding, Motivation, Confidence, Knowledge, and Physical activity behavior. Responses for the first four domains use a 6-point Likert scale (5 to 0), while Knowledge uses closed response categories and Physical activity behavior uses open response categories. Precisely, PA behavior is assessed using the International Physical Activity Questionnaire Short Form (IPAQ-SF). Also, Metabolic equivalents of task (METs) representing the ratio of the rate of energy expended during PA to the rate of energy expended at rest were calculated from the IPAQ-SF to provide detailed insight into PA levels. Precisely METs in the moderate-to-vigorous intensity PA were calculated. The PA behavior domain score is based on a theory-driven nonlinear saturation function, with 300 minutes of MVPA per week equating to a score of 100. Domain scores range from 0 to 100, with higher values indicating stronger competency. The total PL score is a composite of the six domain scores, each weighted at 16.67%. The composite score ranges from 0 to 100, with higher scores indicating higher PL levels. The questionnaire demonstrates sufficient internal consistency for all domains ($0.70 \leq \omega \leq 0.90$) and acceptable model fit. The

answers to the questionnaire were collected using the online platform SurveyMonkey which was sent through social media to all interested participants.

Statistical analysis

The normality of the distribution was checked by the Kolmogorov-Smirnov test for normality, which allowed to choose the parametric or non-parametric tests in further statistical calculations. Due to highly skewed data, variables were log-transformed to decrease the non-uniformity of error. Analysis were conducted on log-transformed data but the results in the figures and tables are presented as actual, non-log-transformed values.

Mann-Whitney-U test was used to determine the differences between males and females in study variables. Additionally, effect sizes (ES) were calculated to further check for gender differences, and they were interpreted as: <0.2 = very small; 0.21–0.49 = small; 0.50–0.79= moderate; ≥0.8 = large; ≥1.2 = very large (Cohen, 2013). The correlations between the study variables

were evaluated by Spearman Rank Order correlation coefficients, gender-stratified. Additionally, values of correlation coefficients were presented into magnitude-based descriptors as follows: very low correlation (0.00–0.20), low correlation (0.21–0.40), moderate correlation (0.41–0.60), high correlation (0.61–0.80), and very high correlation (0.81–1.00) (Schober, Boer, and Schwarte, 2018). Statistical analyses were conducted using Statistica ver.13 (Tibco, Palo Alto, California) with a p-value of 0.05.

Results

According to IPAQ-SF activity classification, 76.44% of participants were categorized as highly active 18.2% as moderately active, and 5.36 % with low activity. Moreover, males accumulated a mean of 4258.61 METmin/week, while females accumulated 3085.23 METmin/week ($Z=-5.50, p<0.001$).

Descriptive statistics (means and standard deviations) and differences between males and females in the study's variables are presented in Figure 1. The most significant differences between

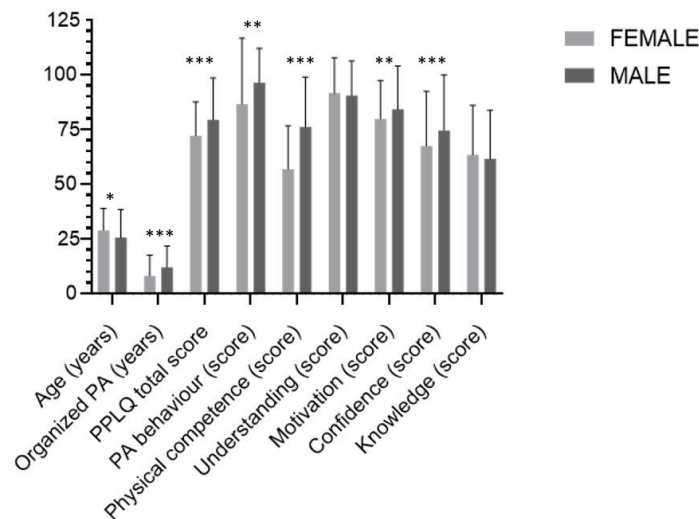


FIGURE 1. Gender differences in physical literacy scores and organized physical activity. Note * denotes $p<0.05$; ** denotes $p<0.01$, ***, PPLQ – Perceived Physical Literacy Questionnaire, PA- Physical activity.

