

Original Research

# Motivational variables and their relationship with health determinants in physical education students

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**Abstract:** This research aims to analyze the relationship between basic psychological needs, motivation, and health-related behaviors in students aged between 11 and 16 years. The sample consists of 561 students with an average age of 13.6 years (267 boys and 294 girls), 147 participants from 5<sup>th</sup> and 6<sup>th</sup> grade of Primary Education and 414 participants from 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade of Secondary Education. The study is based on the Self-Determination Theory, the design is cross-sectional, and the variables under study are as follows: physical activity, sedentary behaviors, nutrition, socio-economic status, teacher support of basic psychological needs, motivation towards physical education, and intention to be physically active. The results show that the highest values in the variable of socioeconomic status, as well as in the variable of adherence to the Mediterranean diet, correspond to higher values in the variable of out-of-school physical activity practice. Furthermore, the physical education teacher's support of competence and autonomy needs positively influences intrinsic motivation and the intention to be physically active in the future, which, in turn, favors the practice of out-of-school physical activity and reduces levels of sedentary time. In conclusion, it is suggested that school physical education programs should not only promote physical activity but also support students' needs for competence and autonomy. Additionally, encouraging adherence to the Mediterranean diet and considering the students' socioeconomic context can increase out-of-school physical activity. These strategies could help reduce sedentary levels among young people.

**Keywords:** Health Determinants; Basic Psychological Needs, Motivation, Physical Education

## 1. Introduction

Some studies have shown that physical activity (PA) is related to health determinants (Jiménez-Boraita et al., 2022). Considering the World Health Organization (WHO) guidelines on Physical Activity and Sedentary Habits (2020), schools and, more

specifically, the subject of physical education (PE), are shown to be a privileged opportunity to promote compliance with these guidelines (Bujosa-Quetglas et al., 2023)

Health determinants could be defined as those factors that, combined, affect the health of individuals and communities. In this sense, people's health is determined by their



circumstances and environment (WHO, 2017). According to the WHO-recommended Social Determinants of Health Model, we can differentiate two main categories of determinants: (1) structural and/or social determinants, which include aspects related to social position, gender, race and ethnicity, and access to education; (2) intermediate and personal determinants, whose main categories include material circumstances, psychological circumstances, behavioral and biological factors, social cohesion, and health systems (De La Guardia & Ruvalcaba, 2020).

Specifically, in this study, we focus on some of these determinants due to the relationship that exists between them. In the epidemiological meta-analysis by Esposito *et al.* (2011), it is observed that the effect of the Mediterranean diet, combined with PA and the reduction of sedentary behaviors, leads to health benefits for individuals. Additionally, in studies such as Afshin *et al.* (2019), it is demonstrated that populations with lower socioeconomic status tend to lead a sedentary lifestyle or have lower levels of PA, which when accompanied by an unhealthy diet, results in poorer health outcomes.

The WHO (2022) defines PA as any bodily movement produced by skeletal muscles with consequent energy consumption. The WHO (2022) guidelines establish that children and adolescents between ages 5 and 17 should (1) do at least an average of 60 minutes per day of moderate-to-vigorous intensity exercise, (2) incorporate vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, at least 3 days a week, (3) limit the amount of sedentary time, particularly the amount of recreational screen time.

Furthermore, engaging in physical activity yields numerous benefits to children and adolescents, such as the development of the muscular and nervous systems, which leads to greater well-being, both physical and psychological (Soriano-Sánchez *et al.*, 2023).

Sedentary behavior refers to activities that do not increase energy expenditure substantially above the resting level and includes activities such as sleeping, sitting, lying down, watching television, and other forms of screen-based entertainment. Operationally, sedentary behavior includes activities that involve energy expenditure at the level of 1.0-1.5 metabolic equivalent units (METs) (Pate *et al.*, 2008). The WHO does not recommend screen time, whereas the 24-hour movement guidelines (Tremblay *et al.*, 2016) recommend a maximum of 2 hours of recreational screen time. Although the young population should be at the top of the list of PA practice in our society (Cocca *et al.*, 2014), the prevalence of sedentary behavior increases during adolescence (Amagua-Maldonado, 2023). Epidemiological studies reveal that this lack of PA, along with the prevalence of sedentary behaviors, represents a serious problem with a rapidly growing trend, especially in the young population, making it a public health issue (Rodríguez-Torres *et al.*, 2020). Specifically, the data report that 23.3% of schoolchildren are overweight and 17.3% are obese (López-Sobaler *et al.*, 2021).

