

Factors associated with compliance with physical activity recommendations among adolescents in Huesca¹

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FACTORS ASSOCIATED WITH COMPLIANCE WITH PHYSICAL ACTIVITY RECOMMENDATIONS AMONG ADOLESCENTS IN HUESCA

KEYWORDS: Moderate to vigorous physical activity, Early adolescence, Accelerometry, Motivation, Physical education.

ABSTRACT: Schools have been identified as environments of choice for physical activity promotion. This study examines factors associated with compliance with objectively assessed physical activity recommendations for early adolescents taking part in "Sigue la Huella", a school-based intervention guided by a social ecological framework and Self-Determination Theory (Deci and Ryan, 2002). A total of 200 students (108 boys) aged 12-13 years ($M = 12.16$; $SD = \pm 0.51$), wore accelerometers during a seven-day period and completed a questionnaire. Participants were considered compliant to the recommendations if their moderate to vigorous physical activity, averaged over seven days, was ≥ 60 minutes a day. As a result 57.4% of boys and 9.9% of girls met recommendations. In a multilevel logistic regression model, compliance was higher among boys and students attending private schools, and lower for obese students. Compliance was also associated with higher perceptions of physical competence, higher perceptions of autonomy in physical education, greater importance attached to physical education and less sedentary time. In conclusion, assessed objectively, gender differences in compliance with physical activity recommendations were greater than expected. Self-Determination Theory emerged as a useful framework to identify motivational factors that can be addressed in school-based physical activity interventions and programs for early adolescents.

Physical activity (PA) is associated with many positive health benefits in children and adolescents (Parfitt and Eston, 2005), but many young people do not accumulate sufficient quantities of moderate to vigorous physical activity (MVPA) to satisfy the current recommendations (Pate, 2002). Furthermore, PA tends to decrease from childhood to adolescence (Van der Horst, Paw, Twisk and Van Mechelen, 2007), hence the importance of having an objective estimate of this behaviour during the key transitional period of early adolescence using tools such as accelerometers (Bornstein et al., 2011).

For youth physical activity promotion research to move forward, it is important to better understand the factors that can be targeted in behavioural interventions (Fairclough, Ridgers and Welk, 2012). In addition to modifiable factors, non-modifiable factors (for example, age, gender or socioeconomic level) are useful to identify target populations for interventions (Butcher, Sallis, Mayer and Woodruff, 2008). From a social ecological perspective (Spence and Lee, 2003), it is important to examine together individual and social environmental factors that may impact upon youth PA behaviour in order to determine the unique effect of each factor and identify the factors exerting the greatest impact.

Research has established a relationship between individual demographic and biological factors such as gender (Silva, Aznar, Aires, Generelo, Zaragoza and Mota, 2010), age (Riddoch et al, 2004), socioeconomic status (Mo, Turner, Krewski and Mo, 2005), and weight status (Livingstone, 2001) with participation in PA. In addition to behavioural factors such as sedentary behaviour and participation in organized out of school physical activity (Mandic, García Bengoechea, Stevens, Leon de la Barra and Skidmore, 2012), psychological factors such as the extent to which individuals feel competent in terms of their physical abilities, and find PA enjoyable, have been also identified as individual factors that influence PA in youth (Van der Horst et al., 2007).

In terms of social environmental influences, school-based physical education (PE) has been identified as a context where opportunities exist to promote PA (Sallis, Cervero, Ascher, Henderson, Kraft and Kerr, 2006). Therefore, it is essential to know more about factors that affect students' motivation in PE lessons and their association with participation in PA. One of the most commonly used theories in PA motivation research is Deci and Ryan's Self-Determination Theory (SDT) (Deci and Ryan, 2002). Based on the tenets of SDT, Vallerand (2007) proposed a sequence

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according to which social factors or antecedents (e.g., motivational climate, autonomy support, teaching strategies, etc.) can have an influence on the basic psychological needs of autonomy, competence and relatedness. The degree of satisfaction of these psychological mediators can then affect the extent to which students feel autonomous or self-determined when engaging in activities, which may elicit different forms of motivation (e.g., intrinsic, extrinsic, amotivation) and motivational regulations. The latter, in turn, are associated with a series of affective, cognitive and behavioural consequences relevant to participation in PA, such as the degree to which young people enjoy participating in PA and find it interesting, their actual levels of participation, and how focused or disruptive they are in PE lessons (Van den Bergue, Vansteenkiste, Cardon, Kirk and Haerens, 2014).

Previous research using a SDT perspective has found associations, consistent with theoretical expectations, between social factors in PE, such as the degree of autonomy support that students perceive during lessons, and PA participation (Vansteenkiste, Niemc and Soenens, 2010). Furthermore, a relationship has been established between the importance that students attach to PE and the generation of a habit of practicing PA (Kilpatrick, Hebert and Jacobsen, 2002).

