The (co-)authors declare that they have no conflict of interest.

Abstract

Purpose: The main aim was to examine the effects of a school-based intervention on multiple health behaviours in adolescents, such as 24-hour movement behaviours [i.e., physical activity (PA), sedentary time (ST), and sleep duration], diet, and substance consumption (i.e., alcohol and tobacco). Another aim was to examine intra-gender differences in the effectiveness of the programme.

Methods: A quasi-experimental design was carried out in two secondary schools throughout one academic year. A final sample of 210 students participated: 105 in the control (Mage=13.07±0.63) and 105 in the experimental school (Mage=13.05±0.59). A multicomponent school-based intervention was conducted by teachers in the experimental school via curricular (i.e., tutorial action plan, interdisciplinary project, and school break) and extracurricular (i.e., family involvement, institutional, non-curricular activities, and dissemination of health information and events) actions to promote adolescents' healthy lifestyles. PA and ST were measured by accelerometers, and the rest of health behaviours by using self-reported scales.

Results: Experimental school students showed a significant improvement in meeting specific and general combinations of 24-hour movement guidelines, sedentary screen time levels, nap duration, (un)healthy diet scores, breakfast intake, and soft drink consumption compared to both control school students and their baseline values ($p>.05$). Active commuting and substance consumption rates only showed a significant improvement compared to control school students ($p>.05$). Although the intervention programme was effective in improving health-related behaviours in both genders, a large effect size was observed in boys.

Conclusions: Conducting multiple health behaviour interventions becomes essential to improve adolescents' healthy lifestyles.

Keywords: adolescent health; physical activity; sedentary behaviour; screen time; diet; sleep; substance abuse prevention; simultaneous health behaviour interventions.

Implications and Contribution

The school-based intervention was effective in improving a broader range of energy balance-related behaviours (i.e., physical activity, sleep duration, sedentary time, and (un)healthy diet) and addictive behaviours (i.e., alcohol and tobacco consumption) among adolescents. Although both boys and girls reported positive health effects, boys benefited more from the intervention programme than girls.

High levels of physical activity (PA), low levels of sedentary time (ST), good quality diet, sufficient sleep duration (SD), and low rates of alcohol and tobacco consumption are independently associated with health benefits in adolescents [1]. Growing evidence has also found that a positive combination of some of these health-related behaviours seems to significantly decrease the risk of all-cause mortality [2]. However, most of the adolescents, particularly girls, do not meet either individual or combinations of health-related recommendations [3].

A recent integrative approach suggests that components of the movement continuum (i.e. PA, ST, and SD) are co-dependent behaviours across the whole day [4]. An increase in one of these movement behaviours (e.g., PA) could be related to a decrease in other behaviours (e.g., ST), due to the finite amount of time in a single 24-hour period [4]. Considering other health-related behaviours, a carry-over effect between healthy or unhealthy behaviours may take place (e.g., healthy diet may facilitate PA) [5]. However, compliance with one healthy behaviour does not necessarily have a downstream effect on other healthy behaviours [3]. This agrees with research based on cluster analysis that evidenced how most of the profiles were simultaneously comprised of both healthy and unhealthy behaviours [6]. Given that school-based health interventions have usually been focused on single health behaviours, reporting non-significant or small effect sizes [7], the body of research supporting multiple health behaviour change (MHBC) interventions has grown in recent years [8]. MHBC interventions may have a greater public health impact than interventions focused on health-related behaviours in isolation [9].

Social Ecological Model (SEM) [10], Self-Determination Theory (SDT) [11], and Theory of Planned Behaviour (TPB) [12] have emerged as three complementary theoretical frameworks to implement school-based interventions. SEM and SDT suggest that school provides the opportunity to adopt a global approach to involve the whole school community to promote healthy lifestyles among adolescents. According to SDT, these multiple sources of support may influence students' motivational outcomes, and consequently initiation and maintenance of health-related behaviours. The combined constructs from TPB and SDT improve the explanation of health-related behavioural intention, which has been considered one of the best predictors of health-related behaviour changes [13].

Physical education (PE), school break, interdisciplinary projects, active commuting to school (ACS), after-school intervention programmes, and tutorial action plans are some of the opportunities that may be used to promote healthy lifestyles [14]. Multicomponent school-based intervention, which should involve curricular and non-curricular opportunities, has been considered one of the most promising strategies to improve adolescents' healthy lifestyles [9]. In addition, the effectiveness of tackling multiple health-related behaviours in a simultaneous way (i.e., all at once) seems to be as good as a sequential approach (i.e., one behaviour after another) [15].

To date, school-based programmes targeting multiple health behaviours have usually been focused on two behavioural clusters: addiction (e.g., alcohol, smoking) and energy balance-related behaviours (e.g., diet, PA) [9], with duration from two months to seven years [8]. Very few studies have examined the effect of a joint MHBC intervention on a broader range of health-related behaviours, especially across one academic year [8,9]. In addition, despite interventions that focus on single isolated behaviours seeming to be more beneficial in girls than boys [16], little is known about the effects of MHBC interventions across gender [17].