If we focus on gender and age differences, it is noteworthy that boys exhibit higher levels of habitual PA than girls, who are more sedentary. Additionally, levels of sedentary behavior and PA practice decrease as they approach adolescence (Ortiz *et al.*, 2021).

Beyond PA and sedentary behaviors, recent studies (e.g. Leyton et al., 2020) have shown that there are other variables such as diet, socioeconomic status, or intention to be physically active, which directly influence determining whether an individual exhibits a healthy lifestyle.

Regarding food, the WHO (2020) states that a healthy diet should include (1) fruit, vegetables, legumes, nuts, and whole grains; (2) at least 400g of fruit and vegetables per day; (3) less than 10% of total energy intake from free sugars; (4) less than 30% of total energy from fats; (5) less than 5g of salt per day. Thus, the study by Tapia-Serrano et al. (2021) reveals that only 24.5% of adolescents adhere adequately to the Mediterranean diet, indicating that most schoolchildren exhibit medium or low adherence (75.5%) and, consequently, need to improve their dietary habits to align with the Mediterranean pattern. To address this problem, the systematic review by López-Gil et al. (2020) indicates that the implementation of strategies through PE, such as offering students the opportunity to choose healthy products, providing theoretical and informative content about healthy eating, conducting theoretical-practical sessions and workshops on healthy eating, and involving parents through meetings, can lead to significant improvements in students' dietary habits.

It is also important to highlight that age influences adherence to the Mediterranean diet, while differences by sex are scarcely observed (Rosa et al., 2018).

Regarding socio-demographic variables and socio-economic status, there is evidence suggesting that, in developing countries, poorer people exhibit a growing trend

towards obesity. Their pattern commonly includes malnutrition, infections, overweight, obesity, and associated pathologies (Hernández-Rodríguez et al., 2019). The study by Sánchez-Urrea and Izquierdo-Rus (2021) reports that socio-economic factors directly influence PA and students' health. They recommend the WHO (2012) to encourage countries to develop healthy lifestyles, focusing in part on socio-economic factors.

Finally, regarding the intention to be physically active, it should be noted that understanding adolescents' future intentions to pursue an active lifestyle is essential because it reflects the motivational strength towards engaging in physical activity in adulthood (Sterdt et al., 2014).

The two mini-theories on which this research is based (the theory of basic psychological needs and the theory of organic integration) fall within the framework of SDT (Deci & Ryan, 1985).

On the one hand, the mini-theory of basic psychological needs (BPN) asserts that various social factors coexist, influencing learners' motivational regulation, either in the form of satisfaction or frustration of these needs (Ryan & Deci, 2000a). Firstly, autonomy support refers to the teacher's behaviors that allow students' freedom of expression and action, granting them responsibility in decision-making and valuing their preferences and desires when performing tasks (Reeve, 2006). Secondly, competence support refers to the teacher's behaviors aimed at optimizing students' perception of ability through activities tailored to their level and giving them sufficient time to achieve objectives. Additionally, this variable is associated with

positive feedback, employing reinforcements rather than punishments (Skinner & Belmont, 1993). Lastly, relatedness support refers to the degree of empathy the teacher offers students and is related to fostering the integration of all the classmates within the class group (Skinner & Edge, 2002).