Another variable of interest at the school level for PA participation, which has recently garnered attention in the literature, is the public or private nature of the school that students attend (García Bengoechea, Ruiz Juan, and Bush, 2013; Peiró, Devís, Beltrán and Fox, 2008). In general, studies suggest there is greater variability in levels and patterns of PA of secondary public school students. This greater variability may be due to an effect of day of the week on activity (e.g., with a very active group but also an inactive group during weekends) (Peiró et al., 2008), or more generally, to the more heterogeneous adolescent population typically found in secondary public schools (García Bengoechea et al., 2013). Nevertheless, a recent survey (Consejo Superior de Deportes, 2011) indicates that while participation in organized PA is similar among students from private and public schools (67% vs. 61%, respectively), the gender difference in participation is smaller in private schools.

Correlates of PA in children and adolescents are usually described in relation to MVPA, as this outcome is consistent with public health recommendations, which aim to maximize the health benefits of participation (Fairclough et al, 2012). However, it is usually open to interpretation whether young people are required to meet activity targets (1) all days of the week, (2) on most days of the week, (3) on average across all days, or (4) whether compliance should be understood as the probability that a randomly selected young person meets the recommendations on a randomly selected day (Olds et al., 2007). These different methods of assessing compliance to the recommendations result in different prevalence estimates and may produce different results in analyses of factors associated with compliance or analyses of the impact of interventions.

Based on the previous considerations, the objectives of this study were to obtain an accurate baseline estimate of compliance with PA recommendations for participants in the *Sigue la Huella* ("Follow the Footprint") intervention (Murillo, García Bengoechea, Julián and Generelo, 2014; Murillo, García Bengoechea, Generelo, Zaragoza and Julián, 2014); to identify factors relevant to the youth PA literature upon which to intervene, along with preferential target subgroups; and to examine the usefulness of SDT in the context of objectively

assessed PA research with early adolescents. At the outset, based on previous research (Olds et al., 2007; Currie et al., 2008; Vries, Hopman-Rock, Bakker and Van Mechelen, 2008; Aznar et al., 2010; Abarca-Sos, Zaragoza, Generelo and Julián, 2010), it was hypothesized that less than 60% of participants would be compliant with current PA recommendations. Based on the extant literature (Sallis, Prochaska and Taylor, 2000; Fairclough, 2003; Pate, Ward, Saunders, Felton, Dishman and Dowda, 2005; Simon et al., 2006; Butcher et al., 2008), it was also hypothesized that male participants, those reporting greater perceptions of physical competence, and those who spend less time being sedentary on a daily basis, would be more likely to comply with recommendations. Given the context specific, PE-based nature of the other SDT variables used in this study, and its exploratory nature, no additional hypotheses were advanced at this time.

Method

Participants

The participants in the study belong to the student population of the city of Huesca (Spain). A total of 234 adolescents from four secondary schools (two public and two private) aged 12 and 13 years were recruited for this study as part of the *Sigue la Huella* intervention. *Sigue la Huella* is a school-wide physical activity promotion intervention for adolescents aged 12-15 years. Based on a social ecological framework (Spence and Lee, 2003) and the postulates of SDT, the intervention incorporates strategies to create favourable environments, address barriers, and empower adolescents to live a more physically active life (Murillo et al., 2014; Murillo et al., in press). The study had an experimental mortality of 34 students as they did not satisfy the accelerometry inclusion criterion, a minimum of 10 hours recorded per day (Riddoch et al., 2004). The resulting sample of this study was 200 adolescents (108 boys and 92 girls) with an average age of 12.16 (± 0.51) years. Of these, 142 attended public schools, and 58 private schools.

Instruments

Weight status was calculated based on body mass index (BMI), which we derived from the adolescents' measured weight and height using the formula: $BMI = (\text{weight in kg})/(\text{height in m})^2$. Participants were identified as "normal weight," "underweight," "overweight," or "obese" according to the age- and sex-specific BMI cut-offs proposed by the U.S. Centers for Disease Control (Kuczmarski, Ogden and Grummer-Strawn, 2000). The socioeconomic level of the students (low, middle, high) was determined based on participants' scores on the 4 item Scale of Family Influence from the Health Behaviour in School-aged Children Study (HBSC) (Boyce, Torsheim, Currie and Zambon, 2006). Participation in organized physical activities out of school was also included by way of one single question asking students whether they took part or not in this type of activities.

The instrument chosen to assess perceptions of physical competence was the Spanish version (Goñi, Ruiz de Azúa and Rodríguez, 2006) of the Physical Self Concept Questionnaire, using the six questions of the "physical skill" dimension, with scoring options ranging from one to five. An internal consistency alpha coefficient of 0.83 was obtained in this study. Enjoyment of Physical Activity was measured with the Spanish version (Moreno, González-Cutre, Martínez Galindo, Alonso, and López de San Román, 2008) of the 16 item Physical Activity Enjoyment

Measurement Scale (PACES) (Motl, Dishman, Saunders, Dowda, Felton and Pate, 2001), scored from one to five. The alpha coefficient of this scale was 0.82. For the purposes of the analyses, we used mean scores in both cases.