The primary objective of this study was to examine the effects of a school-based intervention programme conducted simultaneously on multiple health behaviours (i.e., 24-hour movement behaviours, diet, and substance consumption) in adolescents. The secondary objective was to examine intra-gender differences in intervention effects. We hypothesized that adolescents who participated in the school-based intervention would have improvements in all health-related behaviours. Finally, we expected that the intervention would be effective in both genders showing a greater effect size in girls.

Methods

Design and participants

A quasi-experimental design was carried out in two secondary schools in Huesca (Spain) throughout one academic year. From an initial convenience sample of 225 students, aged 12-14 years (52.9% girls; Mage=13.06±0.61 years; control: n=115, 48.69% boys; experimental: n=110; 49.09% boys), a final sample of 210 students, 105 from the control school (Mage=13.07±0.63 years, 53.3% girls) and 105 from the experimental school (Mage=13.05±0.59 years, 52.4% girls), participated in this study (93.33% response rate). Written informed consent was required from both parents and adolescents. The Ethics Committee for Clinical Research of Aragon approved this study.

Measures

Socio-demographic characteristics. Students' self-reported age, gender, weight, and height. Body mass index (BMI) for each adolescent was calculated using the World Health Organization growth reference for adolescents [18]. Socio-economic status (SES) was reported by students using the Family Affluence Scale II (FAS II) [19]. A socio-economic indicator (0-9 range) was calculated as a continuous variable by summing the four possible responses.

PA and ST. Daily PA and ST were objectively measured using Actigraph GT3X accelerometer. An epoch length of 15 seconds and Evenson cut-points [20] were used to determine the time spent on light PA, MVPA, and ST for seven days. Two criteria were considered to determine valid accelerometery data: (1) wearing the accelerometer at least 10 hours/day on weekdays and 8 hours/day on weekend days; (2) wearing the accelerometer at least on 3 weekdays and 1 weekend day [21].

Sedentary screen time. Adolescents self-reported time spent on TV, video games, computers, and mobile phones for both weekdays and weekend days [22]. A weighted mean minutes/day of sedentary screen time of each behaviour was calculated at a ratio of 5:2 [e.g., (Daily TV viewing on weekdays x 5) + (Daily TV viewing on weekend days x 2) / 7]. Total daily sedentary screen time was calculated summing the different daily screen time behaviours. Total weekday and weekend screen time was also calculated.

SD and sleep quality. Adolescents self-reported their average SD for weekdays and weekend days, as well as their sleep quality using the Pittsburgh Sleep Quality Index [23]. Daily SD was calculated by weighting weekday and weekend day at a ratio of 5:2 [e.g., (Daily SD on weekdays x 5) + (Daily SD on weekend days x 2) / 7].

Based on daily 24-hour movement guidelines for adolescents (i.e., ≥60 minutes of MVPA, <2 hours of sedentary screen time and 8-10 hours of SD), students were classified into two groups for each behaviour: “meeting recommendation” and “not meeting recommendation” [4].

Nap duration. Nap duration was assessed using a Spanish translated and adapted version of the Napping Behaviour Questionnaire [24]. Nappers were defined as students who habitually napped at least twice per week, and non-nappers as those who napped on one or less than one day per week. Although there are no recommendations regarding nap duration, several studies suggest that taking a short nap (i.e., < 30 minutes per day) could be healthy, while long naps are usually associated with detrimental health outcomes [25].

ACS. ACS was assessed using the Spanish version of the mode of commuting to and from school questionnaire [26]. Participants were categorized as: active commuters (both trips are active) and non-active commuters (at least one of their trips is not active).

Dietary habits. Diet consumption was assessed using the WHO Health Behaviour in School Children (HBSC) Survey [27]. Students reported frequency of consumption per week of 12 types of healthy (e.g., fruit, vegetables) and unhealthy (e.g., sweets, chips) food items, on a 3-point scale ranging from "never" to "every day". The (un)healthy diet indices were calculated by summing the scores of the individual healthy or unhealthy food items, and recoding both variables in a range from 0 to 6. Higher values of (un)healthy food indicated a healthier or more unhealthy diet [27]. Breakfast consumption was assessed with a dichotomous question (yes or no).

Soft drink, tobacco, and alcohol consumption. The frequency of these risk-behaviours was assessed using a single question [28], the WHO HBSC survey [27], and one item from the Alcohol Use Disorder Identification Test [29], respectively. Categorization of soft drink consumption was: 1) non-soft-drinkers (i.e., never); 2) sporadic soft-drinkers (i.e., once or less than once per week); 3) weekly soft-drinkers (i.e., 2-4 times per week); and 4) soft-drinkers (i.e., 5 or more times a week). Categorization of tobacco consumption was: 1) non-smokers (i.e., never); 2) occasional smokers (i.e., less than once per week); and 3) smokers (i.e., smoke every week or every day). Categorization of alcohol consumption was: 1) non-drinkers (i.e., never) and 2) occasional drinkers (i.e., monthly or less).

Procedure and data collection

Students' health-related behaviours were measured before and immediately after the intervention programme. The effects of the intervention programme on PA and ST levels were analyzed in a sample of 183 adolescents because 27 students were excluded from the dataset after applying the accelerometery inclusion criteria across the two measurements. The effects of the intervention programme on nap duration were examined in a sample of 27 adolescents because not all students take a nap.