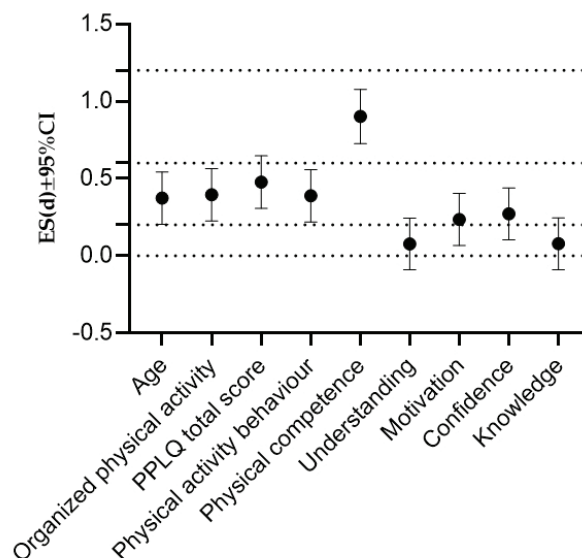


FIGURE 2. Gender differences in physical literacy and physical activity are expressed through effect sizes and confidence intervals. Note PA – physical activity.

males and females were noted in years of organized PA, PPLQ total score, physical competence, and confidence, with males having higher scores than females.

Gender differences expressed through effect sizes are shown in Figure 2. Small differences (ES) were noted for age, years of organized physical activity, physical literacy total score, physical activity behavior, motivation and confidence, while physical competence had moderate ES.

The gender-stratified correlation coefficients and magnitude of correlations are presented in Figure 3. In the total sample, years of organized PA were correlated to PL total score ($p < 0.001$), Physical activity behaviour ($p < 0.001$), physical

competence ($p < 0.001$), Understanding ($p < 0.001$), Motivation ($p < 0.001$), Confidence ($p < 0.001$), Knowledge ($p < 0.01$), and Moderate-to-vigorous PA ($p < 0.001$). Among males, years of organized PA were correlated to PL total score ($p < 0.001$), Physical activity behaviour ($p < 0.001$), physical competence ($p < 0.01$), Understanding ($p < 0.01$), Motivation ($p < 0.05$), Confidence ($p < 0.001$), Knowledge ($p < 0.01$), and Moderate-to-vigorous PA ($p < 0.001$). Moreover, in females, years in organized PA were correlated to PL total score ($p < 0.001$), Physical activity behaviour ($p < 0.001$), physical competence ($p < 0.001$), Understanding ($p < 0.001$), Motivation ($p < 0.01$), and Moderate-to-vigorous PA ($p < 0.01$).

