

## Article

# Adherence to 24-Hour Movement Guidelines among Spanish Adolescents: Differences between Boys and Girls

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**Abstract:** Background: The 24-Hour Movement Guidelines for adolescents recommend  $\geq 60$  min/day of moderate-to-vigorous physical activity (PA),  $\leq 2$  h/day of screen time, and 8–10 h/day of sleep. Since little information is available on the 24-Hour Movement Guidelines in Spanish adolescents, this study aims to estimate the proportion of Spanish adolescents meeting individual and combinations of these 24-Hour Movement Guidelines. Moreover, another aim of this study is to examine gender differences in compliance with 24-Hour Movement Guidelines. Methods: A final sample of 1465 Spanish adolescents (44.50% girls;  $13.08 \pm 0.86$ ) participated in this cross-sectional study. The 24-Hour Movement Guidelines were measured during weekdays and the weekend days by self-reported questionnaires. Results: Although most adolescents met sleep duration guidelines (81.3%), only 38% and 15.8% met physical activity and screen time guidelines, respectively. Only 5.4% of these adolescents met all three 24-Hour Movement Guidelines, whereas 10.2% of this sample did not meet any of these guidelines. Although boys reported greater compliance with physical activity recommendations and girls with screen time recommendations, no significant gender differences were found in the compliance of all three 24-Hour Movement Guidelines. Conclusion: Given that 94.4% of Spanish adolescents did not meet 24-Hour Movement Guidelines, promoting all these three movement behaviours in both boys and girls is an urgent public health priority.

**Keywords:** physical activity; prevalence; 24-Hour Movement Guidelines; recommendations; screen time; sedentary; sex; sleep; youth



**Citation:** Tapia-Serrano, M.A.; Sevil-Serrano, J.; Sánchez-Miguel, P.A. Adherence to 24-Hour Movement Guidelines among Spanish Adolescents: Differences between Boys and Girls. *Children* **2021**, *8*, 95. <https://doi.org/10.3390/children8020095>

Received: 31 December 2020

Accepted: 28 January 2021

Published: 1 February 2021

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## 1. Introduction

It is well established that the adoption of a healthy lifestyle, characterized by high levels of physical activity, low levels of screen time, and optimal sleep duration, provides additional health benefits than the adoption of just one of these behaviours [1–3]. Although these health-related behaviours have usually been studied in isolation, compelling evidence shows that these movement behaviours interact across the whole day (24-hour period) [2,4–6]. Therefore, an increase in one of these movement behaviours (e.g., sleep duration) could be related to a decrease in other movement behaviours (e.g., physical activity), due to the finite amount of time in a single 24-hour period [7]. The 24-Hour Movement Guidelines for children and adolescents provide a new holistic approach to youth health promotion by integrating all 24-hour time-use continuum behaviours. Therefore, this integrative approach states that the whole day matters on health indicators [8,9].

These guidelines propose that adolescents should engage in at least 60 minutes per day of moderate-to-vigorous physical activity [8,10], should avoid spending more than 2 hours per day in leisure-time screen time (such as watching television, playing videogames, surfing the internet or social networks) [8,11], and should accumulate an optimal sleep duration per day (8–10 h/day) [5,8]. Adhering to all three 24-Hour Movement Guidelines has been related to more physical, social, and cognitive health benefits than meeting just one or none [3,9,12].

However, most existing studies have reported that less than 10% of adolescents met the 24-Hour Movement Guidelines [13–32]. These aforementioned studies have found inconsistent results in the proportion of adolescents who meet the 24-Hour Movement Guidelines, which have ranged from 0.3% to 2.0% in Asian [14,21,26] 3.1% in South Americans [25], 2.2% to 9.4% in North Americans (ranging from 2.2% to 5.2% in Canadian and from 5.0% to 9.4% in American) [4,15,16,18,22–24,28–33], and from 1.7% to 2.2% in European [17,19,27]. Most adolescents met sleep duration recommendations [13–15,17–22,25,28–32], whereas less than half of adolescents met physical activity [13,15–18,20–23,25–31] and screen time [14,19,32] recommendations in these mentioned studies.

Moreover, inconsistent results were also found in the proportion of adolescents who do not meet any of these three 24-Hour Movement Guidelines, which have ranged from 5.1% to 38.7% in Asian [14,21,26], 32.97% in South Americans [25], 9.1% to 42.0% in North Americans (ranging from 12.5% to 42.0% in Canadian and from 9.1% in American) [15,16,18,20,22–24,28–32,34], and from 8.7% to 36.4% in European [17,19,27]. These differences in 24-Hour Movement Guidelines across countries may be explained by social (e.g.; age and gender), cultural (e.g.; ethnicity), or economic (e.g.; socioeconomic status or family structure) factors [34]. Therefore, more research about the prevalence of these 24-Hour Movement Guidelines in different countries is required.

To our knowledge, there is only one study that has analyzed the proportion of Spanish adolescents meeting the 24-Hour Movement Guidelines [19]. The study conducted by Sevil-Serrano et al. [19] showed that only 1.7% of participants met physical activity, screen time, and sleep duration recommendations, while 8.2% did not comply with any of these 24-Hour Movement Guidelines. Most of the adolescents of this study met sleep duration recommendations (88%), while only 21.4% and 1.7% of adolescents simultaneously met the physical activity and screen time recommendations, respectively. No gender differences in the meeting of 24-Hour Movement Guidelines were found in this study [19]. However, these findings cannot be generalized to the rest of the Spanish adolescents, because this study only included a small and non-representative sample of two high schools ( $n = 173$ ) [19]. Given this limitation, more studies that examine the adherence to 24-Hour Movement Guidelines among Spanish adolescents are needed. In addition to the study mentioned above [19], only one study has examined gender differences in 24-Hour Movement Guidelines [26]. No gender differences in meeting physical activity, screen time, and sleep duration guidelines, separately or jointly, were found in this study [26].