Intervention programme

This MHBC intervention programme, called “Paths of the Pyrenees”, aimed to empower adolescents to develop health literacy skills and take responsibilities for adopting healthy lifestyles. Framed in SEM, SDT, and TPB, this intervention adopted a multicomponent school-based approach that fostered the empowerment not only of students, but also of all members of the school community, to create a healthier school environment.

This intervention was mainly conducted by teachers from the experimental school through curricular actions (i.e., tutorial action plan, interdisciplinary project-based learning, and school break) and extracurricular actions (i.e., family involvement, institutional and non-curricular activities, and dissemination of health information and events). During the intervention programme, teachers actively participated in a workshop to create and implement their own project-based learning about healthy lifestyles. Grounded in SDT, an additional need-supportive teacher-training programme, (i.e., autonomy, competence, and relatedness support) was developed with the PE teacher. All actions were co-developed and co-supervised by school teachers and some members of the research group. In line with previous intervention studies [1], one person called facilitator (i.e., member of the research team with an educational background) was responsible for coordinating all curricular and extracurricular actions within the whole school community. Curricular and extracurricular actions are explained in greater depth in supplementary material.

Curricular actions: During the workshop, teachers decided to develop this health intervention programme across different subjects (i.e., PE, Sciences, Maths, Spanish, History, and Geography), and from an interdisciplinary perspective (e.g., in the trekking unit students learned the importance of consuming water and healthy food). Guided by SDT, providing support (e.g., teachers encourage fruit consumption during school break) and role-modelling (e.g., teachers participate in PA during school break) of different health-related behaviours were key points for teachers' daily behaviour at high school. Additionally, 12 sessions were taught during the weekly tutorial action plan related to: (a) increasing knowledge and awareness of health-related recommendations; (b) educating in optimal time distribution, allowing re-allocations between PA, ST, and SD; c) empowering adolescents to design activities and to manage their own health decisions.

Extracurricular actions: Based on SEM and SDT, four parental sessions were conducted. During the intervention, information about students' PA, ST levels, and other health-related behaviours was presented to families (e.g., children's PA and sedentary screen time were analyzed in one session). Different health topics (e.g., PA, diet) were discussed. According to SDT, parents were provided with healthy lifestyle and autonomy-supportive strategies (e.g., adolescents were provided with choices and opportunities to participate in PA). In addition, the variety and novelty of extra-curricular activities as well as the dissemination of health information and sports events played a key role in involving families, teachers, and students in the promotion of healthy lifestyles outside school.

Although the intervention programme was mainly focused on PA promotion, several promising school-based strategies [8, 14] were also simultaneously developed to promote other health-related behaviours. Most of the intervention programme was similar for both genders, barring several PA strategies where girls' interests and needs were especially considered (e.g., giving girls more opportunities to choose activities and encouraging them to express their opinions and preferences). The control school did not receive any school-based health intervention.

Data analysis

The SPSS Statistics v.23.0 software was used for data analysis. Firstly, Levene and Kolmogorov-Smirnov tests were performed for each health behaviour to test for homogeneity of variance between groups (p>.05), and whether the data was normally distributed (p>.05). Frequency, mean, and standard deviation were calculated for each variable. To examine the effects of the intervention programme, a 2×2 (time x group) repeated measures multivariate analysis of covariance (MANCOVA) was performed on health-related behaviours (pre-test and post-test). Gender, SES, and BMI were included as covariates in both analyses. To examine intra-gender differences of the intervention, a 2x2x2 (time x group x gender) repeated measures MANCOVA (pre-test and post-test) was performed on health-related behaviours. Multiple paired t-tests with Bonferroni correction were calculated for continuous variables to determine intragroup (i.e., experimental-control school differences) and intergroup (i.e., pre-post differences) differences. In addition, chi-square test was performed to evaluate categorical variables. Cramer's V was used to describe the degree of association between categorical variables and schools. McNemar's test was used to analyze pre-post differences in categorical variables in the control and experimental school, respectively. Effect sizes were assessed by Partial Eta Squared Values (η_p^2) and Cramer's V for continuous and categorical variables, respectively. Effect sizes were considered small, moderate or large, when η_p^2 were above 0.01, 0.06, and 0.14, and when Cramer's Vs were above 0.10, 0.30, and 0.50, respectively [30].

Results

Levene and Kolmogorov-Smirnov tests revealed homogeneity of variance between the school groups and normality of data in each school group. No significant differences were found between schools before the intervention programme in most of the health-related behaviours. After the intervention programme, the experimental school significantly improved in all health-related behaviours, except daily computer time, in comparison to the control school (Table 1). Experimental school students showed a significant improvement in meeting specific and general combinations of recommendations for 24-hour movement guidelines, ST levels, (un)healthy diet scores, breakfast intake, and soft drink consumption rates compared to control school students and their baseline values (Table 1 and 2). Experimental school students reported a significant improvement in meeting more than two recommendations of 24-hour movement guidelines compared to their baseline values (from 17.1% to 65.6%) and control school students (from 17.6% to 65.6%). ACS and substance consumption rates only showed a significant improvement compared to control school students. Effect sizes in health-related behaviours in the experimental school were large (i.e., PA, sedentary screen time, sleep and nap duration, (un)healthy diet, and 24-hour movement guidelines), medium (i.e., sleep quality and soft-drink consumption), and small (i.e., ST, ACS, and breakfast and substance consumption) (Tables 1 and 2).

