

## UNDERSTANDING THE RELATIONSHIP BETWEEN PHYSICAL LITERACY LEVEL AND PHYSICAL ACTIVITY IN SCHOOL ADOLESCENTS

### COMPREENDENDO A RELAÇÃO ENTRE O NÍVEL DE LITERACIA FÍSICA E A ATIVIDADE FÍSICA EM ADOLESCENTES ESCOLARES

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#### RESUMO

A redução da atividade física entre os estudantes após o confinamento devido à pandemia de SARS-CoV-2 mostrou uma queda nas suas capacidades físicas e no desenvolvimento de habilidades motoras, tanto básicas quanto complexas. Com base nos princípios da Literacia Física (LF), este estudo tem como objetivo analisar o seu nível em relação ao nível auto-relatado de atividade física (NAF) em uma amostra de estudantes de ensino secundário da Região do Maule, Chile (n = 368, 175 mulheres e 193 homens), com idades entre 12 e 18 anos (14,5 ± 1,8). A LF foi medida utilizando o Perceived Physical Literacy Instrument (PPLI), enquanto o NAF foi avaliado com o Physical Activity Questionnaire – Adolescents (PAQ-A). Os resultados preliminares, em uma escala de 1 a 5 pontos, mostram um nível médio de LF de 3,70 ± 0,8 (homens 3,8 ± 0,8; mulheres 3,7 ± 0,8) e um NAF de 2,8 ± 0,8 (homens 2,8 ± 0,8; mulheres 2,8 ± 0,8). Dentre as dimensões do PPLI, a mais destacada foi o Conhecimento e Compreensão (4,1 ± 1,1), seguida por Autoconfiança e Comunicação com os Outros (3,4 ± 1,3), enquanto o Sentido de Si Mesmo e Confiança foi o mais baixo (3,4 ± 1,2). Quanto às atividades físicas mais frequentes, caminhar (3,3 ± 1,5), andar de bicicleta (3,0 ± 1,4), correr e jogar futebol (2,7 ± 1,4) foram as mais relatadas, realizadas principalmente de quarta a sexta-feira. Não foi encontrada uma relação significativa entre o nível de LF e o NAF (r = 0,170). Em conclusão, o nível de literacia física alcançado é moderadamente alto, enquanto o nível de atividade física está abaixo da média esperada para a idade, sem evidências de uma relação direta entre os dois indicadores.

**Palavras-chave:** Literacia Física, nível de atividade física, motivação, confiança, PPLI.

#### ABSTRACT

The reduction in physical activity among schoolchildren following the lockdown due to the SARS-CoV-2 pandemic has shown a decline in their physical capacities and the development of basic and complex motor skills. Based on the principles of Physical Literacy (PL), this study aims to analyse its level concerning the self-reported physical activity level (PAL) in a sample of secondary school students from the Maule Region, Chile (n = 368, 175 females and 193 males), aged between 12 and 18 years (14.5 ± 1.8). PL was measured using the Perceived Physical Literacy Instrument (PPLI), while PAL was assessed with the Physical Activity Questionnaire – Adolescents (PAQ-A). Preliminary results, on a scale from 1 to 5 points, show an average PL level of 3.70 ± 0.8 (males 3.8 ± 0.8; females 3.7 ± 0.8) and a PAL of 2.8 ± 0.8 (males 2.8 ± 0.8; females 2.8 ± 0.8). Among the dimensions of the PPLI, the most prominent was Knowledge and Understanding (4.1 ± 1.1), followed by Self-Confidence and Communication with Others (3.4 ± 1.3), while the Sense of Self and Confidence was the lowest (3.4 ± 1.2). As for the most frequent physical activities, walking (3.3 ± 1.5), cycling (3.0 ± 1.4), running, and football (2.7 ± 1.4) were reported, mainly carried out from Wednesday to Friday. No significant relationship was found between the level of PL and PAL (r = 0.170). In conclusion, the level of physical literacy achieved is moderately high, while the level of physical activity is below the expected average for their age, with no evidence of a direct relationship between the two indicators.