The perception of competence, autonomy, and relatedness emerges as one of the keys to PE due to its high potential for increasing students' motivation levels. These needs are largely determined by individuals' experiences of success or failure throughout their PA practice trajectory. Therefore, the prevalence of successful experiences will lead to a higher likelihood of continuing to engage in PA in the future (Deci & Ryan, 2000)

This study also relies on the mini theory of organic integration (Deci & Ryan, 1985), which posits that motivation is organized on a continuum of self-determination, where actions occur with varying degrees of autonomy. At one extreme is amotivation, meaning a lack of intentionality to act (Deci & Ryan, 2000). This is followed by external regulation, which refers to behaviors aimed at obtaining a reward or avoiding punishment. Introjected regulation is associated with behaviors that seek to alleviate feelings of guilt or enhance self-esteem (Ryan & Deci, 2020). In identified regulation, the individual engages in an activity because they consider it important and beneficial, even if it is not inherently interesting or satisfying. Integrated regulation emerges in adulthood and comes into play when individual needs and values align with outcomes of socially expected behaviors, thus becoming part of the self (Deci & Ryan, 1985). Finally, intrinsic

motivation represents the highest level of behavioral autonomy and is associated with the curiosity and pleasure experienced when performing an activity (Moreno & Martínez, 2006).

This study makes significant contributions compared to the existing literature, as it goes one step further and assigns a fundamental role to PE teachers in managing the students' overall health. Most of the previous research focuses solely on increasing PA levels through motivational strategies (Salazar-Ayala & Gastélum-Cuadras, 2020), whereas this study addresses more variables, such as nutrition and socio-economic status, which have proven to be crucial in determining an individual's health.

Considering the above, the objectives of this study are:

1. To analyze the relationship between the health determinants in children and adolescents: PA practice, sedentary behaviors, and nutrition, in addition to various socio-demographic variables and socio-economic status.
2. To test the sequence of the Self Determination Theory, where NPB influence specific types of motivation, which in turn influence the intention to be physically active in the future. Also, to examine how this intention predicts out-of-school PA and sedentary behavior.

Therefore, we start with the following hypotheses:

1. PA is positively related to the Mediterranean diet and a high socioeconomic status, and negatively related to sedentary time.

2. There will be a positive relationship between the need-supportive behaviors and the attainment of intrinsic motivation, resulting in students intending to be physically active in the future. In turn, this intention will be positively related to engaging in out-of-school PA and low levels of sedentary behaviors.

Some previous studies have similarly examined these objectives. For example, Vasconcellos et al. (2020) examined the evidence regarding the principles of SDT within the context of PE. For this purpose, the strength of each association proposed in the SDT-based model and the potential demographic moderators (age, sex, country, culture) of these associations were examined to test the SDT principle suggesting that these associations are universal.

## 2. Materials and Methods

*Participants* – Participants were a total of 561 (267 boys and 294 girls) from three educational centers, with a mean age of 13.6 years, ranging from 11 to 16 years (from 5<sup>th</sup> grade of Primary Education to 4<sup>th</sup> grade of Secondary Education). The sample from the first educational center was enrolled in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> grades of Secondary Education and comprised 285 students (150 girls and 135 boys), representing 50.8% of the total sample. The sample from the second educational center was enrolled in 5<sup>th</sup> and 6<sup>th</sup> grades of Primary Education and included 67 students (36 girls and 31 boys), representing 11.94% of the total sample. The sample from the third educational center was enrolled in 5<sup>th</sup> and 6<sup>th</sup> grades of Primary Education, and in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> grades of Secondary Education, and included 209 students (108

girls and 101 boys), representing 37.25% of the total sample.

*Instruments* - The variables of PA and sedentary behaviors were measured with the Youth Activity Profile (YAP; Saint-Maurice & Welk, 2014). In this research, we used the Spanish validation of the YAP-S (Youth Activity Profile – Spain) carried out by Segura-Díaz et al. (2020). The YAP measures PA and sedentary behaviors. It is validated in children and adolescents aged 8 to 17 years, and its 15 items are divided into three sections: 1) school activity, 2) out-of-school activity, and 3) sedentary habits. The first section includes transportation to and from school, as well as activity during PE class, lunch, and recess. The second section includes activity before school, right after school, in the evening, and on weekends (Saturday and Sunday). The third section includes time spent watching television, playing video games, using the computer, mobile phone, and a general sedentary item. All items are rated on a five-point Likert scale. The Spearman correlation coefficient indicated reliability ranging from good to excellent (.75 to .94) in all three sections both in children and adolescents (Segura-Díaz et al., 2020).