[INSERT TABLE 1 AND 2]

After the intervention programme, both boys and girls from the experimental school reported healthier lifestyle behaviours than their adolescent counterparts in the control school and their own baseline values, with the only exception of ST in girls. However, experimental school boys showed larger effect sizes in PA levels, ST levels, sedentary screen time, healthy nutrition, and SD than experimental school girls (Table 3).

[INSERT TABLE 3]

Discussion

The principal aim was to examine the effects of a school-based intervention conducted simultaneously on multiple health behaviours in adolescents. Consistent with the first hypothesis, participants in the experimental programme experienced significant improvements in almost all health-related behaviours. These results are congruent with other MHBC interventions in adolescents, in which small to large effect sizes were observed for most of the health-related behaviours [8]. Although it is difficult to specifically determine which action was more effective, the tutorial action plan may be particularly useful for the regular implementation of healthy lifestyle strategies. The tutorial action plan allows connections with other curricular (e.g., school break) and extracurricular (e.g., sport events) actions of this school-based multicomponent intervention. These findings contribute to a growing body of literature which suggests that targeting multiple health behaviours through multicomponent school-based interventions could have more effects on health benefits than single-behaviour interventions [9].

The largest effect sizes were found in the experimental school with respect to the proportion of compliance of 24-hour movement guidelines. Promoting different guidelines via holistic and simultaneous approaches may be a more effective way of promoting all components of the 24-hour movement continuum [4, 15]. The increase of weekday SD, light PA and MVPA, and the reduction of daily weekday ST, sedentary screen time, and nap duration may suggest that strategies designed to achieve an optimal distribution of time (i.e., reallocation of ST to PA and sufficient SD) were effective in this intervention. These results are even better than a previous multidimensional intervention in preschool children where PA, screen time, and SD were targeted, and improvements were only found in PA guidelines and sedentary screen time [31].

Going deeper into the specific 24-hour movement behaviours, the largest effect size was observed in PA levels. This could be because a high percentage of the actions in the intervention programme were especially focused on PA promotion. Although there was a significantly higher percentage of adolescents who met total sedentary screen time recommendations in the experimental school than in the control school, no significant differences were found when compared to baseline values. Nevertheless, significantly higher compliances were independently observed in the four types of sedentary screen time. One possible explanation for the low percentages of total sedentary screen time recommendations after the intervention could be the high values reported at baseline (i.e., 405.1 minutes/day in the experimental school), which were more than double the screen time recommendations (i.e., <120 minutes/day), considerably complicating their reduction. Unlike most of the previous studies [7], we have also considered the time spent using mobile phones as an electronic device, which could considerably increase sedentary screen values given the high prevalence of the use of this electronic device among adolescents. With respect to daily SD, no significant differences were found in the experimental school between the two measures in absolute terms. However, an increase in the percentage of adolescents from the experimental school who met SD recommendations was observed compared to baseline. Students in the experimental school could accumulate less sleep debt during weekend days and, consequently, could show better percentages of compliance with SD recommendations.

Despite mixed findings of other school intervention programmes to promote ACS [32], our study showed positive changes in ACS, which may suggest that both curricular and extracurricular actions could be effective in improving opportunities to become more active. For instance, the curricular and non-curricular actions derived from the “Bike Week” could raise awareness about the importance of ACS.

Our results in terms of (un)healthy diet, breakfast intake, soft drink, and substance consumption rates seem to support that multi-component school-based interventions conducted on multiple health behaviours could be effective to promote healthy nutrition [33], to reduce soft drink consumption [34], and to prevent substance use [35]. Alcohol and tobacco consumption rates were quite low both after the intervention programme and at baseline, which may explain non-significant differences in the experimental school. The lower values of substance consumption in the experimental school evidence promising results, especially in this age range, when Spanish adolescents start going out on weekend days on a regular basis.

Given that there are not a lot of studies that evaluate the equity effects of health behaviour interventions in terms of gender [17], and that some inconsistencies still remain [36], our secondary objective was to examine intra-gender differences. This intervention had a positive effect on healthy lifestyle behaviours in boys and girls from the experimental school, with the only exception of ST in girls. This could be explained because girls usually spend more time on weekdays in non-screen-based ST during the after-school period (e.g., studying, doing homework) than boys [37], and our intervention did not focus on those sedentary behaviours.

Despite improvements in both genders, and contrary to our hypothesis and previous studies [16], a positive and large effect size of PA, ST, sedentary screen time, healthy nutrition, and SD was observed in boys. These contradictory findings could be explained by the fact that girls usually perceive more barriers to PA than boys [38], whereas most of the actions were focused on promoting PA. Social and cultural stereotypes in terms of PA could encourage boys more than girls [39]. Moreover, the improvement of PA in boys could create a positive ripple effect in healthy diet [5] and SD [40]. Considering that boys displayed higher sedentary screen time and ST at baseline data, the effects of the intervention programme could be more successful in boys. These findings call for a further study of school-based strategies to empower girls.