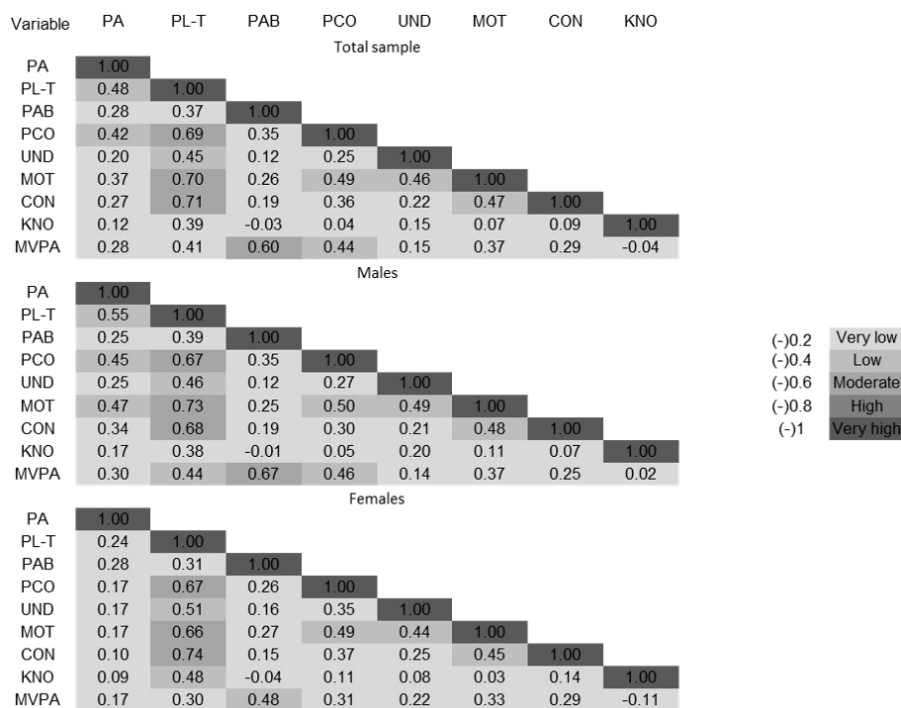


FIGURE 3. Gender-stratified correlation coefficients and magnitude of correlations between study variables. Note PA – Years of organized physical activity, PL-T – Total physical literacy score, PAB - physical activity behavior, PCO- Physical competence, UND – Understanding, MOT – Motivation, CON – Confidence, KNO – Knowledge, MVPA – Moderate-to-vigorous physical activity.

Discussion

This research aimed to investigate gender differences in PL levels and associations between PL and participation in organized PA. The most interesting findings from this study are that (i) males had higher participation rates and PL scores compared to females and (ii) participation in organized PA was associated with PL levels.

Gender differences in participation in organized physical activity and physical literacy levels

The most significant differences between males and females were noted in years of organized PA, PPLQ total score, physical competence, and confidence, with males having higher scores than females. The reason for these findings can be found in the following explanation. Precisely, males are generally more active than females, which is noted from childhood till adolescence (Guthold et al., 2018). The reason for gender differences in childhood and adolescence can be found in the type of activity. Notably, boys are more involved in vigorous-intensity PA such as team sports (e.g., soccer, basketball, handball) while girls are more involved in low-to-moderate intensity PA

such as dance, artistic gymnastics, ballet, artistic swimming (Frömel, Groffik, Šafar, & Mitaš, 2022). However, the gender differences in adults can be influenced by some other factors.

In the past, men were seen as the foundation responsible for contributing to their families and ensuring life's essentials. Even today, due to social norms and accepted roles, men are often more active than women. This is supported by numerous studies that have identified competitiveness and the desire for greater strength as key motivators for men's participation in PA (Edwards et al., 2017; Molanorouzi, Khoo, & Morris, 2015). Considering the importance of social support in promoting PA, it becomes clear how interactions and support from the environment can strongly influence individuals' motivation and engagement in PA. Research has shown that males are often in a more favorable position when it comes to receiving support, whether from peers, parents, or the broader community, compared to females. This support, coming from various sources, not only provides emotional backing but is also perceived as a means that positively impacts individuals' well-being. Through these positive interactions and support, individuals feel encouraged to be active, further promoting

their participation in PA. Additionally, social support can provide practical assistance, such as engaging in sports activities together or supporting goals related to PA (Smith, Moyle, & Burton, 2023). Through these mechanisms, individuals feel connected to others and feel part of a community that supports their commitment to a healthy lifestyle. Therefore, understanding the importance of social support can be crucial for promoting PA and a healthy lifestyle.