The KIDMED index (Serra-Majem et al., 2004) was used to measure the eating variable. This instrument is based on the principles that support the Mediterranean diet and is validated in children and youth aged 2 to 24 years. The KIDMED index ranges from 0 to 12 points, and the instrument comprises 16 questions. Questions indicating a negative connotation regarding the Mediterranean diet are assigned a value of “-1”, whereas questions with positive connotations are assigned a



value of “+1”. Therefore, as there are 12 items that add 1 point and 4 items that subtract 1 point, the maximum score is 12 points (Serra-Majem et al., 2004). Cronbach’s alpha coefficient indicated a reliability and reproducibility of .79 for the entire questionnaire (Carrillo & Ramírez-Vélez, 2020).

The Family Affluence Scale III (FAS III; Corell et al., 2021) was used to measure socioeconomic status. This international questionnaire presents six items related to material consumption indices and the household’s wealth. This questionnaire is validated only in adolescents. However, the confirmatory factor analysis (CFA) conducted in the validation article showed that the one-dimensional model had a good fit to the data, as indicated by the comparative fit index (CFI) greater than .975 and the root mean square error of approximation (RMSEA) less than .03. The items in this questionnaire address familiar topics, such as whether the respondents own a motorized vehicle and have their own bedroom (two responses options: yes/no); the number of computers and/or tablets the family possesses (four response options: none/one/two/more than two), etc. (Corell et al., 2021).

Socio-demographic variables were measured based on participants’ gender, school year, date of birth, educational center and stage. This measurement method has been shown to be accurate and effective for children and adolescents in studies like that by Yslado-Méndez et al. (2019).

To measure support for BPN, we used the Support for BPN Questionnaire in the context of PE (Sánchez-Oliva et al., 2013). This questionnaire is validated only in

adolescents. However, in the CFA conducted in the validation article, adequate fit indices were obtained. This instrument consists of 12 items: four on the need for competence (“Always tries to help us achieve the goals set”), four on the need for autonomy, and four on the need for relatedness. Responses are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Cronbach’s alpha coefficient was .80 for support for competence, .82 for autonomy, and .81 for relatedness (Sánchez-Oliva et al., 2013).

Motivation was measured with the Physical Education Motivation Questionnaire, validated in both children and adolescents (Leo et al., 2016). The questionnaire begins with the phrase: “I participate in PE classes...”. Subsequently, 18 items are presented, encompassing five variables related to motivation: intrinsic motivation (“I participate in PE classes because PE is fun”), identified regulation, introjected regulation, external regulation, and amotivation. Students express their level of agreement on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Regarding construct validity data, Cronbach’s Alpha coefficient was .65 for intrinsic motivation, .69 for identified motivation, .65 for introjected motivation, .78 for external motivation, and .64 for amotivation (Leo et al., 2016).

Adolescents’ intention to practice PA was measured through the Physical Activity Intentions Scale (Hein et al., 2004). It consists of five items rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Some examples of the items used are: “After graduating, I would like to be physically active” or “Outside of physical

education classes, I enjoy doing sports". The Spanish version (MIFA: Moreno-Murcia et al., 2007) has an internal consistency of .94 (in our study, the alpha was .70 and the omega was .82). The CFA of the MIFA showed a value of  $\chi^2/df = 18.193$ , which is above the acceptable values for the model. Regarding the incremental fit measures CFI and the Tucker-Lewis index (TLI), the factorial model adequately explained the covariance matrix, as their values were above .90. The RMSEA and standardized root mean square residual (SRMR) showed acceptable values for the model (RMSEA = .056, SRMR = .018).

*Procedure* – This study was approved by a Research Ethics Committee (C.P.- C.I. PI20/357).