Since little information is available on the 24-Hour Movement Guidelines in Spanish adolescents, this study has two aims: (1) to identify the proportion of Spanish adolescents meeting individual and combinations of these 24-Hour Movement Guidelines and; (2) to examine gender differences in compliance with 24-Hour Movement Guidelines.

## 2. Materials and Methods

### 2.1. Design and Participants

The present cross-sectional study was developed within a project aimed at promoting healthy behaviours among youth [35]. The baseline data were collected, before the COVID-19 pandemic, from March to June 2019 in Extremadura (Spain). In total, 2217 adolescents, from 22 high schools, initially participated for this study. Of the 2217 adolescents, 752 participants were excluded because physical activity ( $n = 122$ ) and screen time ( $n = 630$ ) were not reported, respectively. A final sample of 1465 adolescents (652 girls;  $13.05 \pm 0.83$  years, and 813 boys;  $13.11 \pm 0.89$  years), aged between 11 to 16 years old ( $13.08 \pm 0.86$  years), participated in the study (student response rate was 66.1%).

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Extremadura (89/2016).

## 2.2. Measures

### 2.2.1. 24-Hour Movement Guidelines

#### Physical Activity

Physical activity was measured using the Spanish version of the Physical Activity Questionnaire for Adolescents (PAQ-A; [36]). The instrument comprises nine items that relate to the type and frequency of participation in physical activities over the last 7 days. Participants self-reported the frequency of participation of a list of activities or moments such as physical education, school break, lunchtime, after school, evenings, and weekends. Each answer is scored on a 5-point scale ranging from 1 to 5. To compute the physical activity index score, the average value of all responses (higher scores indicate higher levels of physical activity) was calculated. The physical activity recommendations were categorized based on a cut-off score of 2.75 points to discriminate between “active” and “non-active” adolescents [37].

#### Screen Time

Screen time was obtained using an adapted version of the Youth Leisure-Time Sedentary Behaviour Questionnaire (YLSBQ; [38]), validated in Spanish children and adolescents. The students self-reported their daily average time spent on four screen behaviours (i.e., TV, videogames, computer, and mobile phone). The daily average time spent on each sedentary screen behaviour was calculated using a ratio of 5:2 (i.e., ((Daily screen time on weekend days  $\times$  5) + (Daily screen time on weekend days  $\times$  2))  $\div$  7). Total daily screen time was measured summing the different daily screen time behaviours.

#### Sleep Duration

Participants self-reported sleep duration for weekdays and weekend days. Daily sleep duration was assessed by weighting weekday and weekend day at a ratio of 5:2 (i.e., ((Daily sleep duration on weekday  $\times$  5) + (Daily sleep duration on weekend days  $\times$  2))  $\div$  7).

The 24-Hour Movement Guidelines for adolescents recommend  $\geq 60$  min/day of moderate-to-vigorous physical activity,  $\leq 2$  h/day of screen time, and 8–10 h/day of sleep. Participants were classified into two groups for each movement behaviour: “meeting guidelines” and “not meeting guidelines” [39].

## 2.3. Procedure

The research team contacted the school principal and teachers to carry out this study. Parents were informed by letter about the nature and purpose of the study and written informed consent was required from both adolescents and their parents/legal guardians. The paper-and-pencil survey was administered by one member of the research team for approximately 30 min.

## 2.4. Statistical Analysis

All analyses were performed using SPSS version 23.0 (IBM, Armonk, NY, USA), and the level of significance was set at  $p < 0.05$ . Descriptive statistics were used to examine the daily average time spent in physical activity, screen time, and sleep duration, as well as the proportion of participants meeting individual 24-Hour Movement Guidelines (i.e., not meeting recommendations, meeting PA only, meeting ST only, and meeting SD only) and in combination (i.e., meeting PA + ST only, meeting PA + SD only, meeting ST + SD only, and meeting all three recommendations). Gender differences in 24-Hour Movement Guidelines were assessed using t Student’s for continuous variables and chi-square test for categorical variables. Given a significant interaction between physical activity, screen time, and sleep duration in relation to gender were found (all,  $p > 0.05$ ), analyses were performed in both boys and girls.

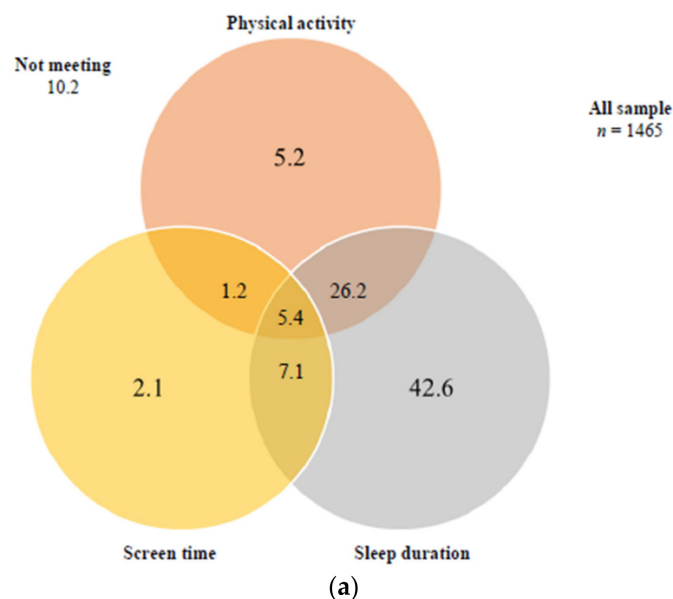
### 3. Results

Descriptive characteristics of the participants and the prevalence of the three 24-Hour Movement Behaviours are presented in Table 1. The physical activity index score was found to be close to the mean value of the scale (2.53 of 5). Average screen time and sleep duration were 4.5 h/day and 8.65 h/day, respectively. Although boys reported higher physical activity levels than girls, no differences in screen time and sleep duration were found.