SDT considers that motivation can either have an internal (more self-determined) or external (less self-determined) origin and establishes three types of motivation: intrinsic motivation, extrinsic motivation, and amotivation. We used a Spanish version (Núñez, Martín-Albo, Navarro and González, 2008) of the Sport Motivation Scale, (SMS, Brière, Vallerand, Blais and Pelletier, 1995) adapted to PE. The scale showed alpha values of 0.86 for intrinsic motivation (12 items), 0.83 for extrinsic motivation (12 items) and 0.49 for amotivation (four items). Scoring options ranged from one to seven. We used mean scores for all motivational subscales in the analyses.

The students' psychological need satisfaction in PE lessons was measured through a questionnaire adapted from the "The Basic Need Satisfaction at Work Scale" (Ilardi, Leone, Kasser and Ryan, 1993), translated into Spanish and adapted to the education context (Moreno, Llamas and Ruiz, 2006). It is comprised of nine items, scored from one to five, grouped into: perceived competence (three items), perceived autonomy (three items) and perceived relatedness to others (three items). The scale displayed alpha values of 0.57 for autonomy, 0.75 for perceived competence and 0.50 for relatedness to others. The variable of importance attached by students to PE was measured by the Physical Education Importance Scale (IEF) (Moreno, González-Cutre, Ruiz, 2009). It is comprised of three items with scores ranging from one to four. The internal consistency alpha coefficient was 0.64. We used mean scores for each subscale in the analyses.

The average daily sedentary activity was obtained via the accelerometer (uniaxial GTIM Actigraph), an objective instrument to measure PA that has the capacity to process and segment the data by time and intensity (Bornstein et al., 2011). Compliance with PA recommendations was also determined based on accelerometer data. To obtain the data for both variables, each participant was assigned an accelerometer in order to record the PA in waking hours over a seven-day period. The cut-points used in this study were 0-99, 100-2291, 2292-4007, ≥ 4008 for sedentary, light, moderate and vigorous activity, respectively (Trost, Loprinzi, Moore and Pfeiffer, 2011). Participants were considered compliant to the recommendations if their MVPA, averaged by the numbers of days for which accelerometer data was available, was ≥ 60 minutes a day (Olds et al., 2007). To be included in the study, participants needed to wear the accelerometer for at least 4 days (3 during week days and 1 during the weekend) (Trost, McIver and Pate, 2005) with a minimum of 10 hours recorded per day (Rowlands, Pilgrim and Eston, 2008).

Although less demanding than other guidelines commonly used internationally (Olds et al., 2007) (i.e., ≥ 60 minutes of MVPA daily, or on most days of the week), this criterion was deemed appropriate given the low PA levels of participants in this study, particularly among girls.

Procedure

Prior to carrying out the research at the schools, a meeting was held with school administrators and personnel to address the objectives, the importance and repercussions of the study. Following approval from the appropriate Ethics Review Board, the first author explained the study to potential participants.

Subsequently, she assigned and monitored the use of accelerometers by participants, administered the survey containing the self-reported study questions during regular school hours and proceeded to take objective measures regarding the participants' height and weight. No other adults were present during the administration of the survey.

Data Analyses

We used a sequential approach for the analyses. First, we calculated descriptive statistics for all predictor variables and the outcome variable. The outcome variable was compliance with physical activity recommendations. Adolescents' gender, socioeconomic status and BMI, participation in organized out of school PA, perceptions of physical competence, enjoyment of physical activity, motivational regulations, psychological need satisfaction in PE lessons, importance attached to PE lessons, and sedentary behavior were the independent variables we used in this study. Second, we performed chi-square tests and analyses of variance (ANOVA) to examine potential associations between the predictor variables and compliance with recommendations. Statistical significance in both cases was set at $p < .05$.

Subsequently, we conducted a multivariate logistic regression analysis to determine how well each independent variable uniquely predicted compliance with recommendations when accounting for all other independent variables in the model. We used generalized estimated equations to fit the logistic regression model in order to account for the hierarchical structure of the data (i.e., students nested within schools) and obtain more robust estimates. Odds ratios were considered significant if their 95% confidence intervals did not cross one. The very low number of girls meeting the PA recommendations in this study prevented us from running two separate logistic regression analyses, which would have been suitable given the well-known gender differences in patterns of PA. Nevertheless, we still examined the interactions between gender and each of the remaining independent variables in terms of their effect on compliance with the recommendations. Since none of these interactions were statistically significant, or meaningful, they were not included in the final multivariate model. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 15.0 (SPSS, Inc., Chicago, IL).

Results

Participants' gender was strongly associated with compliance, with 56.4% of boys and only 9.9% of girls meeting the recommendations (Table 1). ANOVA analyses show that those who comply with the physical activity recommendations had higher perceptions of physical competence, higher levels of intrinsic and extrinsic motivation, and higher perceptions of autonomy in PE. On the other hand, those not meeting the recommendations engaged in higher levels of weekly sedentary behavior (Table 2).

