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Meeting 24-h movement guidelines: Prevalence, correlates, and associations with socioemotional behavior in Spanish minors

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The aims of this study were to determine for the first time the prevalence of a national sample of Spanish minors meeting the 24-h movement guidelines; to determine their correlates; and to examine their associations with socioemotional behavioral problems. Cross-sectional data from the Spanish National Health Survey (2017) were analyzed for this study. A total of 3772 Spanish minors were included. Physical activity was parent-reported by a modified short version of the International Physical Activity Questionnaire, which included a single question related to the participation in physical activity in free time. Recreational screen time was parent-reported by asking respondents for weekdays and weekends independently: "How much time does your child typically spend in front of a screen, including a computer, tablet, television, video, video game, or cell phone screen?". Sleep duration was parent-reported by the following question: "Can you tell me approximately how many hours your child usually sleeps daily?". The Strengths and Difficulties Questionnaire was applied for the evaluation of socioemotional behavioral problems. The prevalence of meeting of all the three guidelines was 13.5%. Compared to meeting all guidelines, higher odds of socioemotional behavioral problems were found in participants meeting two guidelines (OR = 1.42; CI95%, 1.10–1.83), one guideline (OR = 1.50; 95%CI,1.14–1.96), or none of the guidelines (OR = 1.92; 95%CI,1.30–2.83). Our study demonstrated that the proportion of Spanish minors who meet with all the 24-h movement guidelines is low. Furthermore, it could be relevant to the promotion of the 24-h movement guidelines to prevent the risk of socioemotional behavioral problems.

KEYWORDS

lifestyle, physical activity, sedentary behavior, sleep, youth mental health, mental health

1 | INTRODUCTION

Mental health complications among young people, referred to social, emotional, and behavioral problems[1] involve serious modifications in the way that they normally behave, handle, or learn their emotions. As a result, this is causing them distress and they are experiencing difficulties in their relationships and daily life activities.[2] These complications, such as anxiety, depression, and behavioral disorders, are the leading causes of illness and disability among young people.[3] Strikingly, for most of these mentioned problems, no assistance is sought and no care is received,[3] and the majority of these complication are undertreated and underdiagnosed.[4] A meta-analysis has found that the pooled estimated prevalence of suffering any mental health complication among children and adolescents was 13.4%.[5] Most mental health complications begin in childhood[3] and have been shown to remain considerably stable over time.[6] Therefore, early identification and treatment of such complications is essential during this life period.[6]

Sleep, physical activity (PA), and sedentary behavior (including screen time (ST)) are associated with a wide range of important health and developmental benefits in children and adolescents.[7] To date, most research has examined these behaviors in isolation. However, recently, the focus has shifted to a more integrated approach, recognizing that 24-h movement behaviors are co-dependent.[8] Such guidelines acknowledge that the clustering and interactions among all components of 24-h movement should be targeted to maximize health benefits.[8] Despite these health benefits, a recent systematic review and meta-analysis by Tapia-Serrano et al.[51] has reported that the overall adherence to the 24-h movement guidelines is 7.12%.

Some sociodemographic, lifestyle, and environmental factors have been previously found to be correlates of meeting 24-h movement guidelines.[9] For instance, Rubín et al.[10] showed that Czech children had higher odds of meeting specific combinations of two guidelines if they reported regular fruit and vegetable intake, participated in organized PA, or if their fathers had a university degree. Similar evidence related to Spanish children and adolescents is lacking.

Only few studies have assessed the association between meeting the 24-h movement guidelines (i.e., PA, sleep duration, and recreational ST) and socioemotional behavior among young people. Zhu et al.[11] reported that meeting all three 24-h movement guidelines was associated with lower odds of anxiety (children and adolescents) and depression (adolescents). Sampasa-Kanyinga et al.[12] found that meeting the 24-h movement guidelines was linked to better self-rated physical and mental health among adolescents. However, to date, there are no studies examining the association between meeting the 24-h movement guidelines and socioemotional behavioral problems including preschoolers, children, and adolescents. Moreover, scientific literature about this issue is scarce in European countries and, specifically, there are no studies conducted in Spain examining this relationship. Understanding if meeting the 24-h movement guidelines is linked to lower odds of socioemotional behavioral problems is important to help design evidence-informed interventions aimed at improving the health of young people.[9]

Based on the above, the aim of this study was threefold: first, to determine for the first time the prevalence of a national sample of Spanish preschoolers (3–5 years), children (6–12 years) and adolescents (13–14 years) meeting the 24-h movement guidelines (in insolation or in combination); second, to determine the correlates of that meeting; and third, to examine the associations between meeting these guidelines and socioemotional behavioral problems in Spanish minors.