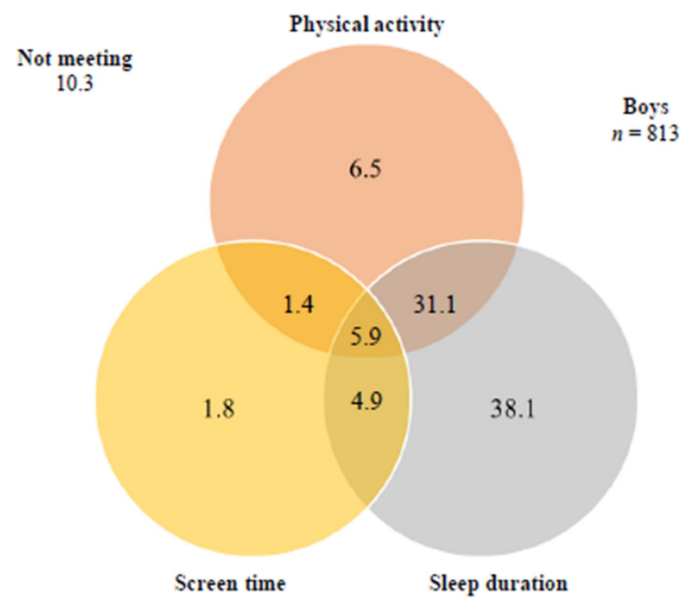
**Table 1.** Descriptive characteristics of the participants and prevalence of the three 24-hour Movement Behaviours among boys and girls.

Study Variables	Total	Boys	Girls	p
	M ± SD	M ± SD	M ± SD	
n (%)	1465 (100.00)	813 (55.50)	652 (44.50)	
Age groups n (%)				
1st graders (11–12 years)	362 (24.70)	198 (24.40)	164 (25.20)	
2nd graders (13–14 years)	682 (46.60)	367 (45.10)	315 (48.30)	0.239
3rd graders (15–16 years)	421 (28.70)	248 (30.50)	173 (26.50)	
Physical activity (1–5)	2.53 ± 0.60	2.63 ± 0.59	2.40 ± 0.58	<0.001
Screen time (h/day)	4.51 ± 2.26	4.62 ± 2.21	4.39 ± 2.33	0.054
Sleep duration (h/day)	8.65 ± 0.93	8.64 ± 0.98	8.66 ± 0.87	0.608

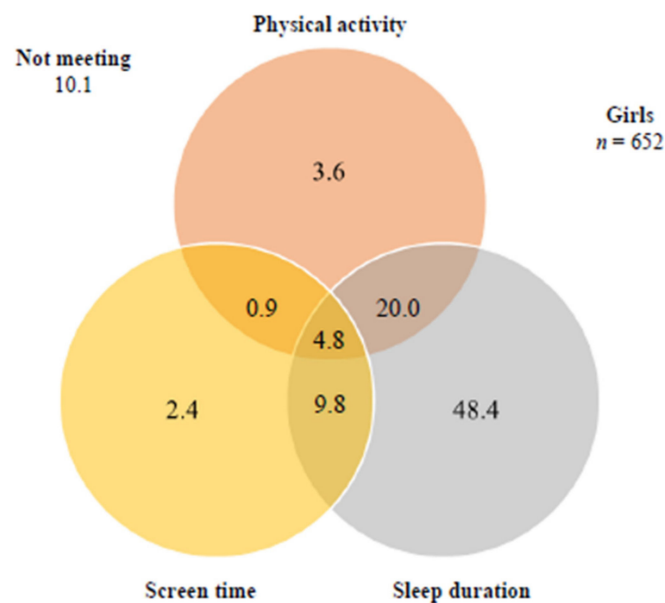
Figure 1 shows the proportion of adolescents meeting 24-Hour Movement Guidelines separately and in all possible combinations. Most of the adolescents (81.3%) met sleep duration guidelines, but only 38% and 15.8% met physical activity and screen time guidelines, respectively. Only 10.2% of the sample did not meet any of these guidelines, 49.9% met exclusively one guideline, 34.5% met exclusively two guidelines, and, finally, 5.4% of the sample met all three guidelines. Boys reported significantly greater compliance with physical activity recommendations (6.5% vs. 3.6%) and the combination of physical activity and sleep duration recommendations (31.1% vs. 20.0%) than girls. Girls reported significantly greater compliance with screen time recommendations (2.4% vs. 1.8%) and the combination of screen time and sleep duration recommendations (9.8% vs. 4.9%) than boys.