Several limitations should be considered. Firstly, all adolescents were exclusively recruited from two public secondary schools. Secondly, due to accelerometer inclusion criteria, sample size was different for PA and ST variables. In addition, the sample size to analyze the intervention programme effects on nap duration was small. The standard error of the estimate has been found to be problematic with short frequencies (e.g., sedentary screen time guidelines), so results should be interpreted cautiously. Thirdly, the use of some self-reported measures could underestimate or overestimate the results. Fourthly, it was not possible to determine which actions of the intervention programme were more effective. Finally, the lack of "follow-up" assessment makes it difficult to determine the scope and sustainability of the intervention effects. Hence, more research is necessary to study the applicability of MHBC interventions in terms of generalizability and translatability.

Conclusion

The multicomponent school-based intervention programme called "Paths of the Pyrenees", was effective in improving adolescents' health-related behaviours over one academic year. Although both boys and girls reported positive health effects, boys benefited more from the intervention programme than girls. The key role of the whole school community in school-based interventions seems decisive for improving health-related behaviours.

References

1. Saunders TJ, Gray CE, Poitras VJ *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**: 283-293.

2. Loef M, Walach H. The combined effects of healthy lifestyle behaviors on all-cause mortality: a systematic review and meta-analysis. *Prev Med* 2012; **55**: 163-170.

3. Olds T, Sanders I, Maher C *et al.* Does compliance with healthy lifestyle behaviours cluster within individuals in Australian primary school-aged children?. *Child Care Health Dev* 2018; **44**: 117-23.

4. Tremblay MS, Carson V, Chaput JP *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**: 311-27.

5. Miao M, Gan Y, Gan T *et al.* Carry-over effect between diet and physical activity: the bottom-up and top-down hypotheses of hierarchical self-efficacy. *Psychol Health Med* 2017; **22**: 266-74.

6. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. *Int J Behav Nutr Phys Activ* 2014; **11**: 4.

7. Friedrich RR, Polet JP, Schuch I *et al.* Effect of intervention programmes in schools to reduce screen time: a meta-analysis. *J Pediatr* 2014; **90**: 232-41.

8. Busch V, de Leeuw JRJ, de Harder A *et al.* Changing multiple adolescent health behaviors through school-based interventions: a review of the literature. *J School Health* 2013; **83**: 514-23.

9. Prochaska JJ, Prochaska JO. A review of multiple health behavior change interventions for primary prevention. *Am J Lifestyle Med* 2011; **5**: 208-21.

10. Sallis JF, Owen N, Fisher EB. Ecological models of health behavior. In: Glanz K, Rimer BK, & Viswanath K (eds). *Health behavior and health education: Theory, research, and practice*. San Francisco, CA: Jossey-Bass, 2008, 465-85.

11. Deci EL, Ryan RM. The general causality orientations scale: Self-determination in personality. *J Res in Pers* 1985; **19**: 109-34.

12. Ajzen I, Driver BL. Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior. *Leis Sci* 1991; **13**: 185-204.

13. Jacobs N, Hagger MS, Streukens S *et al*. Testing an integrated model of the theory of planned behaviour and self-determination theory for different energy balance-related behaviours and intervention intensities. *Br J Health Psychol* 2011; **16**: 113-34.

14. Murillo B, García-Bengoechea E, Generelo E *et al.* Promising school-based strategies and intervention guidelines to increase physical activity of adolescents. *Health Educat Res* 2013; **28**: 523-38.

15. James E, Freund M, Booth A, *et al*. Comparative efficacy of simultaneous versus sequential multiple health behavior change interventions among adults: A systematic review of randomised trials. *Prev Med* 2016, 89, 211-23.

16. Yildirim M, Stralen MM, Chinapaw MJ *et al.* For whom and under what circumstances do school-based energy balance behavior interventions work? Systematic review on moderators. *Pediatr Obes* 2011; **6**: 45-57.

17. Love RE, Adams J, van Sluijs EM. Equity effects of children's physical activity interventions: a systematic scoping review. *Int J Behav Nutr Phys Activ* 2017; **14**: 134.

18. de Onis M, Onyango A, Borghi E *et al.* Development of a WHO growth reference for school-aged children and adolescents. *B World Health Organ* 2007; **85**: 660-67.

19. Currie C, Molcho M, Boyce W *et al.* Researching health inequalities in adolescents: The development of health behaviour in school-aged children (HBSC) family affluence scale. *Soc Sci Med* 2008; **66**: 1429-36.

20. Trost SG, Loprinzi PD, Moore R *et al.* Comparison of accelerometer cut points for predicting activity intensity in youth. *Med Sci Sports Exerc* 2011; **43**: 1360-68.

21. Rowlands AV. Accelerometer assessment of physical activity in children: an update. *Pediatr Exerc Sci* 2007; **19**: 252-66.