2 | MATERIAL AND METHODS

2.1 | Population sample and study design

Cross-sectional data from the nationally representative Spanish National Health Survey (2017)[13] were analyzed for this study. The survey was conducted by the Spanish Ministry of Health, Consumer Affairs and Social Welfare and the National Statistics Institute.[14] The sampling framework involved non-institutionalized Spanish citizens. A three-stage sampling design was applied: (1) first stage (census section); (2) second stage (households); and (3) third stage (individuals). Within each household an adult (aged 15 years or older) was selected to complete the Adult Questionnaire and if there were minors in the household (from 0 to 14 years of age) a minor was also selected with parents/guardians completing the Minors Questionnaire. The participants were informed about the survey methodology by an explanatory letter from the Ministry of Health, Consumer Affairs and Social Welfare, defining the survey's objectives, the voluntary and anonymous nature of their participation, and the appointment with a qualified and authorized interviewer. The public and anonymized data from the Spanish National Health Survey (2017) were acquired from the Ministry of Health, Consumer Affairs and Social Welfare.[13] As this is a study using secondary data, no requirement of Ethics Committee approval was needed.

For the purpose of this study, the sample was restricted to young people aged 0–14 years (Minors Questionnaire). The sample originally included 6106 (100.0%) participants. The final sample included 3772 (61.8%) Spanish

preschoolers, children and adolescents. Information about the selection process of the study sample is shown in Figure S1. In addition, the characteristics and differences according to the participants' exclusion/inclusion are shown in Table S1.

2.2 | Procedures

2.2.1 | 24-h movement behaviors

Physical activity was assessed by a modified short version of the International Physical Activity Questionnaire,[15] which included a single question related to the participation in PA in free time. Although not validated, this single-item question is being used in the different waves of the Spanish National Health Survey. Four possible responses were offered: (a) "no exercise" (free-time mainly occupied by sedentary activities such as going to the cinema, watching TV, reading, ...); (b) "occasional PA or sport"; (c) "PA several times monthly"; and (d) "sports or physical training several times weekly."[16] In the absence of a specific measure to assess meeting with the PA guideline, we used the category "sports or physical training several times weekly" as a proxy for that guideline. Recreational ST was assessed by asking respondents for weekdays and weekends independently: "How much time does your child typically spend on weekdays/weekends in front of a screen, including a computer, tablet, television, video, video game, or cell phone screen?". The possible options were (a) "nothing or almost nothing"; (b) "<1 hour"; and (c) "≥1 hour". If participants reported "≥1 hour," they were additionally asked about the exact number of hours they spent with ST. Recreational ST guidelines were established following the World Health Organization international guidelines for children under 5 years[11] (under 2-years: no ST; 2- to 4-years: ≤1 h/day) and the Canadian guidelines on ST for young people[10] (5- to 14-years: ≤2 h/day of ST). Sleep duration was assessed by the following question: "Can you tell me approximately how many hours your child usually sleeps daily? (Including nap times)". The proportion of young people meeting the sleep guideline was determined by the National Sleep Foundation's sleep duration guidelines[17]: preschoolers (from 10 to 13 h/day of sleep); children (from 9 to 11 h/day of sleep); adolescents (from 8 to 10 h/day of sleep).

2.2.2 | Potential correlates

Age (preschoolers: aged 4–5 years, children: aged 6–12 years, and adolescents: aged 13–14 years), gender (male/female), and immigrant status (i.e., nationality) were reported by the parents/guardians. SES was established according to the reference person's work occupation. SES categories ranged from "class 1" (the highest) to "class 6" (the lowest). For further analyses, these six original categories were collapsed into 3 groups: a) "high SES" ("class 1" and "class 2"); b) "medium SES" ("class 3" and "class 4"); and, c) "low SES" ("class 5" and "class 6"). To provide information about the different Spanish regions, the Human Development Index (HDI) was determined for each of them.[14] Similarly, the S80/S20 ratio was computed, which depicts the relative disparity in the distribution of a given order of magnitude, such as wage, income, and standard of living.[14] For additional analyses, both and HDI and S80/S20 ratio were divided into tertiles. Weight and height were reported by parents/guardians. Body mass index (BMI) was computed by dividing weight (in kilograms) by height (in meters squared). BMI (z-score) and, then, excess weight were calculated following the International Obesity Task Force criteria.[18] Diet quality was determined by the Spanish Health Eating Index (S-HEI),[19] which is an adapted version of the original Healthy Eating Index (HEI).[16] The S-HEI includes 10 food groups (e.g., fruit, vegetables, and dairy products) divided into five categories related to food consumption: (a) "never or hardly ever"; (b) "one time per week"; (c) "from one to two times per week"; (d) "more than three times per week, but not daily", and (e) "daily", following the Spanish Society of Community Nutrition guidelines.[20] The overall score for the S-HEI was computed by summing the frequency of food group consumption (0–10 points), and it reflects the meeting of the Spanish Society of Community Nutrition guidelines (i.e., higher S-HEI score means higher meeting these guidelines). To obtain balanced groups, S-HEI score was categorized into tertiles: (a) "high-quality diet" (first tertile); (b) "medium-quality diet" (second tertile); and, (c) "low-quality diet" (third tertile).