As shown in Table 3, boys in this study were almost 24 times more likely than girls to comply with the recommendations. The odds that students attending private schools comply with the recommendations were almost three times higher than those attending public schools. Furthermore, for every unit increase in the mean of perceptions of physical competence there was a corresponding threefold increase in the odds of meeting recommendations. Likewise, every unit increment in the mean of

perceptions of importance of PE was associated with an increment of almost 1.5 in the odds of complying with the recommendations, and every increment of one unit in the mean of perceptions of autonomy in PE corresponded to an increment of almost twice in the odds of complying with the

recommendations. In contrast, compared with normal weight students, the odds of complying with the recommendations were approximately 30% lower in obese students. Finally, there was a significant negative relationship between sedentary behavior and compliance with recommendations.

Variable	%	X^2	p
Gender		48.59	0.001
Girls	9.9%		
Boys	56.4%		
Type of school		2.30	0.127
Public	32.4%		
Private	43.9%		
Socioeconomic level		0.45	0.798
Low	50%		
Middle	33.3%		
High	35.2%		
Weight Status		2.50	0.473
Underweight	40%		
Normal weight	36.7%		
Overweight	27.5%		
Obese	50%		
Organized out of school PA		2.50	0.115
Yes	27.6%		
No	39.4%		

Table 1. Chi-Square Tests for Compliance with PA Recommendations.

Variable	Does not meet	Meets	All participants		Effect size
	recommendations	recommendations	F	p	
	$MD \pm SD$	$MD \pm SD$			
PA perceptions of competence	3.70±0.75	4.11±0.68	14.34	0.001	0.07
PA enjoyment	4.26±0.48	4.41±0.53	3.71	0.056	0.01
Intrinsic motivation PE	5.08±0.75	5.33±0.79	4.45	0.036	0.02
Extrinsic motivation PE	4.88±0.96	5.26±1.05	6.13	0.014	0.03
Amotivation PE	2.32±1.14	2.13±1.15	1.19	0.276	0.00
Perceptions of competence PE	3.71±0.65	3.95±0.66	6.16	0.014	0.03
Autonomy PE	3.71±0.62	3.85±0.70	2.16	0.143	0.01
Relatedness PE	3.43±0.73	3.43±0.74	0.00	0.978	0.00
Importance of PE	3.29±0.52	3.34±0.60	0.36	0.544	0.00
Average sedentary PA week	483.63±49.80	429.70±48.01	54.90	0.001	0.21

Tabla 2. ANOVA Analyses for Compliance with PA Recommendations.

Compliance with physical activity recommendations

Variable	Beta	SE	p	Adjusted OR	95% CI for adjusted OR	
					Lower	Upper
Gender						
Boys	3.16	0.60	0.001	23.62	7.25	77.44
Girls	.	.	.	1	.	.
Body mass index						
Underweight	-1.22	1.33	0.357	0.29	0.02	3.98
Overweight	-0.89	0.60	0.136	0.40	0.12	1.32
Obese	-0.37	0.13	0.006	0.69	0.53	0.89
Normal weight	.	.	.	1	.	.
Socioeconomic level						
Low	0.03	0.96	0.973	1.03	0.15	6.80
Average	-0.37	0.65	0.565	0.68	0.18	2.48
High	.	.	.	1	.	.
Organized out of school PA						
Yes	-0.43	0.28	0.126	0.64	0.37	1.13
No	.	.	.	1	.	.
Type of school						
Private	1.00	0.14	0.001	2.72	2.04	3.64
Public	.	.	.	1	.	.
Average sedentary PA week	-0.02	0.00	0.001	0.97	0.96	0.98
PA perceptions of competence	1.20	0.52	0.023	3.33	1.18	9.40
PA enjoyment	-0.68	0.39	0.088	0.50	0.23	1.10
Intrinsic motivation PE	-0.34	0.23	0.150	0.71	0.44	1.13
Extrinsic motivation PE	0.22	0.15	0.148	1.25	0.92	1.71
Amotivation PE	0.02	0.37	0.937	1.03	0.49	2.13
Perceptions of competence PE	0.44	0.32	0.179	1.55	0.81	2.96
Relatedness PE	-1.20	0.72	0.100	0.30	0.07	1.25
Autonomy PE	0.55	0.25	0.031	1.73	1.05	2.86
Importance of PE	0.28	0.06	0.001	1.33	1.16	1.52

Abbreviations: CI = confidence interval; OR = odds ratio; SE = standard error

Dash indicates that parameter/value is missing for this category because it is the reference group

Tabla 3. Logistic Regression for Compliance with Physical Activity Recommendations.