**Figure 1.** Cont.



(b)



(c)

**Figure 1.** Venn diagram showing the proportion (%) of participants meeting 24-Hour Movement Guidelines separately and in all possible combinations. (a) Venn diagram showing the proportion (%) of participants meeting no guidelines; physical activity, sedentary screen time and sleep duration guidelines; and combinations of these guidelines, in the full study sample ( $n = 1465$ ). Legend: recommendations are:  $\geq 60$  min/day of moderate-to-vigorous physical activity; no more than 2 h/day of screen time and 8–10 h/day of sleep duration. The sum of each circle is equivalent to the % meeting each individual recommendation (i.e., 38.0% for physical activity, 15.7% for sedentary screen time and 81.3% for sleep duration); (b) Venn diagram showing the proportion (%) of participants meeting no guidelines; physical activity, sedentary screen time and sleep duration guidelines; and combinations of these guidelines, in boys ( $n = 813$ ). The sum of each circle is equivalent to the % meeting each individual guideline (i.e., 44.9% for physical activity, 14.0% for sedentary screen time and 80% for sleep duration); (c) Venn diagram showing the proportion (%) of participants meeting no guidelines; physical activity, sedentary screen time and sleep duration guidelines; and combinations of these guidelines, in girls ( $n = 652$ ). The sum of each circle is equivalent to the % meeting each individual guideline (i.e., 29.3% for physical activity, 17.9% for sedentary screen time and 83.0% for sleep duration).

Moreover, as shown in Table 2, the proportion of girls who met exclusively one guideline was higher than boys. Otherwise, the number of boys who met exclusively two guidelines were greater than girls.

**Table 2.** Meeting of 24-Hour Movement Guidelines among adolescents' boys and girls.

Meeting 24-Hour Movement Guidelines	Total	Boys	Girls	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Not meeting guidelines	150 (10.20)	84 (10.30)	66 (10.10)	0.483
Meeting exclusively 1 guideline	731 (49.90)	377 (46.40)	354 (54.30)	<0.010
PA	556 (38.00)	365 (44.90)	191 (29.30)	<0.001
ST	200 (15.80)	114 (14.00)	117 (17.90)	<0.050
SD	1191 (81.30)	650 (80.00)	541 (83.00)	0.079
Meeting exclusively 2 guidelines	505 (34.50)	304 (37.40)	201 (30.80)	<0.010
PA + ST	96 (6.60)	59 (7.30)	37 (5.70)	0.133
PA + SD	433 (31.60)	280 (37.00)	153 (24.80)	<0.001
ST + SD	178 (12.50)	87 (10.80)	91 (14.60)	<0.050
Meeting 3 guidelines				
PA + ST + SD	79 (5.40)	48 (5.90)	31 (4.80)	0.198

PA: physical activity; ST: screen time; SD: sleep duration.

#### 4. Discussion

The main findings of this study revealed that a low proportion of Spanish adolescents met combination of physical activity, screen time, and sleep duration guidelines. Moreover, boys reported a higher percentage of physical activity recommendations and the combination of physical activity and sleep duration recommendations than girls. Otherwise, the number of girls who met screen time recommendations and the combination of screen time and sleep duration recommendations were greater than boys.

Only 5.4% of adolescents (5.9% boys and 4.8% girls) met the three 24-Hour Movement Guidelines, while 10.2% of adolescents (10.3% of boys and 10.1% of girls) did not meet any of these three recommendations. The adherence to 24-Hour Movement Guidelines found in our study is higher than those found in the studies conducted with European [17,19,27] and Asian adolescents [14,21,26] and lower than several studies conducted in the United States (5.0%–9.4%) [16,22,23]. However, our results are similar to the results found in Canadian adolescents [15,18,28–33]. These results underline the importance of addressing these movement behaviours from an integrative and holistic approach to increase physical activity and sleep duration and decrease screen time [8]. Regarding gender, no significant differences were found in meeting all three 24-Hour Movement Guidelines in both and girls. In addition, while boys reported a higher prevalence of combined physical activity and sleep duration recommendations, girls revealed greater compliance with the combination of screen time and sleep duration recommendations.

Less than half of the adolescents met physical activity recommendations (38.0%). Regarding gender, boys (44.9%) reported higher adherence to physical activity guidelines than girls (29.3%). According to our results, a previous study conducted with a 1.6 million population revealed that 77.6% of adolescents' boys and 84.7 of adolescents' girls did not meet physical activity guidelines [40]. This study showed that the gender differences for physical activity recommendation are getting bigger in the last fifteen years, especially in some high-income countries, such as Ireland and the United States. Therefore, promoting physical activity, particularly among girls, is one of the biggest challenging today. Given that global trends in meeting physical activity recommendations are decreasing, new policies and action plans are needed to promote and increase physical activity in adolescents, particularly in girls. There are examples such as This Girl Can campaign developed in the United Kingdom, whose aim was to develop social marketing campaigns combined with community-based interventions to increase physical activity levels in girls [41].

Screen time guidelines were only achieved by 15.8% of adolescents. The proportion of students met screen time guidelines varies substantially from one study to another [42].