2.2.3 | Socioemotional behavioral problems

The Strengths and Difficulties Questionnaire (SDQ)[21] parents' version form was applied for the evaluation of different behavioral, emotional, and social problems of the young people. In this study, the SDQ Spanish version was administered.[22,23] The SDQ contains a total of 25 items with five different subscales: (a) "emotional problems," (b) "conduct problems," (c) "hyperactivity," (d) "peer problems," and (e) "prosocial behavior". A Likert-scale with three possible options (0: "not true"; 1: "somewhat true"; and 2: "certainly true") was applied. Each subscale offers a different score (0–10 points). The first four subscales (emotional problems, conduct problems, hyperactivity,

and peer problems) were used to establish a total score of socioemotional behavioral problems. The original 3-band categorization of SDQ includes: "unlikely" (0–13 points), "borderline" (14–16 points), or "abnormal" (17–40 points). For additional analyses, the SDQ score was dichotomized into: (a) "no socioemotional behavioral problems" ("normal", and "borderline"); and, (b) "socioemotional behavioral problems" ("abnormal").

2.3 | Statistical analysis

Descriptive data are shown as numbers and frequencies for categorical variables and mean and standard deviation for continuous variables. Chi-squared test was used to verify differences between categorical variables. Fisher's exact tests were employed instead of chi-squared test when sample sizes are small. Student's *t*-test was applied to examine differences between continuous variables. The proportion of young people who met the 24-h movement guidelines was determined. Then, a logistic regression analysis was conducted to determine the correlates of meeting these guidelines. All the potential covariates were included as independent variables and meeting the 24-h movement guidelines was incorporated as the dependent variable; covariates with a *p*-value below .05 were retained as correlates of meeting the 24-h movement guidelines. Additionally, a logistic regression analysis was conducted to assess the association between meeting the 24-h movement guidelines (independent variable) and socioemotional behavioral problems (dependent variable), adjusting by immigrant status, SES, HDI, S80/S20 ratio, BMI (*z*-score), and diet quality (adding gender and age for total sample analyses). We applied the survey functions in STATA 16.1 (StataCorp) to conduct all analyses in order to consider the population weighting for each participant. Statistical significance was set at $p < .05$.

3 | RESULTS

Table 1 shows the characteristics of study participants. Males were younger (9.4 ± 3.1 years) than females (9.7 ± 3.1 years) ($p = .002$). The global prevalence of excess weight (overweight and obesity) was 38.4% (without significant differences between males and females). Females showed a higher S-HEI score (diet quality) than males ($p = .020$). Males presented higher SDQ mean score (8.0 ± 5.3) than females (6.9 ± 5.0) ($p < .001$).

The prevalence of the sample meeting the 24-h movement guidelines is shown in Figure 1. The total prevalence of meeting of all the three guidelines was 13.5%. Although no significant differences were found ($p = .266$), a greater proportion of males (14.1%) met all the 24-h movement guidelines than females (12.8%). In terms of age group, the highest prevalence of meeting with 24-h movement guidelines was found in schoolchildren, both males (15.0%) and females (15.6%). The only significant age group differences were found for females ($p < .001$). Further information about the prevalence of meeting different 24-h movement guidelines is shown in Figure S2.

The associations between meeting all three 24-h movement guidelines and the potential correlates are shown in Table 2. A greater association between meeting all the 24-h movement guidelines was found for children (OR = 1.61; CI 95%, 1.30–2.83), high SES (OR = 1.92; CI95%, 1.30–2.83), medium SES (OR = 1.43; CI95%, 1.08–1.89), high HDI tertile (OR = 1.56; CI95%, 1.13–2.16), high S80/S20 tertile (OR = 1.78; CI95%, 1.31–2.43), and high diet quality (OR = 1.92; CI95%, 1.30–2.83).