Discussion

This study aimed to obtain an accurate baseline estimate of compliance with PA recommendations for adolescents in the *Sigue la Huella* intervention. Other objectives were: to identify factors relevant to the youth PA literature upon which to intervene, along with key target subgroups; and to examine the usefulness of SDT in the context of objectively assessed PA research with early adolescents. We hypothesized that less than 60% of participants would be compliant with current PA recommendations. We also hypothesized that male participants, those reporting greater perceptions of physical competence, and those who spend less time being sedentary on a daily basis, would be more likely to comply with recommendations.

In agreement with our hypotheses, less than 60% of participants complied with international PA recommendations. Using an objective measure of PA, our results contrast with another study that used this same criterion (≥ 60 minutes of MVPA daily, or on most days of the week) (Oldset al., 2007), where 68% of adolescents (aged 13 to 19 years) met the recommendation. However, in the latter study, PA was assessed through self-report, which may help explain, at least in part, the observed differences.

Consistent as well with our initial hypotheses, there were significant differences between genders, and gender was the most important predictive variable in the multivariate model, which is consistent with other studies in which PA was assessed objectively (Van der Horst et al., 2007; Butcher et al., 2008). A

considerably larger number of boys than girls accumulate sufficient PA to obtain health benefits, at least in the sample used in this study, and it is a serious concern that this difference is already present in early adolescence. This emphasizes the need for PA interventions and programs catering specifically to the needs and preferences of girls in this important transitional period (Taber et al., 2011).

In line with hypotheses, and similar to other studies (Fairclough, 2003; Sallis et al., 2000), perceptions of physical competence were also significantly associated with PA. In fact, in the present study this variable was the strongest psychological correlate of compliance with recommendations. As Ryan and Deci (2007) and Ennis (2011) noted, although perceptions of competence can be considered an individual psychological factor, in the school environment this perception can be internalised with the help of the PE teachers, having a direct effect on adolescents' PA behaviour. Likewise, the significant association we found between compliance with recommendations and the importance attached to PE is indicative of the relevance of the school environment for PA promotion, and more specifically of the perceptions that students have of the PE class and of the teachers' instructional behaviours (Duda, 2001).

Similarly, in a PE context, it remains important to understand the motivational variables that are more correlated with participation in PA. The finding that perceptions of autonomy were significantly associated with compliance with recommendations suggests that teachers can empower students and help create a positive climate in PE lessons by fostering meaningful opportunities for student choice and decision-making (Sproule, Wang, Morgan, McNeill and McMorris, 2007).

Echoing previous research (Sproule et al., 2007), results from the univariate analyses support the significant relationship between the students' intrinsic motivation in PE lessons and their PA levels (Table 2). Extending previous research, extrinsic motivation in PE was also positively associated with objectively assessed PA. This suggests PE teachers could also consider supplying extrinsic incentives to students judiciously in order to increase motivation in PE lessons and the chances of students engaging in PA outside of class. However neither of these associations remained significant in the multivariate regression analysis, which suggests their effect may have been mediated, at least in part, by other variables. Longitudinal studies are necessary to better understand the relationship between the motivational variables postulated in SDT and participation in PA during early adolescence.

Also in agreement with our initial hypotheses, we found a negative association between daily sedentary time and compliance with PA recommendations. This stands overall in line with a recent meta-analysis examining associations between sedentary behaviour and physical activity in children and adolescents (Pearson, Braithwaite, Biddle, Van Sluijs and Atkin,

2014). Not surprisingly, several intervention programmes have proposed combining actions to increase PA together with strategies to reduce sedentary behaviours (Simon et al., 2006), or specific interventions with the adolescent population with a greater risk of sedentary lifestyles (Wilson, Evans, Williams, Mixon, Sirard and Pate, 2005).

As observed in other studies (García Bengoechea et al., 2013; Peiró et al., 2008) the type of school (public vs. private), was associated with participation in PA. More specifically, we found that students attending public schools were less likely to comply with recommendations than those enrolled in private centres. These results are partially consistent with Peiró et al., who reported that while adolescents attending public schools have higher PA energy expenditure than those frequenting private schools, particularly during weekends, the percentage of adolescents categorized as "inactive" was also higher among public school students. Likewise, in line with previous research in which PA was assessed objectively (Mota, Santos, Guerra, Ribeiro and Duarte, 2002), the results also show that obese adolescents are less likely to participate in sufficient MVPA than those with normal weight. Therefore, in addition to girls, it seems important to take also into account the PA needs of students attending public schools and those who are obese to guide the development of PA interventions for early adolescents.

This study has several limitations. First, data on motivational factors are self-reported, which may have introduced biases in some responses. Second, the study design is cross-sectional, which limits the extent of the inferences we can make about the direction of the observed associations. Third, the study sample, although representative of the population of the schools from which it was drawn, is not necessarily representative of the larger adolescent population of Huesca, which limits the external validity of the findings. Finally, some of the psychosocial subscales we used displayed low internal consistency values. Therefore, the findings concerning these subscales should be interpreted with caution.