Specifically, a range between 25.7% and 40.1% have been found in European adolescents ranging in age from 14 to 18 years [17,27]. However, our results are slightly better than those found in a recent study conducted in Spanish adolescents, which reported that only 1.7% met the screen time guidelines [19]. Differences in compliance with the screen recommendations between studies could be explained by the type of questionnaire used to measure screen time. While some studies have only assessed television viewing time, other studies have assessed a wide range of screen-based behaviours [42]. Previous research has revealed an increased time spent on screen-based sedentary behaviours such as television, computers, videogames, and, especially, mobile phones in adolescents from developed countries [42], which may explain why many adolescents do not meet screen time guidelines. Given the breakthrough of new technologies in developed countries, practitioners, and policymakers should reconsider new screen time guidelines for each screen-based sedentary behaviour [19]. Moreover, in this investigation, girls (17.9%) were more likely to meet screen time guidelines than boys (14.0%). Our results are consistent with those found in the study by Guthold et al. [40] who reported higher compliance with screen time recommendations in girls. Differences have also been found between boys and girls regarding screen media use [7,43]. Generally, boys tend to spend more time on video games and computers [7], while girls spend more time talking on the phone, listening to music and using social networks [43].

Most adolescents met sleep time recommendations (81.3%). Unlike physical activity and screen time recommendations, no gender differences were found for sleep duration guidelines. Other studies have shown that between 40.1% and 25.7% of European adolescents meet sleep duration recommendations [17,27]. However, a recent study conducted in Spanish adolescents also found that 89.0% of adolescents met sleep duration guidelines [19]. Although sleep duration was adequate for most adolescents, almost 20.0% of adolescents reported low sleep duration, negatively affecting their health. Sleep duration is critical for the well-being of children and adolescents [44]. Previous studies have shown that an of lack sleep duration during adolescence may results in symptoms of mental health diagnoses, including depression and anxiety [45], poor health behaviours decisions, including overeating, skipping exercise, or misusing drugs such as caffeine, nicotine, or other stimulants [46].

#### *4.1. Practical Implications*

A few students comply with the recommendations for physical activity, screen time and sleep duration. Thus strategies and programs to promote adherence to the 24-Hour Movement Guidelines among Spanish adolescents are needed. Given the low compliance of adolescents with physical activity recommendations and, especially, screen time recommendations, special attention should be paid to these behaviours.

In this sense, school can be an ideal environment to promote adolescents' health-related behaviours [47–49]. School-based lifestyle interventions can involve teachers, school staff, and families in developing and implementing programs to promote health-related behaviours in young people. For example, parental restrictions on the use of media, particularly one hour before bedtime, encouraging physical activity during school breaks [50], and promoting physical activity outside of school and active commuting [51] may be some strategies that could be used to reallocate sedentary time to active behaviours or optimal sleep duration.

#### *4.2. Limitations, Future Perspectives, and Strengths*

This study has several limitations that future research should address. Firstly, although validated and reliable questionnaires were used, self-reported measures to assess the 24-Hour Movement Guidelines could underestimate or overestimate the results. Secondly, only four of the twelve items of YLSBQ were included in the present study (i.e., television, videogames, computer, and mobile phone). It must be noted that these four screen-based behaviours are those with the highest prevalence among Spanish adolescents [52].

Finally, although a large sample of Spanish adolescents was used, the sample was not representative of the whole Spanish adolescents. Moreover, the response rate to the study was low because some adolescents did not complete the entire questionnaire. Future studies should use a larger representative sample of Spanish adolescents and measure the different movement behaviours through objective measures such as accelerometers. Another research field of research is to examine the temporal stability of these 24-Hour Movement Guidelines of Spanish adolescents using a longitudinal design. Finally, multiple health behaviour change interventions in Spanish adolescents' boys and girls are required to improve these behaviours. Despite these limitations, this study has some strengths that should be acknowledged. This research is the first to examine, in a large sample of Spanish adolescents, the adherence to 24-Hour Movement Guidelines. Moreover, very few studies have examined gender differences in 24-Hour Movement Guidelines.

## 5. Conclusions

This study has revealed that only 5.4% of the Spanish adolescents met the three 24-Hour Movement Guidelines, whereas 10.2% did not meet any recommendations. Although boys reported greater compliance with PA recommendations and girls with screen time recommendations, no significant gender differences in the compliance of all three 24-Hour Movement Guidelines were found. Finally, futures policies and interventions should promote the 24-Hour Movement Guidelines behaviours among boys and girls, following an integrated and holistic approach.

**Author Contributions:** Conceptualization, M.A.T.-S. and J.S.-S.; methodology, M.A.T.-S. and P.A.S.-M.; software, M.A.T.-S.; formal analysis, M.A.T.-S.; investigation, M.A.T.-S., J.S.-S. and P.A.S.-M.; resources, M.A.T.-S.; data curation, M.A.T.-S. and P.A.S.-M.; writing—original draft preparation, M.A.T.-S.; writing—review and editing, M.A.T.-S. and J.S.-S.; visualization, P.A.S.-M.; supervision, J.S.-S.; project administration, P.A.S.-M.; funding acquisition, P.A.S.-M. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by Ethics Committee of the University of the Extremadura (89/2016).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Authors will be happy to share data analyses to with those who request it.