A lack of confidence is certainly one factor contributing to lower PA among girls compared to boys. According to a recent study conducted in the UK on girls, one-third stated that they did not participate in PA due to low confidence in their physical abilities, while another third avoided PA due to feeling scrutinized and judged by others regarding their bodies (Cowley et al., 2021). When we consider opportunities and resources, it can be noticed that many areas offer a limited number of sports activities mostly targeted towards males, while options for females are lacking. For example, males can participate in recreational soccer, basketball, handball, and combat sports, while for females the offer is mainly limited to some dance and light fitness classes. These lower opportunities for females are most likely one of the decisive factors for lower participation in organized PA.

Also, as males are more involved in sports activities, it is logical that they also have higher PL levels as organized PA is generally associated with increased PL (Belanger et al., 2018). Access to sports facilities, coaching, and organized sports teams all have an impact on PL levels. In certain areas, females may have fewer possibilities to participate in organized sports or leisure activities than males. Furthermore, societal norms or family dynamics may favour boys' engagement in sports over girls' (Westerbeek & Eime, 2021). All of these factors can influence PL levels and can be responsible for gender differences found in this research.

Associations between participation in organized physical activity and physical literacy levels

The second most interesting finding of this study is that years of organized PA were correlated to PL total score. However, the magnitude of correlations was higher in males than in females, and certain PL domains were not significantly correlated with PA among females, which is in line with the first result of this study. The result that years of organized PA were correlated to PL total score and subdomains physical competence, Understanding, Motivation, Confidence, and Knowledge are consistent with numerous previous studies regarding associations between PL and PA. Precisely, it was found that children who met PA guidelines had higher PL scores, particularly in the domains of Physical Competence and Motivation and Confidence (Belanger et al., 2018). Similarly, it was reported that higher PL was linked to better health indicators, with the relationship between PL and aerobic fitness being influenced by moderate-to-vigorous PA (Caldwell et al., 2020). Noteworthy, one study demonstrated a correlation between

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Conflicts of interest

The authors declare no conflicts of interest.

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PL and self-perceived fitness in children and adolescents, with higher self-perceived fitness being associated with greater PL (Pastor-Cisneros et al., 2021). These findings collectively suggest that participation in organized PA can enhance PL levels, leading to improved health and fitness outcomes.

In addition, persons who have been active in organized physical exercise for a longer period of time are more likely to have participated in many various activities. Organized PA often exposes participants to a range of motions and exercises, which broadens their movement repertoire and improves overall PA. For example, a person who participates in numerous sports would acquire a broader range of movement abilities than one who exclusively participates in one activity (Mackenzie-Stewart et al., 2023). Furthermore, many organized programs incorporate assessment and feedback tools to track progress and offer suggestions for improvement. This feedback loop is critical for growing PL because it helps people recognize their own strengths and areas for improvement, resulting in better-informed decisions.

Overall, participation in organized PA provides a structured and supportive environment for individuals to develop and enhance their PL, which encompasses not only physical skills but also knowledge, motivation, confidence, and enjoyment in being physically active.

Limitations and strengths

One of the main limitations of this study comes from the sample included in the research. Specifically, we included mainly active participants. Therefore, the results of this study should be considered with caution and future studies should consist of a heterogenous sample regarding PA involvement. Moreover, this study did not include objectively measured PA or physical fitness measures which could add value to this research. On the other side, the main strength of this research is that this is among the first studies investigating PL levels in Croatia and the entire Southeastern Europe and can be used as the direction for future similar studies.

Conclusions

The purpose of this study was to investigate the gender differences in PL levels as well as the relationship between PL and involvement in organized PA. The most noteworthy findings from this study are that males had greater participation rates and PL scores than females, and participation in organized PA was connected with PL levels. The finding that years of organized PA are associated with total PL supports the theory that PL is the cornerstone for lifetime participation in PA. The results of this study emphasize the importance of introducing the concept of PL in numerous institutions and organizations connected with organized PA. Also, special attention should be paid to increasing the offer of female organized PA which should also increase their PL levels. Future studies should investigate more heterogenous samples regarding PA participation to gain detailed insight into herein studied topic.

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