Figure 2 illustrates the associations between socioemotional behavioral problems and meeting none, one, two or three (all) 24-h movement guidelines. Compared to meeting all guidelines, higher odds of socioemotional behavioral problems were found for those participants meeting two guidelines (OR = 1.42; CI95%, 1.10–1.83), one guideline (OR = 1.50; CI95%, 1.14–1.96), or none of the guidelines (OR = 1.92; CI95%, 1.30–2.83). This relationship was also found for males (Figure 2B) (two guidelines met: OR = 1.53; CI95%, 1.07–2.18; one guideline met: OR = 1.78; CI95%, 1.23–2.56; no guideline met: OR = 2.88; CI95%, 1.73–4.81) and for females (Figure 2C) (two guidelines met: OR = 1.68; CI95%, 1.17–2.41; one guideline met: OR = 1.53; CI95%, 1.05–2.23; none guidelines met: OR = 1.67; CI95%, 1.00–2.81) separately. Data stratified by gender and age group can be found in Figure S3.

4 | DISCUSSION

Our results indicate that the prevalence of Spanish children and youth meeting the 24-h movement guidelines was low, and was related to age, SES, HDI, S80/S20 ratio, and diet quality. About one out of ten participants showed socioemotional behavioral problems. Meeting the 24-h movement guidelines was linked to lower odds of socioemotional behavioral problems when analyzing the total sample, as well as for males and females (especially for children and adolescents).

A recent systematic review and meta-analysis performed by Tapia-Serrano et al.[51] showed that the prevalence of meeting all the three 24-h movement guidelines was 11.26%, 10.31%, and 2.68% for preschoolers, children, and adolescents, respectively. Our results seem to be within the range of this meta-analysis, although the prevalence among Spanish children and youth could be

TABLE 1 Characteristics of the Spanish young population analyzed

Variables	Total sample (N = 3772; 100.0%)	Males (*n* = 1908; 50.6%)	Females (*n* = 1864; 49.4%)	*p*
Age	9.5 (3.1)	9.4 (3.1)	9.7 (3.1)	.002
Preschoolers (4–5 y)	531 (14.1)	293 (15.4)	238 (12.8)	.019
Children (6–12 y)	2405 (63.8)	1219 (63.9)	1186 (63.6)	
Adolescents (13–14 y)	836 (22.2)	396 (20.8)	440 (20.8)	
Immigrant status				
Native	3591 (95.2)	1812 (95.0)	1779 (95.4)	.498
Immigrant	181 (4.8)	96 (5.0)	85 (4.6)	
SES				
High SES	824 (21.8)	415 (21.8)	409 (21.9)	.842
Medium SES	1285 (34.1)	659 (34.5)	626 (33.6)	
Low SES	1663 (44.1)	834 (43.7)	829 (44.5)	
HDI	0.886 (0.023)	0.887 (0.023)	0.886 (0.023)	.439
First HDI tertile	1337 (35.4)	664 (34.8)	673 (36.1)	.704
Medium HDI tertile	1224 (32.4)	625 (32.8)	599 (32.1)	
Low HDI tertile	1211 (32.1)	619 (32.4)	592 (31.8)	
S80/S20 ratio	6.25 (1.24)	6.25 (1.27)	6.24 (1.22)	.841
First S80/S20 tertile	1161 (30.8)	664 (34.8)	664 (34.8)	.099
Medium S80/S20 tertile	1296 (34.4)	625 (32.8)	625 (32.8)	
Low S80/S20 tertile	1315 (34.9)	619 (32.4)	619 (32.4)	
Anthropometric data				
Weight (kg)	37.5 (14.8)	37.3 (15.3)	37.7 (14.2)	.406
Height (cm)	139.4 (20.6)	139.0 (21.0)	139.8 (20.2)	.260
BMI (z-score)[a]	0.57 (1.37)	0.60 (1.40)	0.55 (1.34)	.267
Overweight/Obesity (%)[a]	1448 (38.4)	749 (39.3)	699 (37.5)	.268
Diet quality				
S-HEI (score)	69.8 (9.0)	69.5 (9.1)	70.1 (8.9)	.020
High-quality diet (%)	89 (2.4)	45 (2.4)	44 (2.4)	.681
Medium-quality diet	3250 (87.8)	1659 (86.9)	1591 (85.4)	
Low-quality diet	364 (9.8)	177 (9.3)	177 (10.0)	
PA				
No exercise	521 (13.8)	205 (10.7)	316 (17.0)	<.001
Occasional PA or sport	824 (21.9)	366 (19.2)	458 (24.6)	
PA several times monthly	1151 (30.5)	617 (32.3)	534 (28.7)	
Sports or physical training several times weekly	1276 (33.8)	720 (37.4)	556 (29.8)	
ST				
Weekdays ST duration (hours)	1.8 (1.2)	1.8 (1.2)	1.7 (1.2)	.511
Weekends ST duration (hours)	2.6 (1.5)	2.6 (1.5)	2.5 (1.5)	.209
Global ST duration (hours)	2.0 (1.2)	2.0 (1.1)	2.0 (1.2)	.343
Sleep				
Global sleep duration (hours)	9.3 (1.0)	9.3 (1.0)	9.3 (1.1)	.087
Socioemotional behavioral problems				
SDQ (score)	7.4 (5.1)	8.0 (5.3)	6.9 (5.0)	<.001