**Acknowledgments:** This study was funded by the European Community and Ministry of Economy of Extremadura (IB16193). We gratefully acknowledge the financial support of the Ministry of Economy and Infrastructures and European Community. M.A.T.-S is supported by the Ministry of Economy and Infrastructures of Extremadura (PD18015). The authors wish to thank the schools, children, and their parents who, generously, volunteered to participate in the study. We also acknowledge all the staff members involved in the fieldwork and data analysis for their efforts and great enthusiasm.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Chaput, J.-P.; Carson, V.; Gray, C.; Tremblay, M. Importance of all movement behaviors in a 24 Hour period for overall health. *Int. J. Environ. Res. Public Health* **2014**, *11*, 12575–12581. [[CrossRef](#)] [[PubMed](#)]
2. Saunders, T.J.; Gray, C.E.; Poitras, V.J.; Chaput, J.-P.; Janssen, I.; Katzmarzyk, P.T.; Olds, T.; Connor Gorber, S.; Kho, M.E.; Sampson, M.; et al. Combinations of physical activity, sedentary behaviour and sleep: Relationships with health indicators in school-aged children and youth. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S283–S293. [[CrossRef](#)] [[PubMed](#)]
3. Carson, V.; Chaput, J.P.; Janssen, I.; Tremblay, M.S. Health associations with meeting new 24-hour movement guidelines for Canadian children and youth. *Prev. Med.* **2017**, *95*, 7–13. [[CrossRef](#)] [[PubMed](#)]



4. Janssen, I.; Roberts, K.C.; Thompson, W. Is adherence to the Canadian 24-hour movement behaviour guidelines for children and youth associated with improved indicators of physical, mental, and social health? *Appl. Physiol. Nutr. Metab.* **2017**, *42*, 725–731. [[CrossRef](#)] [[PubMed](#)]
5. Chaput, J.-P.; Gray, C.E.; Poitras, V.J.; Carson, V.; Gruber, R.; Olds, T.; Weiss, S.K.; Connor Gorber, S.; Kho, M.E.; Sampson, M.; et al. Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S266–S282. [[CrossRef](#)] [[PubMed](#)]
6. Poitras, V.J.; Gray, C.E.; Borghese, M.M.; Carson, V.; Chaput, J.P.; Janssen, I.; Katzmarzyk, P.T.; Pate, R.R.; Connor Gorber, S.; Kho, M.E.; et al. Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S197–S239. [[CrossRef](#)]
7. Olds, T.S.; Maher, C.A.; Ridley, K.; Kittel, D.M. Descriptive epidemiology of screen and non-screen sedentary time in adolescents: A cross sectional study. *Int. J. Behav. Nutr. Phys. Act.* **2010**, *7*, 1–9. [[CrossRef](#)]
8. Tremblay, M.S.; Carson, V.; Chaput, J.-P.; Connor Gorber, S.; Dinh, T.; Duggan, M.; Faulkner, G.; Gray, C.E.; Gruber, R.; Janson, K.; et al. Canadian 24-hour movement guidelines for children and youth: An integration of physical activity, sedentary behaviour, and sleep. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S311–S327. [[CrossRef](#)]
9. Rollo, S.; Antsygina, O.; Tremblay, M.S. The whole day matters: Understanding 24-hour movement guideline adherence and relationships with health indicators across the lifespan. *J. Sport Health Sci.* **2020**, *9*, 493–510. [[CrossRef](#)]
10. World Health Organization. *Global Recommendations on Physical Activity for Health*; World Health Organization: Geneva, Switzerland, 2010.
11. Carson, V.; Hunter, S.; Kuzik, N.; Gray, C.E.; Poitras, V.J.; Chaput, J.-P.; Saunders, T.J.; Katzmarzyk, P.T.; Okely, A.D.; Connor Gorber, S.; et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth: An update. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S240–S265. [[CrossRef](#)]
12. Roman-Viñas, B.; Chaput, J.P.; Katzmarzyk, P.T.; Fogelholm, M.; Lambert, E.V.; Maher, C.; Maia, J.; Olds, T.; Onywera, V.; Sarmiento, O.L.; et al. Proportion of children meeting recommendations for 24-hour movement guidelines and associations with adiposity in a 12-country study. *Int. J. Behav. Nutr. Phys. Act.* **2016**, *13*, 1–10. [[CrossRef](#)]