In conclusion, our data indicate low compliance with PA recommendations among study participants in general, but particularly among girls and, to a lesser extent, among public school students and obese students. Assessed objectively, gender differences in compliance with PA recommendation were even greater than initially expected. Consistent with a social ecological perspective, we found associations between compliance with PA recommendations and variables from different levels of organization (demographic and biological, behavioural, psychological) and settings (public vs. private schools, physical education lessons). Overall, the pattern of observed relationships provides also support for the suitability of SDT in the context of PA research and intervention with early adolescents. Findings will serve the key purpose of having baseline data for comparative purposes to assess accurately the impact of the *Sigue la Huella* intervention (Cavill, Roberts and Rutter, 2012).

Compliance with physical activity recommendations

FACTORES ASOCIADOS CON EL CUMPLIMIENTO DE LAS RECOMENDACIONES DE ACTIVIDAD FÍSICA ENTRE LOS ADOLESCENTES DE HUESCA

PALABRAS CLAVE: Actividad física moderada-vigorosa, Jóvenes adolescentes, Acelerometría, Motivación, Educación física.

RESUMEN: Los centros escolares han sido identificados como los entornos seleccionados para la promoción de la actividad física. Este estudio examina los factores asociados con el cumplimiento de las recomendaciones de actividad física evaluados objetivamente para los jóvenes adolescentes que forman parte de "Sigue la Huella", una intervención basada en el entorno escolar guiada por un marco social ecológico y la teoría de la Autodeterminación (Deci y Ryan, 2002). Un total de 200 estudiantes (108 chicos) de 12 y 13 años ($M = 12,16$; $DE = \pm 0,51$), llevaron acelerómetros durante un período de siete días y completaron un cuestionario. A los participantes se les consideraba conformes a las recomendaciones si su actividad física moderada-vigorosa, como promedio durante los siete días, era ≥ 60 minutos al día. Como resultado, el 57.4% de los chicos y el 9.9% de las chicas cumplieron las recomendaciones. En un modelo multinivel de regresión logística, el cumplimiento fue mayor entre los chicos y los estudiantes que asisten a colegios privados, y menor para los estudiantes obesos. El cumplimiento también se asoció con una mayor percepción de competencia física, una mayor percepción de la autonomía en la educación física, mayor importancia que se le concede a la educación física y con un menor tiempo sedentario. En conclusión, a partir de la valoración objetiva, las diferencias de género en el cumplimiento de las recomendaciones de actividad física fueron mayores de lo esperado. La teoría de la Autodeterminación surgió como un marco útil para identificar los factores motivacionales que pueden ser abordados en las intervenciones y programas de actividad física en el ámbito escolar para los jóvenes adolescentes.

References

- Abarca-Sos, A., Zaragoza, J., Generelo, E. and Julián, J. A. (2010). Sedentary behaviors and physical activity patterns in adolescents. *International Journal of Medicine and Science of Physical Activity and Sport*, 10, 410-427.
- Aznar, S., Naylor, P. J., Silva, P., Pérez, M., Angulo, T., Laguna, M., Lara, M. T. and López-Chicharro, J. (2010). Patterns of physical activity in Spanish children: a descriptive pilot study. *Child: care, health and development*, 37, 322-328.
- Bornstein, D. B., Beets, M. W., Byun, W., Welk, G., Bottai, M., Dowda, M. and Pate, R. (2011). Equating accelerometer estimates of moderate-to-vigorous physical activity: In search of the Rosetta Stone. *Journal of Science and Medicine in Sport*, 14, 404-410.
- Boyce, W., Torsheim, T., Currie, C. and Zambon, A. (2006). The family affluence scale as a measure of national wealth: validation of an adolescent self-report measure. *Social Indicators Research*, 78, 473-487.
- Brière, N. M., Vallerand, R. J., Blais, M. R. and Pelletier, L. G. (1995). Développement et validation d'une mesure de motivation intrinsèque, extrinsèque et d'amotivation en contexte sportif: l'échelle de motivation dans les sports (EMS). *International Journal of Sport Psychology*, 26, 465-489.
- Butcher, K., Sallis, J. F., Mayer, J. A. and Woodruff, S. (2008). Correlates of physical activity guideline compliance for adolescents in 100 U.S. Cities. *Journal of Adolescent Health*, 42, 360-368.
- Cavill, N., Roberts, K. and Rutter, H. (2012). *Standard evaluation framework for physical activity interventions*. National Obesity Observatory.
- Consejo Superior de Deportes. (2011). Encuesta de hábitos deportivos de la población escolar en España. Consejo Superior de Deportes.
- Currie, C., Gabbain, S. N., Godeau, E., Roberts, C., Smith, R., Currie, D., Pickett, W., Richter, M., Morgan, A. and Barnekow, V. (Eds.) (2008). Inequalities in Young People's Health: HBSC International Report from the 2005/2006 Survey. Copenhagen: WHO Regional Office for Europe. (Health Policy for Children and Adolescents, nº 5).
- Deci, E. L. and Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.
- Duda, J. L. (2001). Ejercicio físico, motivación y salud: aportaciones de la teoría de las perspectivas de meta, pp. 271-281 en *La Educación Física, el Deporte y la Salud en el siglo XXI*, Alicante, Marfil.
- Ennis, C. D. (2011). Physical education curriculum priorities: Evidence for education and skillfulness. *Quest*, 63, 5-18.
- Fairclough, S. (2003) Physical activity, perceived competence and enjoyment during secondary school physical education. *European Journal of Physical Education*, 8, 5-18.
- Fairclough, S. J., Ridgers, N. D. y Welk, G. (2012). Correlates of children's moderate and vigorous physical activity during weekdays and weekends. *Journal of Physical Activity and Health*, 9, 129-137.
- García Bengoechea, E., Ruiz Juan, F. y Bush, P. L. (2013). Delving into the social ecology of leisure time physical activity among adolescents from south eastern Spain. *Journal of Physical Activity and Health*, 10, 1136-1144.