22. Cabanas-Sánchez V, Martínez-Gómez D, Esteban-Cornejo I, *et al.* Reliability and validity of the youth leisure-time sedentary behavior questionnaire (YLSBQ). *J Sci Med Sport 2018*, **21**: 69-74.

23. Macías JA, Royuela A. La versión española del índice de calidad del sueño de Pittsburg. *Informaciones Psiquiátricas* 1996; **146**: 465-72.

24. Lovato N, Lack L, Wright H. The napping behaviour of Australian university students. *PloS One* 2014; **9**: e113666.

25. Faraut B, Andrillon T, Vecchierini MF *et al.* Napping: A public health issue. From epidemiological to laboratory studies. *Sleep Med Rev* 2017; *35*: 85-100.

26. Chillón P, Herrador-Colmenero M, Migueles JH *et al.* Convergent validation of a questionnaire to assess the mode and frequency of commuting to and from school. *Scand J Public Health* 2017; **45**: 612-20.

27. Balaguer I. *Estilos de vida en la adolescencia*. Valencia: Promolibro, 2002.

28. Singh AS, Vik FN, Chinapaw MJ *et al.* Test-retest reliability and construct validity of the ENERGY-child questionnaire on energy balance-related behaviours and their potential determinants: the ENERGY-project. *Int J Behav Nutr Phys Activ* 2011; **8**: 136.

29. Rubio G, Bermejo J, Caballero MC *et al.* Validación de la prueba para la identificación de trastornos por uso de alcohol (AUDIT) en atención primaria. *Rev Clin Esp* 1998; **198**: 11-4.

30. Cohen J. *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum, 1988.

31. Puder JJ, Marques-Vidal P, Schindler C. Effect of multidimensional lifestyle intervention on fitness and adiposity in predominantly migrant preschool children (Ballabeina): cluster randomised controlled trial. *BMJ* 2011; **343**: d6195.

32. Villa-González E, Barranco-Ruiz Y, Evenson K *et al.* Systematic review of interventions for promoting active school transport. *Prev Med* 2018; **111**: 115-134.

33. Van Cauwenberghe E, Maes L, Spittaels H *et al.* Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *Brit J Nutr* 2010; **103**: 781-97.

34. Vézina-Im LA, Beaulieu D, Bélanger-Gravel A *et al.* Efficacy of school-based interventions aimed at decreasing sugar-sweetened beverage consumption among adolescents: a systematic review. *Public Health Nutr* 2017; **20**: 2416-31.

35. Hale DR, Fitzgerald-Yau N, Viner RM. A systematic review of effective interventions for reducing multiple health risk behaviors in adolescence. *Am J Public Health* 2014; **104**: e19-e41.

36. Foley BC, Shrewsbury VA, Hardy LL *et al.* Evaluation of a peer education program on student leaders' energy balance-related behaviors. *BMC Publ Health* 2017; **17**: 695.

37. Arundell L, Fletcher E, Salmon J *et al.* A systematic review of the prevalence of sedentary behavior during the after-school period among children aged 5-18 years. *Int J Behav Nutr Phys Activ* 2016; **13**: 93.

38. Martins J, Marques A, Sarmento H *et al.* Adolescents' perspectives on the barriers and facilitators of physical activity: a systematic review of qualitative studies. *Health Educat Res* 2015; **30**: 742-55.

39. Chalabaev A, Sarrazin P, Fontayne P *et al.* The influence of sex stereotypes and gender roles on participation and performance in sport and exercise: Review and future directions. *Psychol Sport Exer* 2013; **14**: 136-44.

40. Chennaoui M, Arnal PJ, Sauvet F *et al*. Sleep and exercise: a reciprocal issue?. *Sleep Med Rev* 2017; **20**; 59-72.

Table 1. *Descriptive statistics of health-related behaviours (experimental and control school) and intervention effects.*