13. Lee, E.Y.; Spence, J.C.; Tremblay, M.S.; Carson, V. Meeting 24-hour movement guidelines for children and youth and associations with psychological well-being among South Korean adolescents. *Ment. Health Phys. Act.* **2018**, *14*, 66–73. [[CrossRef](#)]
14. Howie, E.K.; Joosten, J.; Harris, C.J.; Straker, L.M. Associations between meeting sleep, physical activity or screen time behaviour guidelines and academic performance in Australian school children. *BMC Public Health* **2020**, *20*, 520. [[CrossRef](#)]
15. Bang, F.; Roberts, K.C.; Chaput, J.P.; Goldfield, G.S.; Prince, S.A. Physical activity, screen time and sleep duration: Combined associations with psychosocial health among Canadian children and youth. *Health Rep.* **2020**, *31*, 9–16. [[CrossRef](#)]
16. Zhu, X.; Healy, S.; Haegele, J.A.; Patterson, F. Twenty-four-hour movement guidelines and body weight in youth. *J. Pediatr.* **2020**, *218*, 204–209. [[CrossRef](#)]
17. Jakubec, L.; Gába, A.; Dygrýn, J.; Rubín, L.; Šimůnek, A.; Sigmund, E. Is adherence to the 24-hour movement guidelines associated with a reduced risk of adiposity among children and adolescents? *BMC Public Health* **2020**, *20*, 1–8. [[CrossRef](#)]
18. De Guimarães, R.F.; Gilbert, J.-A.; Lemoyne, J.; Mathieu, M.-E. Better health indicators of FitSpirit participants meeting 24-h movement guidelines for Canadian children and youth. *Health Promot. Int.* **2020**, 1–10. [[CrossRef](#)] [[PubMed](#)]
19. Sevil-Serrano, J.; Aibar-Solana, A.; Abós, Á.; Julián, J.A.; García-González, L. Healthy or unhealthy? The cocktail of health-related behavior profiles in Spanish adolescents. *Int. J. Environ. Res. Public Health* **2019**, *16*, 3151. [[CrossRef](#)] [[PubMed](#)]
20. Sampasa-Kanyinga, H.; Colman, I.; Goldfield, G.S.; Janssen, I.; Wang, J.L.; Hamilton, H.A.; Chaput, J.P. Associations between the Canadian 24 h movement guidelines and different types of bullying involvement among adolescents. *Child. Abuse. Negl.* **2020**, *108*, 1–12. [[CrossRef](#)] [[PubMed](#)]
21. Shi, Y.; Huang, W.Y.; Yu, J.J.; Wong, S.H.S. Compliance with the 24-h movement guidelines in Hong Kong adolescents: Associations with body mass index. *Med. Sci. Sport. Exerc.* **2019**, *51*, 52. [[CrossRef](#)]
22. Haegele, J.A.; Aigner, C.J.; Healy, S. Prevalence of meeting physical activity, screen-time, and sleep guidelines among children and adolescents with and without visual impairments in the United States. *Adapt. Phys. Act. Q.* **2019**, *36*, 399–405. [[CrossRef](#)] [[PubMed](#)]
23. Burns, R.D.; Bai, Y.; Pfladderer, C.D.; Brusseau, T.A.; Byun, W. Movement behaviors and perceived loneliness and sadness within Alaskan adolescents. *Int. J. Environ. Res. Public Health* **2020**, *17*, 6866. [[CrossRef](#)] [[PubMed](#)]
24. Knell, G.; Durand, C.P.; Kohl, H.W.; Wu, I.H.C.; Pettee Gabriel, K. Prevalence and likelihood of meeting sleep, physical activity, and screen-time guidelines among US youth. *JAMA Pediatr.* **2019**, *173*, 387–389. [[CrossRef](#)] [[PubMed](#)]
25. Da Costa, B.G.G.; Chaput, J.P.; Lopes, M.V.V.; Malheiros, L.E.A.; Tremblay, M.S.; Silva, K.S. Prevalence and sociodemographic factors associated with meeting the 24-hour movement guidelines in a sample of Brazilian adolescents. *PLoS ONE* **2020**, *15*, 1–12.
26. Ying, L.; Zhu, X.; Haegele, J.; Wen, Y. Movement in high school: Proportion of Chinese adolescents meeting 24-hour movement guidelines. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2395. [[CrossRef](#)] [[PubMed](#)]
27. Rubín, L.; Gába, A.; Dygrýn, J.; Jakubec, L.; Materová, E.; Vencálek, O. Prevalence and correlates of adherence to the combined movement guidelines among Czech children and adolescents. *BMC Public Health* **2020**, *20*, 1692. [[CrossRef](#)] [[PubMed](#)]
28. Lien, A.; Sampasa-Kanyinga, H.; Colman, I.; Hamilton, H.A.; Chaput, J.P. Adherence to 24-hour movement guidelines and academic performance in adolescents. *Public Health* **2020**, *183*, 8–14. [[CrossRef](#)]