B. Murillo Pardo, E. García Bengoechea, A. Aibar Solana, J. A. Julián Clemente, L. García González, J. Martín-Albo y S. Estrada Tenorio

- Gofi, A., Ruiz de Azúa, S. y Rodríguez, S. (2006). *Cuestionario de Autoconcepto Físico (CAF)*. Manual EOS, Madrid.
- Ilardi, B., Leone, D., Kasser, T. y Ryan, R. M. (1993). Employee and supervisor ratings of motivation: Main effects and discrepancies associated with job satisfaction and adjustment in a factory setting. *Journal of Applied Social Psychology*, 23, 1789-1805.
- Kilpatrick, M., Hebert, E. y Jacobsen, D. (2002). Physical activity motivation. A practitioner's guide to SDT. *Journal of physical education, recreation and dance*, 74, 36-41.
- Kuczmarski, R. J., Ogden, C. L. y Grummer-Strawn, L. M. (2000). *CDC. Growth Charts*: United States, 314, 1-28.
- Livingstone, M. B. (2001). Childhood obesity in Europe: a growing concern. *Public Health Nutrition*, 4, 109-116.
- Mandic, S., García Bengoechea, E., Stevens, E., Leon de la Barra, S. y Skidmore, P. (2012). Getting kids active by participating in sport and doing it more often: focusing on what matters. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 86-95. doi:10.1186/1479-5868-9-86
- Mo, F., Turner, M., Krewski, D. y Mo, H. D. (2005). Physical inactivity and socioeconomic status in Canadian adolescents. *International Journal of Adolescent Medicine and Health*, 17, 49-56.
- Moreno, J. A., González-Cutre, D. y Ruiz, L. M. (2009). Self-determined motivation and physical education importance. *Motricidad. European Journal of Human Movement*, 10, 1-7.
- Moreno, J. A., González-Cutre, D., Martínez Galindo, C., Alonso, N. y López de San Román, M. (2008). Propiedades psicométricas de la Physical Activity Enjoyment Scale (PACES) en el contexto español. *Estudios de Psicología*, 29, 173-180.
- Moreno, J. A., Llamas, L. S. y Ruiz, L. M. (2006). Perfiles motivacionales y su relación con la importancia concedida a la Educación Física. *Psicología Educativa*, 12, 49-63.
- Mota, J., Santos, P., Guerra, S., Ribeiro, J. y Duarte, J. (2002). Differences of daily physical activity levels of children according to body mass index. *Pediatric Exercise Science*, 14, 442-452.
- Motl, R., Dishman, R., Saunders, R., Dowda, M., Felton, G. y Pate, R. (2001). Measuring enjoyment of physical activity in adolescent girls. *American Journal of Preventive Medicine*, 21, 110-117.
- Murillo, B., García Bengoechea, E., Julián, J. A. y Generelo, E. (2014). Empowering adolescents to be physically active: Three-year results of the Sigue la Huella intervention. *Preventive Medicine*, 66, 6-11.
- Murillo, B., García Bengoechea, E., Generelo, E., Zaragoza, J. y Julián, J.A. (2014). Effects of the three-year Sigue la Huella intervention on sedentary time in secondary school students. *European Journal of Public Health*, DOI: 10.1093/eurpub/cku194
- Núñez, J. L., Martín-Albo, J., Navarro, J. G. y González, V. M. (2006). Preliminary validation of a Spanish version of the Sport Motivation Scale. *Perception Motor Skills*, 102, 919-930.
- Olds, T., Ridley, K., Wake, M., Hesketh, K., Waters, E., Patton, G. y Williams, J. (2007). How should activity guidelines for young people be operationalised?. *International Journal of Behavioral Nutrition Physical Activity*, 4, 5868-5874.
- Parfitt, G. y Eston, R. G. (2005). The relationship between children's habitual activity level and psychological well-being. *Acta Paediatric*, 94, 791-797.
- Pate, R. (2002). Compliance with physical activity guidelines prevalence in a population of children and youth. *Annals of Epidemiology*, 12, 303-308.
- Pate, R. R., Ward, D. S., Saunders, R. P., Felton, G., Dishman, R. K. y Dowda, M. (2005). Promotion of physical activity among high-school girls: a randomised controlled trial. *American Journal of Public Health*, 95, 1582-1587.
- Pearson, N., Braithwaite, R. E., Biddle, S. J. H., Van Sluijs, E. M. F. y Atkin, A. J. (2014). Associations between sedentary behavior and physical activity in children and adolescents: a meta-analysis. *Obesity Review*, doi: 10.1111/obr.12188.