**Keywords:** Physical Literacy, physical activity level, motivation, confidence, PPLI.

#### Introduction

Physical Literacy (PL) is a concept that has been studied for more than twenty years in various countries<sup>1,2</sup>. According to the International Physical Literacy Association<sup>3</sup>, PL is defined as “the motivation, confidence, physical competence, knowledge and understanding necessary to value and assume responsibility for participating in physical activities throughout life”. Despite its recognition in several countries, its implementation has been slow due to cultural and contextual differences<sup>4</sup>. Currently, the teaching of Physical Education continues to focus on a sport-oriented approach, mainly addressing two components of PL: knowledge and physical competence. However, key aspects such as motivation, confidence and affectivity, which are essential to fostering the understanding and practice of physical activity throughout

life, are not being adequately promoted, recognising its benefits. In addition, the behavioural component, which is essential in Physical Education, is not being sufficiently worked on, which limits commitment to PL and hinders social integration. There is evidence that many young people stop regularly engaging in physical activity after leaving school. This phenomenon is largely due to a lack of motivation, confidence and affection towards physical activity (PA), which shows that, despite knowing its benefits and its importance, it is not integrated as a habit in daily life. Levels of physical inactivity are alarmingly high in all age groups. Globally, one in four adults does not do enough physical activity, 81% of the adolescent population (aged 11 to 17) does not meet the physical activity recommendations, and women are less active than men, with a difference of more than 8% (32% of men versus 23% of women)<sup>5</sup>. These data are worrying worldwide, and even more so for the Chilean population, which ranks second in obesity within the OECD<sup>6</sup>.

The pandemic had a significant impact on the physical and psychological health of the population. Various studies on PA in students at a global level indicate that, in 9 out of 10 investigations, confinement resulted in a general reduction in PA, both moderate and vigorous<sup>7</sup>. This phenomenon has been particularly associated with a notable decrease in PA among young people, which has led to a worrying increase in psychological health problems<sup>8-12</sup>.

In the last twenty years, the assessment of physical literacy in adolescents has focused mainly on the demonstration of basic motor skills or the identification of sporting talents<sup>13</sup>. This perspective is supported by Lundvall<sup>14</sup>, who highlights that most physical literacy assessment instruments are oriented towards the measurement of fundamental movements and motor skills, which limits their scope and does not adequately reflect the complexity of the concept of PL. In this context, he proposes that physical literacy assessments include “states of being”, such as competence in physical movement and knowledge about how to be physically active. Furthermore, Corbin<sup>15</sup> suggests that “behavioural determinants of health” be incorporated, such as the motivation and confidence needed to promote PA. Despite these approaches, there is still a shortage of validated instruments capable of capturing the broader aspects of physical literacy.

In the literature, the Perceived Physical Literacy Instrument (PPLI), initially developed by Sum et al.<sup>16</sup> to assess Physical Education teachers, has been identified. This instrument has been validated and is considered reliable for professionals in the field. Subsequently, the PPLI was adapted for application in adolescents<sup>17</sup>, recognizing the importance of PL through four key dimensions: 1) physical self-confidence; 2) motivation to participate; 3) interaction with the environment, expression and communication with others; and 4) knowledge and understanding of how to maintain physical activity.

In educational centres, it has been identified that the return of students after confinement due to the SARS-CoV-2 pandemic generated two main problems in adolescents: a deficit in their motor skills, both basic and complex, and a decrease in their motivation and socio-affective well-being, which negatively impacted the development of Physical Education classes. In addition, a key factor in the reduction of PA has been the direct relationship between the pandemic and the psychological state of students, which has favoured the increase in inactivity and sedentary lifestyle<sup>18-20</sup>.

The literature suggests a possible solution by proposing PL, closely related to PA. It is argued that the interaction between these two variables could favour a more active lifestyle. In this context, it was proposed to measure the variables of PL and physical activity level (PAL) to evaluate students' perceptions of both. This would allow the implementation of an intervention process and obtain a more accurate assessment of the real level of PL and PAL in students.

The relevance of PL in Physical Education lies in promoting adherence to the regular practice of PA throughout life. Integrating PL in Physical Education classes would be beneficial for both adolescents and future adults, since PA plays a fundamental role in the prevention of

chronic non-communicable diseases (NCDs), such as obesity, diabetes, high blood pressure and metabolic syndrome, among others<sup>21</sup>.

The aim of this research is to examine the relationship between the level of physical literacy and the physical activity level in secondary school students from the Maule Region, Chile.

## Methods

### *Study Design and Type*

This study has a descriptive, non-experimental, cross-sectional approach, with a non-probabilistic design. The research focused on adolescents attending different educational establishments in various cities in the Maule Region. Perceived Physical Literacy scores and time spent on physical activity were self-reported by participants and recorded using two questionnaires: the Perceived Physical Literacy Instrument (PPLI) and the Physical Activity Questionnaire for Adolescents (PAQ-A). In addition, demographic data such as gender, age, and course level were collected.