29. Sampasa-Kanyinga, H.; Chaput, J.P.; Goldfield, G.S.; Janssen, I.; Wang, J.L.; Hamilton, H.A.; Colman, I. 24-Hour Movement Guidelines and Suicidality Among Adolescents. *J. Affect. Disord.* **2020**, *274*, 372–380. [[CrossRef](#)]
30. Sampasa-Kanyinga, H.; Chaput, J.P.; Goldfield, G.S.; Janssen, I.; Wang, J.L.; Hamilton, H.A.; Ferro, M.A.; Colman, I. The Canadian 24-Hour Movement Guidelines and Psychological Distress among Adolescents: Les Directives canadiennes en matière de mouvement sur 24 heures et la détresse psychologique chez les adolescents. *Can. J. Psychiatry* **2020**, 1–10. [[CrossRef](#)]
31. Chemtob, K.; Reid, R.E.R.; de Guimarães, R.F.; Henderson, M.; Mathieu, M.E.; Barnett, T.A.; Tremblay, A.; Van Hulst, A. Adherence to the 24-hour movement guidelines and adiposity in a cohort of at risk youth: A longitudinal analysis. *Pediatr. Obes.* **2020**, 1–11. [[CrossRef](#)]
32. Buchan, M.C.; Carson, V.; Faulkner, G.; Qian, W.; Leatherdale, S.T. Factors associated with students meeting components of Canada's new 24-hour movement guidelines over time in the compass study. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5326. [[CrossRef](#)]
33. Sampasa-Kanyinga, H.; Colman, I.; Goldfield, G.S.; Hamilton, H.A.; Chaput, J.P. Sex differences in the relationship between social media use, short sleep duration, and body mass index among adolescents. *Sleep Health* **2020**, *6*, 601–608. [[CrossRef](#)] [[PubMed](#)]
34. Janssen, I.; Roberts, K.C.; Thompson, W. Adherence to the 24-hour movement guidelines among 10- to 17-year-old Canadians. *Health Promot. Chronic Dis. Prev. Can.* **2017**, *37*, 369–375. [[CrossRef](#)] [[PubMed](#)]
35. Sánchez-Miguel, P.A.; Vaquero-Solís, M.; Sánchez-Oliva, D.; Pulido, J.J.; López-Gajardo, M.A.; Tapia-Serrano, M.A. Promoting healthy lifestyle through basic psychological needs in inactive adolescents: A protocol study from self-determination approach. *Sustainability* **2020**, *12*, 5893. [[CrossRef](#)]
36. Martínez-Gómez, D.; Martínez-de-Haro, V.; Pozo, T.; Welk, G.J.; Villagra, A.; Calle, M.E.; Marcos, A.; Veiga, O.L. Fiabilidad y validez del cuestionario de actividad física PAQ-A en adolescentes españoles. *Rev. Esp. Salud Pública* **2009**, *83*, 427–439. [[CrossRef](#)] [[PubMed](#)]
37. Benítez-Porres, J.; Alvero-Cruz, J.R.; De Albornoz, M.C.; Correas-Gómez, L.; Barrera-Expósito, J.; Dorado-Guzmán, M.; Moore, J.B.; Carnero, E.A. The influence of 2-year changes in physical activity, maturation, and nutrition on adiposity in adolescent youth. *PLoS ONE* **2016**, *11*, e0162395. [[CrossRef](#)]
38. Cabanas-Sánchez, V.; Martínez-Gómez, D.; Esteban-Cornejo, I.; Castro-Piñero, J.; Conde-Caveda, J.; Veiga, Ó.L. Reliability and validity of the Youth Leisure-time Sedentary Behavior Questionnaire (YLSBQ). *J. Sci. Med. Sport* **2018**, *21*, 69–74. [[CrossRef](#)]
39. Tremblay, M.S.; Chaput, J.P.; Adamo, K.B.; Aubert, S.; Barnes, J.D.; Choquette, L.; Duggan, M.; Faulkner, G.; Goldfield, G.S.; Gray, C.E.; et al. Canadian 24-hour movement guidelines for the early years (0–4 years): An integration of physical activity, sedentary behaviour, and sleep. *BMC Public Health* **2016**, *17*, 874. [[CrossRef](#)]
40. Guthold, R.; Stevens, G.A.; Riley, L.M.; Bull, F.C. Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1.6 million participants. *Lancet Child. Adolesc. Health* **2020**, *4*, 23–35. [[CrossRef](#)]
41. World Health Organization. *Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World*; World Health Organization: Geneva, Switzerland, 2018.
42. Bucksch, J.; Sigmundova, D.; Hamrik, Z.; Troped, P.J.; Melkevik, O.; Ahluwalia, N.; Borraccino, A.; Tynjälä, J.; Kalman, M.; Inchley, J. International trends in adolescent screen-time behaviors from 2002 to 2010. *J. Adolesc. Health* **2016**, *58*, 417–425. [[CrossRef](#)]
43. Bauer, K.W.; Friend, S.; Graham, D.J.; Neumark-Sztainer, D. Beyond screen time: Assessing recreational sedentary behavior among adolescent girls. *J. Obes.* **2012**, *2012*. [[CrossRef](#)] [[PubMed](#)]
44. Bowers, J.M.; Moyer, A. Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: A meta-analysis. *Sleep Health* **2017**, *3*, 423–431. [[CrossRef](#)] [[PubMed](#)]
45. Wheaton, A.G.; Chapman, D.P.; Croft, J.B. School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. *J. Sch. Health* **2016**, *86*, 363–381. [[CrossRef](#)] [[PubMed](#)]
46. Mingos, K.E.; Redeker, N.S. Delayed school start times and adolescent sleep: A systematic review of the experimental evidence. *Sleep Med. Rev.* **2016**, *28*, 86–95. [[CrossRef](#)] [[PubMed](#)]
47. Tapia-Serrano, M.Á.; Sevil-Serrano, J.; Sánchez-Oliva, D.; Vaquero, M.; Sánchez-Miguel, P.A. *Promoción de Comportamientos Saludables en Niños de Educación Primaria Desde el Plan de Acción Tutorial*; Wanceulen S. L.: Seville, Spain, 2020; ISBN 978-84-18486-15-9.
48. Sevil, J.; García-González, L.; Abós, Á.; Generelo, E.; Aibar, A. Can high schools be an effective setting to promote healthy lifestyles? Effects of a multiple behavior change intervention in adolescents. *J. Adolesc. Health* **2019**, *64*, 478–486. [[CrossRef](#)]
49. Tapia-Serrano, M.A.; Esteban-Cornejo, I.; Rodríguez-Ayllon, M.; Vaquero-Solís, M.; Sánchez-Oliva, D.; Sánchez-Miguel, P.A. Adherence to the Mediterranean diet and academic performance in adolescents: Does BMI status moderate this association? *Clin. Nutr.* **2021**, 115800. [[CrossRef](#)]
50. Boberska, M.; Horodyska, K.; Kruk, M.; Knoll, N.; Hohl, D.H.; Keller, J.; Luszczynska, A. Parental strategies restricting screen use among children, screen home environment, and child screen use as predictors of child body fat: A prospective parent-child study. *Br. J. Health Psychol.* **2019**, *24*, 298–314. [[CrossRef](#)]
51. Sánchez-Miguel, P.A.; Sánchez-Oliva, D.; Vaquero-Solís, M.; Pulido, J.J.; Tapia-Serrano, M.A. Relationship between the average slope in the active commuting to and from school and fitness in adolescents: The mediator role of fatness. *PeerJ* **2020**, *2020*, 1–13. [[CrossRef](#)]
52. Montañes, L.S.; Solana, A.A.; García-Gonzalez, L.; Catalán, A.A.; Sevil-Serrano, J. "Hyperconnected" adolescents: Sedentary screen time according to gender and type of day. *Eur. J. Hum. Mov.* **2019**, *43*, 49–66. [[CrossRef](#)]