(Continues)

TABLE 1 (Continued)

Variables	Total sample (N = 3772; 100.0%)	Males (*n* = 1908; 50.6%)	Females (*n* = 1864; 49.4%)	*p*
Normal	3283 (87.0)	1617 (84.7)	636 (89.4)	<.001
Borderline	259 (6.9)	151 (7.9)	496 (5.8)	
Abnormal	230 (6.1)	140 (7.3)	732 (4.8)	

Abbreviations: BMI, Body mass index; HDI, Human Development Index; PA, Physical activity; S-HEI, Spanish Healthy Eating Index; SDQ, Strengths and Difficulties Questionnaire; SES, Socioeconomic status; ST, Screen time.

[a]According to the International Obesity Task Force criteria[23].

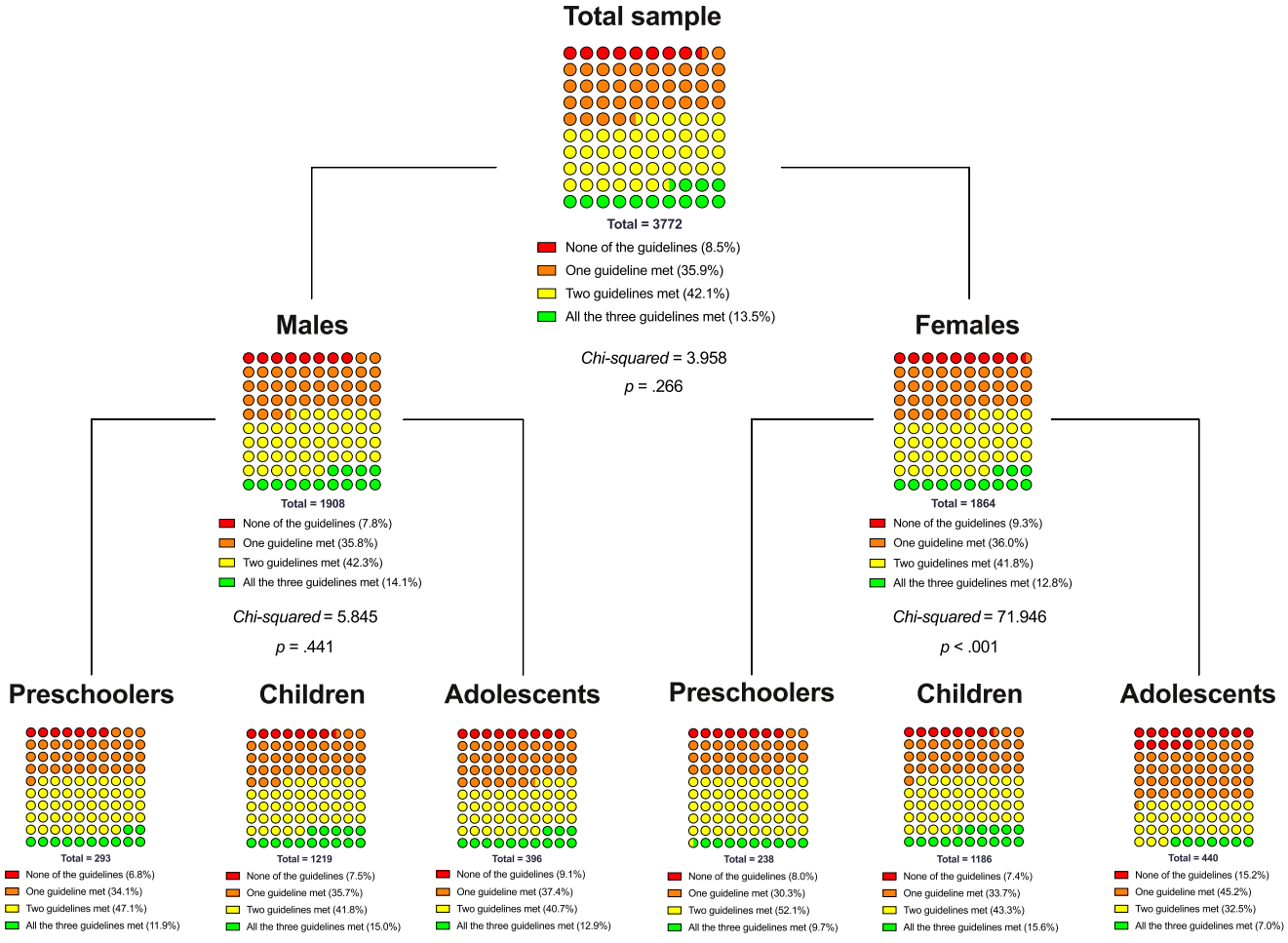

FIGURE 1 Prevalence of meeting none, one, two, or all the 24-h movement guidelines in the total sample and stratified by gender, and by gender and age group

lower if the adherence to PA recommendations had been evaluated by means of a daily estimation. In this sense, including all participants, or imputing missing data would result in even lower prevalence of meeting all the three 24-h movement guidelines (11.4% vs. 13.5%). In addition, these variations in the prevalence rates may be attributed to differences in the methods used to evaluate these behaviors. For instance, some studies used accelerometers to estimate the prevalence of PA,[7,24,25,51] while others used self-reported PA questionnaires (as we did in our study). Thus, caution is required when comparing results across studies. Nevertheless, because of the potential health benefits of meeting the 24-h movement guidelines, our study offers valuable information for developing programs that will increase the prevalence of meeting the guidelines in Spanish minors.