### *Sample*

This study employed a purposive sample comprising 368 students, of whom 175 were women and 193 were men, aged between 12 and 18 years, and studying from seventh grade to fourth year of high school (six years of secondary education). Data collection was carried out in schools in four cities in the Maule Region. The data were collected after obtaining the consent of both the educational establishments and the students, who completed the aforementioned questionnaires, following the ethical guidelines of the Declaration of Helsinki. The instruments were applied to the participants during the first 15 minutes of the Physical Education class in each establishment.

Schools were selected purposively, based on criteria such as institutional willingness to participate, geographic diversity within the Maule Region, and the presence of regular Physical Education classes. Participant inclusion was based on availability during class sessions and informed consent. While this sampling strategy was appropriate for the educational context, it introduces a limitation in the sample's representativeness, which should be considered when interpreting the findings.

### *Instruments*

To assess the study variables, two questionnaires were used: the PAQ-A to measure the physical activity level (PAL) and the PPLI to determine the level of physical literacy (PL) of adolescents. Both questionnaires were administered during regular Physical Education sessions.

#### Physical literacy

The PPLI<sup>17</sup> consists of 9 items distributed in three subscales: "sense of self and self-confidence" (questions 1, 4 and 5), "knowledge and understanding" (questions 2, 3 and 9) and "self-confidence, self-expression and communication with others" (questions 6, 7 and 8). Participants responded using a 1 to 5-point Likert scale (1 = totally disagree; 5 = totally agree). The scores obtained on the scale showed reliable internal consistency, with reliability coefficients ranging from 0.86 to 0.87, supporting the validity of the instrument used.

#### Physical Activity

The PAQ-A<sup>22,23</sup> questionnaire was used to measure physical activity in adolescents. It is a questionnaire designed to assess the level of physical activity performed in the last 7 days.

The instrument is self-reported and consists of 9 questions, covering domains such as free time, participation in Physical Education classes, as well as activities performed during school days and weekends. The results are obtained using a 5-point additive Likert scale (with a minimum of 1 and a maximum of 5), which reflects the frequency of sedentary or physically active behaviours. The final score of the questionnaire is calculated as the arithmetic average of the answers to the first 8 questions. The ninth question determines whether the adolescent was sick or experienced a situation that prevented him or her from performing physical activity.

### Statistical analysis

Descriptive statistics and scores for the PPLI and PAQ-A instruments were calculated as means and standard deviations, stratified by grade, age, and gender. Data normality was assessed using the Shapiro-Wilk test, while homogeneity of variance was analysed using the Levene test. The consistency and reliability of the PPLI questionnaire were determined through Cronbach's alpha coefficient ( $\alpha = 0.87$ ). Pearson's correlation ( $r$ ) was used to calculate the relationship between perceived levels of PL and PAL. In addition, multiple regression analysis ( $r^2$ ) was performed to assess the association between both perceived levels of PL and PAL.

One-way ANOVA and Student's t-tests for independent samples were used to assess differences in means between groups, checking whether the results were statistically significant. In addition, effect sizes were calculated using Cohen's  $d$ , where values  $<0.2$  indicate a small effect size,  $<0.5$  a medium effect size, and  $>0.8$  a large effect size.

Data were entered and measures of central tendency were calculated using Microsoft Excel for Windows. Data analysis was performed using SPSS software, version 21 for Windows. A 95% confidence level ( $p > 0.05$ ) was set to determine the statistical significance of the results.

## Results

The relationship between PL and PAL (Table 1) shows greater significance in the older age groups (16 and 17 years), especially among 3rd and 4th-year high school students, where the positive correlations are stronger ( $r = 0.27$  and  $r = 0.315$ , respectively). In 7th grade students (12 years) and 8th grade students (13 years), although the relationship is weaker, it is still significant. In contrast, 1st and 2nd year high school students present weak or even negative correlations, with a slight negative relationship between AFi and NAF being particularly notable in the 2nd year-high school group ( $r = -0.128$ ).