The design used for the research is descriptive and cross-sectional. This research was implemented with the necessary consent and approval of the tutors, headmasters, and directors of all the educational centers. The students' participation was voluntary. The directors contacted the tutors of each group of students in their respective centers to ensure the completion of the questionnaires. Due to organizational issues in the schools and institutes, the researchers could not administer the questionnaires directly, so clear and specific instructions were provided in the document. However, all participants were given the contact information of one of the researchers so they could raise any unclear questions.

Regarding the participant selection procedure, only criteria and requirements related to age and affiliation to one of the three educational centers mentioned in the previous paragraphs were considered. Thus, all the secondary education students and the 5<sup>th</sup> and 6<sup>th</sup>-grade primary education students

from the participating centers could participate in the research.

*Data Analysis* – Firstly, the Kolmogorov-Smirnov test was applied, indicating that all the variables had a normal distribution. Descriptive statistics of the socio-demographic variables and health determinants were calculated through means and standard deviations.

Bivariate correlational analysis with Pearson's coefficient was carried out using IBM SPSS Statistics 27 software. Values close to 1 indicate a high correlation between variables; conversely, values close to 0 indicate a low or null relationship (Leyva et al., 2014).

A structural equation model was applied using the Mplus program, version 7.11. The proposed model was developed following the two-step procedure recommended by Anderson and Gerbing (1998). Firstly, the construct validity of latent variables was tested through Confirmatory Factor Analysis (CFA). Secondly, once the factorial structure was supported, a structural equation model was conducted with maximum-likelihood-estimation (ML) and robust maximum-likelihood-estimation (MLR) estimators. The fit of the model is deemed adequate when the CFI and the TLI have values  $> 0.90$ , the RMSEA is  $< 0.05$ , and the SRMR is  $< 0.08$  (Iacobucci, 2010). Chi-square was the sole inferential statistic in the model.

### 3. Results

Table 1 presents the descriptive statistics based on socio-demographic variables and health determinants. It shows the mean and standard deviation values for age, gender, stage, socio-economic status, Mediterranean diet, PA in school, out-of-school PA, and sedentary time.

**Table 1.** Descriptive statistics of the socio-demographic variables and health determinants.

	Mean	Deviation
Age	13.62	1.55
Gender	1.56	.55
Stage	1.26	.44
SS	13.87	1.79
MD	5.78	2.55
PAS	2.85	.87
OSPA	3.10	.91
ST	2.51	.70

SS=Socioeconomic Status; MD=Mediterranean Diet; PAS=Physical Activity in School; OSPA=Out-of-School Physical Activity; ST=Sedentary Time.

Table 2 presents the correlations of the participants' socio-demographic variables (age, gender, and stage) and of the health determinants (socio-economic status,

Mediterranean diet, physical activity at school, out-of-school physical activity and, sedentary time).

**Table 2.** Correlations of socio-demographic variables and health determinants.

	Age	Gender	Stage	SS	MD	PAS	OSPA	ST
Age	1	-.021	-.771**	-.061	-.224**	-.095*	-.174**	.216**
Gender		1	.015	-.016	-.073	-.251**	-.204**	-.120**
Stage			1	.088*	-.010	-.008	.085*	-.207**
SS				1	.038	-.096*	.127**	-.029
MD					1	.068	.239**	-.149**
PAS						1	.264**	.022
OSPA							1	-.170**
ST								1