We identified several significant correlates of meeting the 24-h movement guidelines. A higher association of meeting these guidelines was found in younger participants (preschoolers and children) compared with adolescents (although only statistically significant in children). These results are in line with previous studies[25,26] and

TABLE 2 Associations between meeting the 24-h movement guidelines and the different potential correlates analyzed

Variables	OR	CI 95%	*p*
Gender			
Males	1 (Ref.)		
Females	0.99	0.78–1.24	.918
Age group			
Preschoolers (4–5 y)	1.54	0.96–2.29	.076
Children (6–12 y)	1.61	1.67–3.17	<.001
Adolescents (13–14 y)	1 (Ref.)		
Immigrant status			
Native	1 (Ref.)		
Immigrant	1.02	0.59–1.74	.957
SES			
High SES	1.78	1.32–2.41	<.001
Medium SES	1.43	1.08–1.89	.012
Low SES	1 (Ref.)		
HDI			
High HDI tertile	1.56	1.13–2.16	.007
Medium HDI tertile	1.10	0.79–1.53	.566
Low HDI tertile	1 (Ref.)		
S80/S20 ratio			
High S80/S20 tertile	1.78	1.31–2.43	<.001
Medium S80/S20 tertile	1.16	0.76–1.79	.492
Low S80/S20 tertile	1 (Ref.)		
Anthropometric data			
Overweight/Obesity[a]	0.79	0.64–1.04	.056
Normal weight	1 (Ref.)		
Diet quality			
High-quality diet	1.50	1.11–2.03	.009
Medium-quality diet	1.33	0.99–1.79	.061
Low-quality diet	1 (Ref.)		

Note: Data expressed as odds ratio and 95% confident intervals.

Abbreviations: HDI, Human Development Index; SES, Socioeconomic status.

[a]According to the International Obesity Task Force.[23]