**Table 1. Relationship between PL level and PAL by school grade**

Grade	N	Age		r		$p$	$r^2$
-	368	14,5 ± 1,8	F	M	0,17	< 0,000*	
7 <sup>th</sup>	65	12 ± 03	0,203	0,203	0,203	< 0,003*	
8 <sup>th</sup>	81	13,4 ± 0,7	0,125	0,091	0,115	< 0,000*	
1 <sup>st</sup> HS	71	14,1 ± 0,4	0,05	0,08	0,05	< 0,000*	0,025
2 <sup>nd</sup> HS	36	15,2 ± 0,4	0,047	-0,128	-0,128	< 0,002*	
3 <sup>th</sup> HS	49	16 ± 0,7	0,27	0,131	0,27	< 0,000*	
4 <sup>th</sup> HS	66	17 ± 0,4	0,106	0,315	0,266	< 0,000*	

**Note:** Age is shown as mean and SD, distributed by female (F) and male (M), Pearson correlation ( $r = -1 0 +1$ ) and multiple regression coefficient ( $r^2 = -0 0 +1$ ).

**Source:** The authors.

Statistically significant differences were found in the three dimensions assessed (sense of self and self-confidence, knowledge and understanding and self-confidence, self-expression and communication with others) between genders, with *p* values less than 0.05, indicating that the differences are not due to chance. However, despite being significant, the effect size is small in all dimensions, suggesting that the differences between men and women are minimal (Table 2).

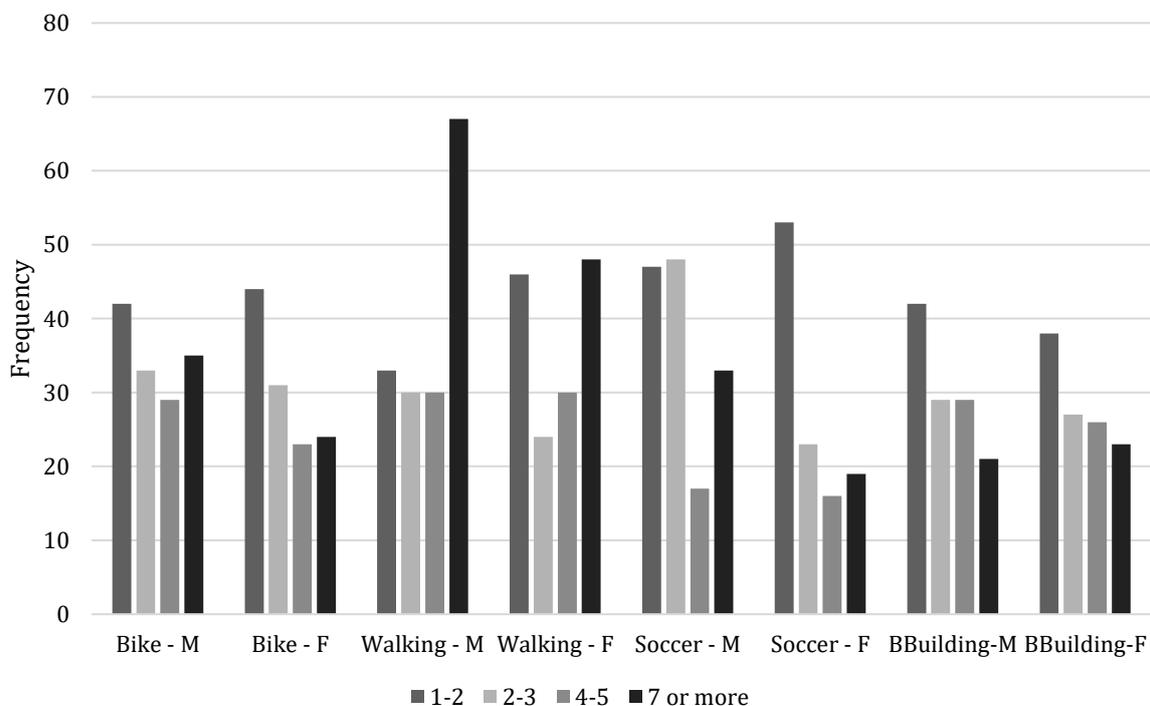
**Table 2. Comparison of perceived PL by dimension and gender**

PPLI Dimensions	Gender			<i>p</i>	d-Cohen
	M	F	Total		
Q1-Q4-Q5	3,4 ± 1,2	3,3 ± 1,2	3,4 ± 1,2	0,021*	0,0
Q2-Q3-Q9	4,2 ± 1,1	4,0 ± 1,2	4,1 ± 1,1	0,047*	0,3
Q6-Q7-Q8	3,5 ± 1,3	3,2 ± 1,4	3,4 ± 1,3	0,000*	0,3

**Note:** Q1-Q4-Q5: sense of self and self-confidence; Q2-Q3-Q9: knowledge and understanding; Q6-Q7-Q8: self-confidence, self-expression and communication with others; Cohen's d (<0.2 = small effect size; <0.5 = medium effect size >0.8 = large effect size); *p* = <0.05.