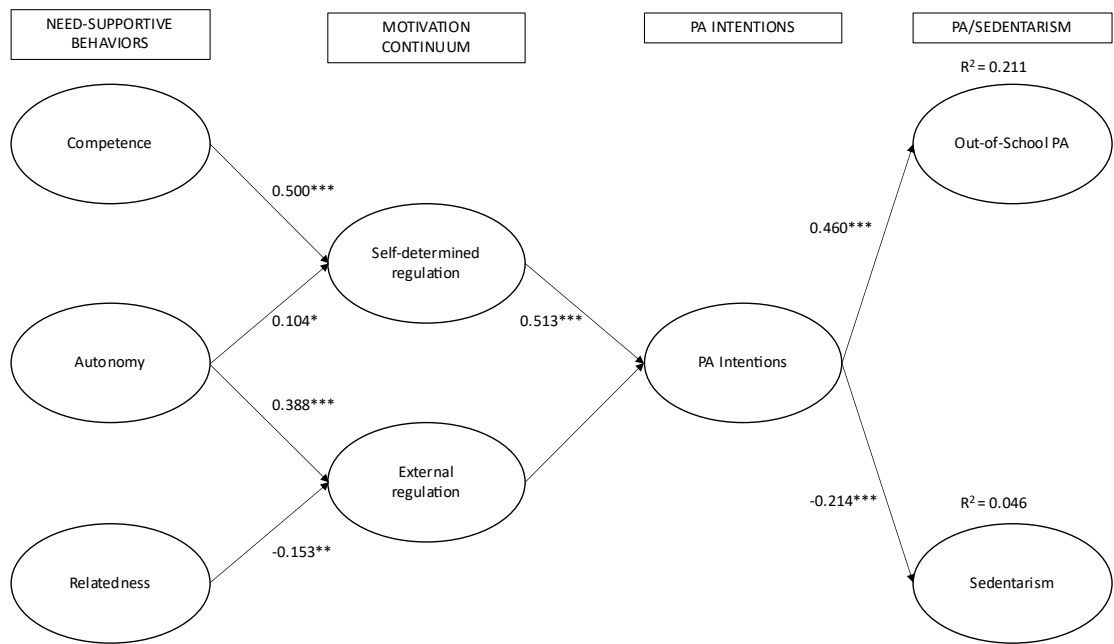
SS=Socioeconomic Status; MD=Mediterranean Diet; PAS=Physical Activity in School; OSPA=Out-of-School Physical Activity; ST=Sedentary Time.

\*\* The correlation is significant at the .01 level (two-tailed).

\* The correlation is significant at the .05 level (two-tailed).

Figure 1 shows the tested model with eight latent variables. The model demonstrated a good fit to the data:  $\chi^2 = 595.173$ ,  $df = 25$ , CFI = .931, TLI = .877, RMSEA = .071, 90% CI [.051, .092], SRMR = .044.





**Figure 1.** Relationships between basic psychological needs, levels of motivation, PA intentions, PA, and sedentary time. PA=Physical Activity. \*\*\*p<.001. \*\*p<.01. \*p<.05.

#### 4. Discussion

The study’s first objective was to analyze the relationship between the determinants of health in children and adolescents: PA practice, sedentary behaviors, and nutrition, as well as various socio-demographic variables and socio-economic status. The results show that older students adhere less to the Mediterranean diet and engage in less PA both in and out of the school. Furthermore, we observed that girls engage in less PA both in and out of the school, and boys are less sedentary. We also observed that participants with a higher socio-economic status engage in less activity in school, but this increases out of school hours. On the other hand, students with high adherence to the Mediterranean diet engage in more out-of-school PA and are less sedentary.

These results were also found in a study by De Vargas and Herrera (2020), which reports that the dropout rate in physical sports practice worsens significantly,

especially among girls. The explanation for this could be that girls are perceived by PE teachers as less competent and capable than boys, who are offered activities that they enjoy (Serra et al., 2020).

Likewise, similar results were found in Galindo-Perdomo et al. (2023), showing that young people decrease their levels of PA as they grow older. One reason for this finding may be that PA promotion programs conducted in recent years have been effective for younger children and adolescents but were inefficient in mid to late adolescence. Therefore, the differences between these programs should be analyzed to ensure that active lifestyles persist as age increases (Ramos et al., 2016).

On the other hand, our results align with those of Aristizábal (2023), indicating that negative economic conditions and parents’ low educational level, pose a greater risk of obesity to children and adolescents. Therefore, it is necessary to design educational programs promoting PA for disadvantaged populations. In this regard,

studies such as that by Cuervo *et al.* (2017) suggest that higher levels of education and income in families lead to more PA practice with their children. This could be attributed to the fact that parents with higher socio-economic status have more time to spend with their children and, generally, as they have a higher educational background, they are aware of the benefits of adopting a healthy lifestyle, which they instill in their children (Wilk *et al.*, 2018).