Groups / Study variables	Test time	Control school	Experimental school	Contrast between groups (control-experimental school)						
		M (SD)	*M (SD)*	Mean Diff.	Standard error	$F_{(11,210)}$	*p*	η_p^2	95% CI differences LL	95% CI differences UL
Physical activity (n= 183; 99 in the ES and 84 in the CS) Wilks' Lambda = .599; F (4,175) = 29.334; *p* < .001; η_p^2 = .401										
Daily light PA levels	Pre	150.4 (41.3)[a]	147.7 (37.7)[a]	2.8	5.9	0.2	.638	.001	-8.98	14.6
(min per day)	Post	151.8 (36.6)[a]	168.1 (42.9)[b]	-16.3	6.0	7.2	.008	.039	-28.3	-4.3
Daily MVPA levels	Pre	46.8 (17.0)[a]	46.7 (18.1)[a]	0.5	2.5	0.0	.983	.000	-5.0	5.1
(min per day)	Post	46.2 (17.2)[a]	67.0 (20.5)[b]	-20.7	2.7	55.5	<.001	.238	-26.3	-15.2
Weekday MVPA levels	Pre	51.7 (19.3)[a]	52.1 (19.8)[a]	-0.3	2.8	0.0	.912	.000	-5.9	5.3
(min per day)	Post	50.1 (18.6)[a]	71.8 (21.9)[b]	-21.1	3.0	48.5	<.001	.214	-27.0	-15.1
Weekend day MVPA	Pre	33.4 (27.2)[a]	30.1 (24.2)[a]	3.3	3.9	0.7	.388	.004	-4.3	11.0
levels (min per day)	Post	33.9 (24.9)[a]	52.4 (28.5)[b]	-18.4	3.9	21.6	<.001	.108	-26.3	-10.6
Sedentary time (n =183; 99 in the ES and 84 in the CS) Wilks' Lambda = .959; F (4,175) = 2.506; *p* = .061; η_p^2 = .041										
Daily ST levels	Pre	531.3 (56.0)[a]	519.1 (47.0)[a]	12.2	7.8	2.4	.120	.013	-3.2	27.6
(min per day)	Post	532.2 (47.6)[a]	496.4 (66.9)[b]	35.8	8.8	16.4	<.001	.084	18.4	53.2
Weekday ST levels	Pre	545.5 (58.5)[a]	531.6 (57.1)[a]	13.9	8.7	2.5	.113	.014	-3.3	31.1
(min per day)	Post	550.5 (55.2)[a]	514.3 (70.6)[b]	36.1	9.5	14.2	<.001	.074	17.2	55.0
Weekend day ST levels	Pre	491.6 (84.7)[a]	484.5 (49.7)[a]	7.1	10.4	0.4	.495	.003	-13.4	27.6
(min per day)	Post	482.9 (74.0)[a]	442.9 (94.5)[b]	40.0	12.8	9.6	<.001	.051	14.6	65.3
Sedentary screen time (n = 210; 105 in the ES and 105 in the CS) Wilks' Lambda = .805; F (5,201) = 9.574; *p* < .001; η_p^2 = .195										
Daily total screen time	Pre	396.0 (179.5)[a]	405.1 (186.6)[a]	-9.0	25.3	0.1	.720	.001	-59.3	40.9
(min per day)	Post	373.4 (109.5)[a]	279.0 (95.0)[b]	94.4	14.3	43.4	<.001	.175	66.2	122.7
Weekday total screen	Pre	346.2 (175.4)[a]	362.7 (180.2)[a]	-16.4	24.7	0.4	.506	.002	-65.2	32.26
time (min per day)	Post	323.5 (107.4)[b]	242.0 (89.0)[b]	81.4	13.8	34.5	<.001	.144	54.1	108.7
Weekend total screen	Pre	520.6 (214.6)[a]	511.3 (207.7)[a]	9.3	29.1	0.1	.749	.000	-48.1	66.8
time (min per day)	Post	498.4 (125.2)[a]	371.3 (113.9)[b]	127.0	16.5	58.6	<.001	.223	-159.7	-94.3
Daily TV viewing	Pre	115.7 (69.0)[a]	131.0 (69.3)[a]	-15.3	9.7	2.4	.117	.012	-34.5	3.8
(min per day)	Post	111.1 (38.9)[a]	89.6 (35.1)[b]	21.5	5.2	16.9	<.001	.076	11.2	31.8
Daily video game	Pre	70.6 (72.89)[a]	83.3 (84.7)[a]	-12.7	10.3	1.4	.223	.006	-34.5	3.8
playing (min per day)	Post	71.9 (54.4)[a]	48.9 (41.8)[b]	22.8	6.5	12.1	<.001	.056	11.2	31.8
Daily computer use	Pre	70.7 (75.9)[a]	82.2 (76.0)[a]	-11.4	10.3	1.1	.287	.006	-33.1	7.7
(min per day)	Post	62.9 (48.0)[a]	56.3 (40.2)[b]	6.6	6.2	1.1	.295	.005	-5.8	19.0
Daily mobile phone	Pre	138.9 (90.3)[a]	108.5 (71.1)[a]	30.4	11.4	7.0	<.001	.033	7.8	52.9
use (min per day)	Post	127.5 (46.2)[b]	84.0 (39.3)[b]	43.5	5.9	52.7	<.001	.205	31.7	55.3
Sleep duration (n= 210; 105 in the ES and 105 in the CS) Wilks' Lambda = .722; F (3,203) = 26.043; *p* < .001; η_p^2 = .278										
Daily sleep duration	Pre	535.1 (46.4)[a]	526.6 (49.8)[a]	8.4	6.4	1.7	.191	.008	-4.2	21.2
(min per day)	Post	514.6 (33.4)[b]	526.2 (21.7)[a]	-11.6	3.8	9.1	.003	.043	-19.2	-4.0
Weekday sleep	Pre	514.5 (45.2)[a]	505.0 (51.5)[a]	9.4	6.5	2.0	.153	.010	-3.5	22.4
duration (min per day)	Post	485.4 (34.3)[b]	513.3 (27.2)[b]	-27.8	4.2	43.0	<.001	.173	19.4	36.2
Weekend day sleep	Pre	588.0 (86.3)[a]	582.0 (79.0)[a]	6.0	11.2	0.2	.593	.001	-28.1	16.1
duration (min per day)	Post	588.9 (69.7)[a]	560.0 (38.5)[b]	28.8	7.8	13.6	<.001	.062	-44.2	-13.4
Nap (n = 27; 15 in the ES and 12 in the CS) Wilks' Lambda = .677; F (1,22) = 10.489; *p* < .004; η_p^2 = .323										
Daily nap duration	Pre	66.19 (34.46)[a]	82.80 (45.12)[a]	-32.7	17.2	3.6	.070	.141	-68.6	3.0
(min per day)	Post	63.52 (25.01)[a]	39.97 (9.36)[b]	-18.6	7.9	5.5	.021	.201	2.2	35.0
(Un)healthy diet (n= 210; 105 in the ES and 105 in the CS) Wilks' Lambda = .666; F (2,204) = 51.063; *p* < .001; η_p^2 = .334										
Healthy diet	Pre	4.5 (0.9)[a]	4.3 (1.0)[a]	0.2	0.1	2.0	.151	.010	-0.0	0.4
(Score: 0-6)	Post	4.3 (0.9)[b]	4.8 (0.9)[b]	-0.4	0.1	10.3	<.001	.048	-0.6	-0.1
(Un)healthy diet	Pre	2.8 (1.3)[a]	2.7 (1.3)[a]	0.1	0.1	0.6	.436	.003	-0.2	0.5
(Score: 0-6)	Post	3.0 (1.3)[b]	2.4 (1.2)[b]	0.6	0.1	11.2	<.001	.052	0.2	0.9