**Source:** The Authors.

Results revealed statistically significant differences between genders in all three dimensions of the PPLI. Perceived PL attributes were identified as significant predictors of PAL ( $3.7 \pm 0.8$ ), suggesting that recurrent physical activity practices influence reported activity levels (Figure 1).



**Figure 1. Preferences of physical activities per week by gender**

**Source:** The authors.

Among the most frequent activities, walking stands out as the most practised, carried out 7 or more times per week, by both men and women. The general average of walking for both genders is  $3.3 \pm 1.5$  points. Biking follows, practised more by men than by women, with a general average of  $3.0 \pm 1.4$  points. Soccer is also a popular activity, with greater participation by men than by women, while bodybuilding is practised to a greater extent by women than by men, with an average of  $2.7 \pm 1.4$  points in both genders.

## Discussion

The present study identifies a relationship between levels of PA and PL, as well as the influence of individual factors and school contexts on these levels. This analysis provides a fundamental framework for understanding PA, which aims not only to examine the individual effects of PA-related behaviour but also to explore how the components of PA, according to Whitehead<sup>24</sup>, contribute to the interpretation of this concept. This approach facilitates the formulation of strategies to improve PA throughout the life cycle of each individual. In this process, dimensions such as sense of self and self-confidence, self-expression and communication with others, knowledge and understanding, motivation or affectivity, physical confidence and competence, as well as interaction with the sociocultural environment are essential. Through the use of Sum's Perceived Physical Literacy Instrument (PPLI)<sup>17</sup>, the relationship between the components and levels of PL and PA in students was evidenced.

Additionally, the cross-sectional design of this study prevents the establishment of causal relationships between physical literacy and physical activity levels. While associations were observed, it is not possible to determine the directionality or causality of these relationships. Longitudinal or intervention-based research designs are recommended for future studies to explore how changes in physical literacy may influence physical activity over time.

There are studies, such as that of Longmuir and Tremblay<sup>25</sup>, which show the importance of PA for PL, and how the lack of the latter makes it difficult to adhere to the practice of PA. According to these authors, PA is not something that is "done" or "had", but rather an experience lived throughout life, which develops at different stages and depends on the decisions that the individual makes regarding PA. Similarly, this study showed that those who have higher perceived levels of PL report higher levels of PA.

In this study, the relationship between PAL and PL was analysed by comparing the experiences lived by students and their perception of PA. However, the results showed weak but significantly positive correlations between perceived levels of PL and PAL, which does not coincide with the findings of previous research on this topic, both in Indonesia and Mexico<sup>26,27</sup>. This low positive correlation could be explained by the moderate perception that adolescents have about their PL, which makes it difficult to associate it with high PAL.

Furthermore, the correlations found between physical literacy and physical activity were weak, suggesting that other unmeasured variables may be influencing these outcomes. Factors such as socioeconomic status, school environment, and individual motivation could act as mediators or moderators. Future research should incorporate more complex multivariate analyses, such as hierarchical regression or structural equation modelling, to better understand the interplay of these variables.

It is possible to show that the attributes of the PL influence the levels of PA among adolescents in the Maule Region, particularly in those dimensions that strengthen their sense of identity and confidence, similar to what Mayordomo et al.<sup>28</sup> reports, who identify that the PAL is a relevant factor in interventions seeking to improve the mental health of young people, positively influencing aspects such as self-esteem and perception of well-being. In the same way, the finding is reinforced in that the relationship with knowledge and understanding, as fundamental elements for development throughout life, similar to what Cedeño<sup>29</sup> reports, who

observed how the PL influences the quality of life of adolescents, which can encourage more active participation throughout the lives of these people. Likewise, as Whitehead<sup>30</sup> points out, the knowledge and understanding of the PL must be in the hands of competent professionals, who will guide the physical literacy process, enhancing motor experiences and active lifestyles. These professionals provide tools that improve motor interaction and health, in addition to preventing chronic non-communicable diseases (NCDs) and other problems related to physical illiteracy.