Furthermore, our findings are also consistent with Rodríguez *et al.* (2020), who determined that high levels of PA are significantly and directly related to better quality of life, and improved nutrition. This may be because, in the case of girls, engaging in PA may be driven by an interest in maintaining their aesthetic image, leading them to eat a better diet. For boys, the practice of PA and the subsequent attention to nutrition may be motivated by a desire to be more competitive in a particular sport, as well as to maintain better physical condition (Tapia, 2019).

However, these results contrast those of the study by Rodríguez-Cayetano *et al.* (2021), who established that students in lower courses adhere less to the Mediterranean diet than students in higher courses. Similarly, Muñoz-Galiano *et al.* (2019) concluded that the parents' educational level is not significantly related to their children's PA practice. Furthermore, Jiménez *et al.* (2019) showed that after an intervention of redistributing spaces and diversifying activities, the gender effect on PA practice was eliminated, and there were no significant gender differences.

The study's second objective was to test the SDT sequence, where need-supportive behaviors influence types of motivation, which, in turn, influence the intention to be physically active in the future, and to determine how that intention predicts out-of-school PA practice and sedentary behavior. The results reveal that the PE teacher's support of the BPN of competence and

autonomy is positively related to intrinsic motivational regulation, (i.e., intrinsic and identified motivation). Additionally, self-determined regulation correlates positively with the intention to engage in PA, which, in turn, is positively related to out-of-school PA practice and negatively related to sedentary behaviors. On the other hand, support of the BPN of autonomy correlates positively with external regulation. In contrast, support of relatedness correlates negatively with external regulation.

Similar results were found by Pulido *et al.* (2022), who reported a positive relationship between need-supportive behaviors and intrinsic motivation, between identified regulation and support of autonomy, and a negative relationship between amotivation and support of relatedness. These findings may be explained by the fact that when sports coaches or physical education teachers propose activities adapted to the students' abilities, allowing them to develop the activities independently, levels of intrinsic motivation toward practicing physical-sports activity increase (Ryan & Deci, 2000b).

Regarding the relatedness BPN, support of socialization is negatively related to amotivation and predicts the achievement of intrinsic motivation (Puertas, 2022). Concerning our research, we note the study by Hernández-Andreo *et al.* (2021), in which participants stated that support of relatedness is one of the most important reasons for feeling motivated to engage in PA.

Furthermore, our results also align with those of Franco *et al.* (2017), where a significant relationship is revealed between intrinsic motivation, self-esteem, and the intention to be physically active in the future. Thus, the study suggests the inclusion of self-esteem as a mediating construct between student motivation and their intention to engage in PA.

The fact that self-determined regulation predicts the intention to engage in PA may be

due to the teacher's use of strategies to enhance the motivational climate, which can effectively promote the intention to be physically active (Baena-Extremera & Granero-Gallegos, 2015).

Additionally, self-determined participants expressed the intention to be more physically active. This, in turn, led to higher levels of out-of-school PA and fewer sedentary behaviors (Gutierrez, 2014; Trigueros-Ramos et al., 2019). Students who engage in PA for their own interest, enjoyment, or pleasure in movement may do so more frequently and intensely in their leisure time, inevitably leading to fewer sedentary behaviors (De Vargas & Herrera, 2020).

However, our findings contradict those of Manzano and Jiménez-Parra (2022), as these authors concluded that support of the need for autonomy is negatively related to amotivation and positively related to enjoyment.

### 5. Practical Applications.

The following practical applications are drawn from the findings of this study: (1) PE teachers should create environments that support the BPN of competence and autonomy, as this will increase the likelihood of students developing intrinsic motivation towards PA practice; (2) specific interventions targeting gender and age differences in PA participation need to be promoted in PE classes; (3) a holistic approach that considers the interaction between diet, PA, and motivational factors is necessary to promote healthy lifestyles from an early age.