- Peiró, C., Devis, J., Beltran, V. J. y Fox, K. R. (2008). Variability of spanish adolescents' physical activity patterns by seasonality, day of the week and demographic factors. *European Sport Sciences*, 8, 163-171.
- Riddoch, C. J., Andersen, L. B., Wedderkopp, N., Harro, M., Klasson-Heggebo, L., Sardinha, L. B., Cooper, A. R. y Ekelund U. (2004). Physical activity levels and patterns of 9-and 15-yr-old European children. *Medicine Science of Sport and Exercise*, 36, 86-92.
- Rowlands, A. V., Pilgrim, E. L. y Eston, R. G. (2008) Patterns of habitual activity across weekdays and weekend days in 9-11-year-old children. *Preventive Medicine*, 46, 317-324.
- Ryan, R. M. y Deci, E. L. (2007). *Active human nature: Self-determination theory and the promotion and maintenance of sport, exercise, and health*. In M. S. Hagger, y N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 1-19). Champaign, IL: Human Kinetics.
- Sallis, J. F., Prochaska J. J. y Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32, 963-975.
- Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K. y Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review Public Health*, 27, 297-322.
- Silva, P., Aznar, S., Aires, L., Generelo, E., Zaragoza, J. y Mota, J. (2010). Differences in the physical activity pattern between portuguese and spanish adolescents. *Archives of Exercise in Health and Disease*, 1, 26-31.
- Simon, C., Wagner, A., Platat, C., Arveiler, D., Schweitzer, B., Schlienger, J. L. y Triby, E. (2006). ICAPS: a multilevel program to improve physical activity in adolescents. *Diabetes Metabolic*, 32, 41-49.
- Spence, J. C. y Lee, R. E. (2003). Toward a comprehensive model of physical activity. *Psychology of Sport and Exercise*, 4, 7-24.
- Sproule, J., Wang, J., Morgan, K., McNeill, M. y McMorris, T. (2007). Effects of motivational climate in Singaporean physical education lessons on intrinsic motivation and physical activity intention. *Personality and Individual Differences*, 43, 1037-1049.
- Taber, D. R., Stevens, J., Lytle, L. A., Foreman, R. D., Moody, J., Parra-Medina, D. y Pratt, C.A. (2011). Association between school-and non school-based activity programs and physical activity in adolescent girls. *Journal of Physical Activity and Health*, 8, 971-977.
- Trost, S. G., McIver, K. L. y Pate, R. R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise*, 37, 531-543.
- Trost, S. G., Loprinzi, P. D., Moore, R. y Pfeiffer, K. A. (2011). Comparison of accelerometer cut-points for predicting activity intensity in youth. *Medicine and Science in Sports and Exercise*, 43, 1360-1368.
- Vallerand, R. J. (2007). *Intrinsic and Extrinsic Motivation in Sport and Physical Activity. A Review an a Look at the Future*. In G. Tenenbaum and R. C. Eklund (Eds.). *Handbook of Sport Psychology* (3ª ed., pp. 59-83). New York: John Wiley and Sons. doi:10.1002/9781118270011.ch3
- Van den Berghe, L., Vansteenkiste, M., Cardon, G., Kirk, D. y Haerens, L. (2014) Research on self-determination in physical education: key findings and proposals for future research. *Physical Education and Sport Pedagogy*, 19, 97-121.
- Van der Horst, K., Paw, M. J., Twisk, J. W. y Van Mechelen, W. (2007). A brief review on correlates of physical activity and sedentariness in Routh. *Medicine and Science in Sport and Exercise*, 39, 1241-1250.

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- Vansteenkiste, M., Niemiec, C. y Soenens, B. (2010). *The development of the five mini-theories of self-determination theory: an historical overview, emerging trends, and future directions*. In T. C. Urdan, y S. A. Karabenick (Eds.), *Advances in motivation and achievement. The decade ahead* (pp. 105-166). UK: Emerald Publishing.
- Vries, S. I., Hopman-Rock, M., Bakker, I. y Van Mechelen, W. (2008). Meeting the 60-Min Physical Activity Guideline: Effect of Operationalization. *Medicine and Science in Sports and Exercise*, 41, 81-86.
- Wilson, D. K., Evans, A. E., Williams, J., Mixon, G., Sirard, J. R. y Pate, R. (2005). A preliminary test of a student-centered intervention on increasing physical activity in underserved adolescents. *Annals of Behavioral Medicine*, 30, 119-124.