It is essential to introduce the concept of Physical Literacy to students, motivating them to take responsibility for identifying and maintaining their daily physical activity, while emphasising the relevance of physical activity for their health throughout life. This approach can serve as a path for them to understand the importance of PL and assume the commitment to be physically literate individuals<sup>24</sup>, ensuring that this skill lasts throughout the life cycle. Since PL is a personal competence, it allows us to recognise and value the unique potential of each human being. In this sense, it is essential to highlight the uniqueness of the individual capacities of each person, highlighting their importance in the process of PL.

Research has focused primarily on measuring objective levels of PA, but this is not sufficient to adequately assess PA<sup>25</sup>. There is an urgent need to determine whether PL is closely linked to the different domains of PA. The World Health Organization (WHO)<sup>31</sup> recommends that children and adolescents perform at least 60 minutes of PA per day. However, various studies in Chile, such as that by Mayorga-Vega et al.<sup>32</sup>, indicate that PAL in students are low at all educational levels, with the situation in adolescents being especially worrying since this stage is crucial for the development of sedentary habits and physical illiteracy. According to the available evidence, PAL is not sufficient to promote health in adolescents. In this study, students met the global PA recommendations, which are correlated with a moderate score in perceived PL, allowing differentiation of the frequency of PA from weekly sports practice.

It is crucial to provide support to adolescents to strengthen their PL skills, taking advantage of their motivation and affectivity towards PA practice. However, promoting PL is not the exclusive responsibility of PE teachers, nor is it limited to PA classes. The promotion of PL is enriched by the support of family, friends, caregivers, coaches and other members of the close environment<sup>4,15</sup>. Therefore, these people must understand the concept of PL, since their influence can be decisive in the process of PL of each individual. Depending on whether the experience is positive or negative, this will directly impact how adolescents understand and value their physical literacy. It is essential to create spaces that encourage and strengthen PL in adolescents<sup>33</sup>, giving them the possibility of choosing recreational physical activities that adapt to their preferences in terms of intensity, and ensuring that these activities are perceived as enjoyable, avoiding being perceived as obligatory or punitive. Adolescents should have the freedom to decide what PA they want to develop on their path to PL, also influenced by their social context, which can positively or negatively impact their journey. In this study, it was observed that physical and sports activity is mainly carried out during independent hours, with walking, cycling, football and weight training leading the weekly frequency of practice. In addition, PA carried out at home is considerably preferred, since it does not present restrictions that can be found in other environments.

The benefits of PA are essential at various stages of development, particularly in motor, cognitive and social growth. However, without adequate PL, the ability to be a physically literate person is restricted. The physiological effects associated with physical activity levels have positive impacts, favouring academic performance<sup>34</sup> and promoting an increase in neurotrophic factors, which, in turn, contribute to greater self-esteem of the individual and improve the ability to understand and learn<sup>35</sup>. These findings reinforce the benefits of being physically literate and underline the multiple positive effects that PL brings to the overall health of the individual.

An important limitation of this study lies in the use of a purposive, non-probabilistic sample, which restricts the generalizability of the findings to the broader adolescent population of the region. Although the results provide valuable insights into the relationship between physical literacy and physical activity in specific school contexts, caution is advised when extrapolating these findings to other educational settings or populations. Future studies should consider probabilistic sampling strategies or include a more diverse set of schools to enhance representativeness.

## Conclusion

The attributes of perceived levels of PL and PAL were associated with recreational physical activity and individual factors such as gender, grade level, and age. After analysing the results from the variables studied, it is concluded that the overall average of the PL level is high compared to the PAL, which is below the expected average according to age and grade. Consequently, a direct relationship between both indicators was not evident.

According to what was evidenced in this research, it is crucial to continue working on the PL of Chilean students, providing opportunities for them to understand the importance of PA throughout their life cycle. The results obtained in this study may be valuable for future research on PL levels and the practice of PA in Chilean adolescents, as well as to promote possible changes in the school context of the country.

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#### **CRedit author statement**

Marcelo Castillo-Retamal: Conceptualization, Methodology, Formal analysis, Data curation, Writing original draft, review & editing; Katherine Contreras-Zapata: Conceptualization, Methodology, Formal analysis, Data curation, Writing original draft, review & editing; Nadia Cruz-Hidalgo: Data curation, Writing original draft, review & editing; Franklin Castillo-Retamal: Data curation, Writing original draft, review & editing.

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