### 6. Conclusions

In relation to the first objective, the findings of this study indicate that the socioeconomic status variable correlates negatively with PA practice in school and positively with out-of-school PA practice. In other words, participants with a higher socioeconomic status tend to engage less PA

in school but increases their out-of-school PA. On the other hand, the adherence to the Mediterranean diet variable correlates positively with out-of-school PA practice and negatively with sedentary behaviors. This suggests that participants with high adherence to the Mediterranean diet tend to engage in more out-of-school PA practice and exhibit fewer sedentary behaviors.

Regarding the second objective, it was found that the PE teacher's support for BPN (competence and autonomy) is positively related to intrinsic motivation and identified regulation. Additionally, it was observed that these two types of motivation are positively related to the intention to engage in future PA, which in turn is positively related to out-of-school PA practice and negatively related to sedentary behaviors.

### 7. Limitations and future prospects

The main limitations of this study are: Firstly, sample size and representativeness: although the study included a substantial number of participants ( $n=561$ ), it may not represent the entire population of adolescents within the region where the investigation was carried out.

Secondly, sampling bias: The participants were selected from specific educational centers, which could introduce bias in the results. For example, students from these centers might not be representative of adolescents from other socio-economic backgrounds or educational settings.

Thirdly, the measurement questionnaires: although validated instruments were used to measure all variables, these tools may not capture the full complexity of the constructs. Additionally, the reliance on self-report measures introduces the potential for response bias or inaccuracies.

On the other hand, the study utilized a cross-sectional design, which captures data at a single point in time. This design precludes establishing causal relationships

between variables and limits the ability to draw conclusions about temporal associations.

Additionally, it should be considered that addressing the first objective of the study through a correlational analysis may present some limitations: (1) absence of a cause-effect relationship between the variables; (2) omission of relevant variables, as the correlational approach could overlook other important variables that could be influencing the results; (3) the interaction among multiple variables in a correlational study may complicate the interpretation of the results.

Furthermore, due to organizational constraints in the educational centers, researchers could not directly administer the questionnaires. Instead, instructions were provided to the participants. This indirect administration method may have affected the quality of responses or led to misunderstandings.

Finally, while the study employed appropriate statistical techniques, such as bivariate correlational analysis and structural equation modeling, the interpretation of results is contingent upon the assumptions underlying these methods and the accuracy of the data.

We propose the following prospective considerations to address these limitations:

Future studies should increase the sample size to enhance the statistical power and improve the representativeness of the findings. This could involve collaborating with more educational centers or recruiting participants from a more diverse range of socio-economic backgrounds within the region.

In the future, it would be interesting to promote research that explores the relationship between other health determinants (such as sleep, addictions...).

Random sampling methods or quota sampling should be used to ensure that participants are selected randomly or in proportion to specific demographic

characteristics, such as gender, ethnicity, or socio-economic status. This could help mitigate potential biases introduced by selecting participants from specific educational centers.

Multiple assessment tools or a combination of quantitative and qualitative methods should be used to measure the constructs of interest and provide a more comprehensive understanding of the phenomena under investigation.

In the future, it would be advisable to analyze the first objective of the study through a regression analysis, as it allows for exploring the relationships between the independent variables and the dependent variable. This approach can help identify the strength and direction of the relationship, as well as control for the effect of other variables.

In addition, it would be interesting to consider employing longitudinal or cohort study designs to investigate the relationships between variables over time and establish causal associations between them. Longitudinal studies would allow researchers to track changes in variables and identify temporal patterns, providing more robust evidence for causal inference.

Also, it should provide clear and detailed instructions to participants, along with opportunities for clarification or assistance by trained researchers, to enhance the quality and accuracy of responses and minimize misunderstandings.

Finally, advanced statistical techniques, such as multilevel modeling or structural equation models with longitudinal data should be utilized, to account for the nested structure of the data and examine complex relationships between variables while controlling for confounding factors.

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