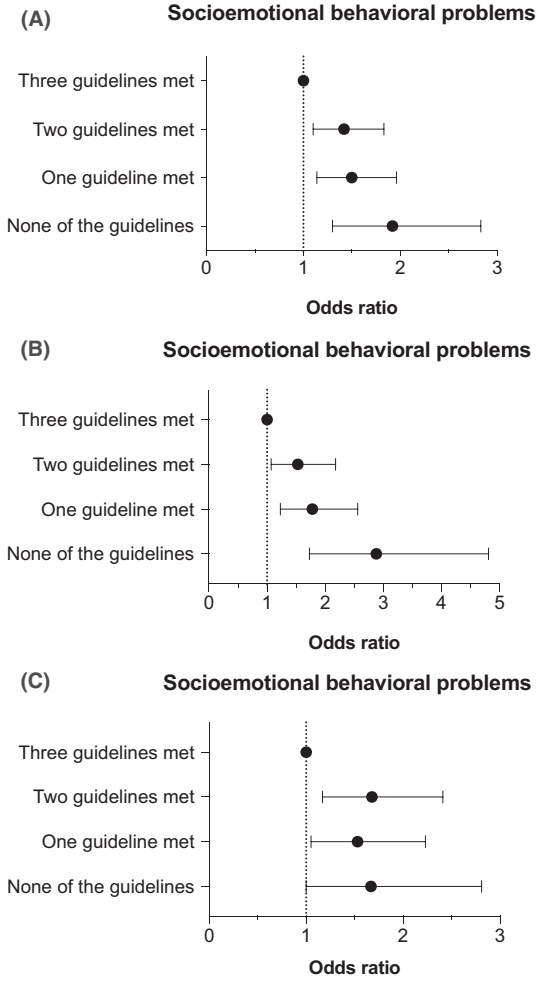

FIGURE 2 Odds of socioemotional behavioral problems and meeting none, one, two, or three 24-h movement guidelines in the total sample, and stratified by gender. Data expressed as odds ratio and 95% confident intervals. (A) Total sample; (B) Males; (C) Females. Adjusted for age, immigrant status, socioeconomic status, human development index, S80/S20 ratio, body mass index (*z*-score) and quality diet. Analysis of total sample was further adjusted by gender and age. Analysis of total sample was further adjusted by gender

could be explained by parental support and role modelling.[27] Support for our findings were also observed in a study performed during the primary to secondary school transition period, that found an unfavorable change in the accelerometer-measured 24-h movement behavior composition, with increased time spent in sedentary behavior and decreased time in sleep, light-intensity PA and moderate- to vigorous-intensity PA.[28] On the other hand, we found higher odds of meeting the 24-h movement behaviors in those with high or medium SES compared with those with low SES. This finding matches with those obtained by previous studies.[26,29] The underlying explanation may be that parents/guardians with higher SES have better awareness of their children's health behaviors and help them pursue healthy lifestyles. These parents/guardians might also offer greater financial support, which helps to facilitate healthful PA and sport opportunities. Therefore, reinforcing the importance of equitable access to interventions for children and adolescents from different SES levels is necessary.[30] Consistent with the SES relationship observed, and despite relatively small HDI differences within Spain, a higher association was observed in participants living in regions located in the highest HDI tertile. HDI is determined by mean annual income, life expectancy, and educational level; in addition to having

higher SES, a higher educational level has also been related to greater likelihood of meeting the 24-h movement guidelines.[10,26] In relation to the S80/S20 ratio (measure of inequalities), we found that a higher S80/S20 ratio was associated with meeting all the 24-h movement guidelines. Chaput et al.[31] examined the role of inequalities (via Gini index) on meeting 24-h movement guidelines and found significant relationships (especially for ST and PA) in their study among children from 12 countries (Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, the United Kingdom, and the United States). Nevertheless, family SES, HDI, and S80/S20 ratio are very difficult to modify.

We did not find any association between meeting the 24-h movement guidelines and excess weight. The published literature is contradictory in this regard. For instance, Chen et al.[26] showed that Chinese children and adolescents with the most ideal 24-h movement behaviors have lower odds of excess weight. Similarly, Roman-Viñas et al.,[24] with data from the above-mentioned study including 12 countries, found that meeting the 24-h movement guidelines was associated with lower odds of excess weight. Conversely, other studies showed that BMI was not associated with the adherence to any of the 24-h movement guidelines.[10,32] Rollo et al.[7] pointed out that literature has reported inconsistent findings about this relationship and suggested that it is possible that different cutoff points are needed to detect the influence of BMI on the early years. In our study, weight and height were parent-reported which could introduce error and bias to the results obtained.[33] In relation to diet quality, we found that participants located in the highest S-HEI tertile were more likely to meet the 24-h movement guidelines. These results match with previous studies.[10,34] Scientific literature has pointed out that children and adolescents who sleep less are more likely to consume a low-quality diet (e.g., higher intake of energy-rich foods, lower proportions of vegetables and fruits, higher snacks intake) compared with those sleeping more.[35] Similarly, ST has been negatively associated with healthy eating pattern score among children.[36] Thivel et al.[34] found that children who met all the 24-h movement guidelines had healthier dietary patterns than those who did not. However, these same authors indicated that moderate-to-vigorous PA was the movement guideline (individually) most strongly linked to an unhealthy dietary pattern. The complex and large interindividual variability between PA and eating behavior among individuals, the increase in hunger promoted by PA that can produce a higher food intake (thus compensating for the energy expended through activity), and/or the overcompensation in food intake due to the activation of certain reward mechanisms by the increase in PA[37] could explain this association.

We found that socioemotional behavioral problems (measured by SDQ score) were associated with lower odds of meeting of all the 24-h movement guidelines. This finding is similar to results obtained by previous studies[11,12,38,39] and a systematic review among children and adolescents.[9] There are some possible explanations for our results. Regarding PA, a systematic review by Lubans et al.[40] trying to explain the mechanisms for the effect of PA on mental health in young people suggest neurobiological, behavioral, and psychosocial hypotheses describing this association. However, the strongest evidence pointed out that PA may improve physical self-perceptions that accompanied enhanced self-esteem which, in turn, may beneficially influence socioemotional behavioral problems. In addition, Atkin et al.[41] have shown that the addition or removal of 15 min of PA per day was associated with improved or worsened mental health, respectively. Nevertheless, a recent review of reviews concluded that there is only partial evidence for a causal association between PA and socioemotional behavioral problems in young people (e.g., depression).[42]

Adverse physiological and psychological effects of ST on children and adolescents have been reported.[43] One study among a large sample of US children and adolescents showed that beyond one hour of ST, lower psychological well-being was experienced.[44] Increases in electronic media use have been negatively linked to mental health (e.g., depressive symptoms and self-esteem).[41] Furthermore, ST can displace other activities (e.g., PA time) recognized to have beneficial effects on sleep.[43] Supporting this notion, higher ST through smartphone use may adversely influence sleep, since these devices may be brought into the bedroom or even the bed, with negative impacts on sleep duration and/or sleep quality.[45]

Regarding sleep duration, a meta-analysis by Baglioni et al.[46] concluded that sleep continuity disturbances suggest a transdiagnostic imbalance in the arousal system, likely representing a basic dimension of mental health. Shorter sleep durations were associated with affective responses (e.g., anger, disgust, fear and sadness), which may have an influence on socioemotional behavioral problems.[47] Children with sufficient sleep experience better mood and are able to regulate their emotions better than those who are sleep restricted.[48]

Concerning all the three 24-h movement guidelines, one study among a representative sample of U.S. youth found that meeting all of these guidelines was linked to lower odds of total, externalizing, and internalizing problems,[49] which matches with our results. We used the SDQ score to assess the odds of socioemotional behavioral problems, which can also be divided into an internalizing score (using emotional and peer problems scales) and externalizing score (using conduct and hyperactivity

scales). Indicators of socioemotional behavioral problems are commonly situated along two dimensions: internalizing (e.g., anxiety, depression, somatic complaints) and externalizing (e.g., delinquency, aggression), and these two dimensions could explain the majority of cases of socioemotional behavioral problems during childhood.[50]

4.1 | Limitations

This study includes some limitations that should be noted. First, due to the cross-sectional design of this study, we cannot establish causal relationships. Prospective intervention studies are necessary to determine if/how socioemotional behavioral problems could influence meeting 24-h movement guidelines (or vice versa). Second, we used parent-reported questionnaires, which may contain errors of biases. However, some of these questionnaires (e.g., SDQ) are validated and reliable instruments; being widely used in the scientific literature.[21] Third, we used the category "sports or physical training several times weekly" as a proxy for the PA guideline due to the lack of a specific measure to assess meeting with the PA guideline. Improved measures (especially for PA) are required in future Spanish National Health Surveys. Fourth, we did not assess sleep quality, which could have an influence on socioemotional behavioral problems. Conversely, the main strength of this study is that, to date, it is the first study to examine the association between 24-h movement guidelines among and socioemotional behavioral problems in a nationally representative large sample of preschoolers, children, and adolescents.

In conclusion, our study demonstrated that the proportion of Spanish preschoolers, children, and adolescents who meet with all the 24-h movement guidelines is low and that meeting is associated with certain sociodemographic and lifestyle factors. In addition, it could be relevant the promotion of the 24-h movement guidelines to prevent the risk of socioemotional behavioral problems.

5 | PERSPECTIVE

This finding is clinically relevant since socioemotional behavioral problems are the leading causes of illness and disability among young people. Further studies with different designs (e.g., longitudinal, interventional) are needed to explore additional correlates and determinants of meeting the 24-h movement guidelines, as well as to verify the relationship between meeting these guidelines and socioemotional behavioral problems (and other health indicators). Lastly, the assessment of 24-h movement behaviors measured objectively by accelerometer devices, could offer a more precise determination of these healthy recommendations.

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AUTHOR CONTRIBUTIONS

J.F.L.-G. involved in conceptualization, methodology, software, validation, analysis, data curation, and writing—original draft preparation; B.R.-V., S.A., and M.T. involved in supervision and writing—review and editing. All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Ministry of Health, Consumer Affairs and Social Welfare at https://www.mscbs.gob.es/estadEstudios/estadisticas/encuestaNacional/encuesta2017.htm.

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