Note: Diff. = Difference; CI = Confidence interval; LL = Lower limit; UL = Upper limit; ES = Experimental school; CS = Control school. Within-group comparisons are shown in the Table 1 with different superscripts (a, b). A mean is significantly different from another mean if they have different superscripts

Table 2. *Intervention effects on the prevalence of health-related behaviours and compliance with health-related recommendations for experimental and control school.*

	Time test	Control school			Experimental school			*x2(df)*	*V*	*p*
		Boys *n (%)*	Girls *n (%)*	All *n (%)*	Boys *n (%)*	Girls *n (%)*	All *n (%)*			
Physical activity										
Meeting PA recommendations (%) (n= 183)	Pre	12 (30.8%)	7 (15.2%)	19 (22.4%)[a]	18 (36.0%)	5 (10.2%)	23 (23%)[a]	0.2(1)	.010	.887
	Post	9 (23.1%)	7 (15.2%)	16 (18.8%)[a]	38 (76.0%)	26 (53.1%)	64 (64.6%)[b]	39.0(1)	.461	<.001
Active commuting to school (%)	Pre	42 (85.7%)	43 (76.8%)	85 (81%)[a]	43 (86.0%)	53 (96.4%)	96 (91.4%)[a]	4.8(1)	.152	.028
	Post	41 (83.7%)	40 (71.4%)	81 (77.1%)[a]	48 (96.0%)	53 (96.4%)	101 (96.2%)[a]	16.4(1)	.280	<.001
Sleep duration										
Meeting sleep duration recommendations (%)	Pre	43 (87.8%)	47 (83.9%)	90 (85.7%)[a]	36 (72.0%)	54 (98.2%)	90 (85.7%)[a]	0.0(1)	.000	1.000
	Post	44 (89.8%)	49 (87.5%)	93 (88.6%)[a]	50 (100%)	54 (98.2%)	104 (99.0%)[b]	9.9(1)	.217	.002
Weekday sleep duration recommendations (%)	Pre	40 (81.6%)	49 (87.5%)	89 (84.8%)[a]	35 (70.0%)	51 (92.7%)	86 (81.9%)[a]	0.3(1)	.038	.579
	Post	35 (71.4%)	41 (73.2%)	76 (72.4%)[b]	49 (98.0%)	53 (96.4%)	102 (97.1%)[b]	24.9(1)	.334	<.001
Weekend sleep duration recommendations (%)	Pre	30 (61.2%)	29 (51.8%)	59 (56.2%)[a]	32 (64.0%)	31 (56.4%)	63 (60.0%)[a]	0.3(1)	.039	.576
	Post	33 (67.3%)	30 (53.6%)	63 (60.0%)[a]	46 (92.0%)	49 (89.1%)	95 (90.5%)[b]	26.1(1)	.353	<.001
Sleep quality (%)	Pre	44 (89.8%)	41 (73.2%)	85 (81.0%)[a]	41 (82.0%)	50 (90.9%)	91 (86.7%)[a]	1.2(1)	.078	.261
	Post	41 (83.7%)	41 (73.2%)	82 (78.1%)[a]	50 (100%)	53 (96.4%)	103 (98.1%)[b]	20.0(1)	.309	<.001
Sedentary screen time										
Meeting all total screen time recommendations (%)	Pre	0 (0.0%)	0 (0.0%)	0 (0.0%)[a]	2 (4.0%)	1 (1.8%)	3 (2.9%)[a]	3.0(1)	.120	.081
	Post	0 (0.0%)	0 (0.0%)	0 (0.0%)[a]	3 (6.0%)	1 (1.8%)	4 (3.8%)[a]	4.0(1)	.139	.043
Meeting TV guidelines (≤2 hrs per day) (%)	Pre	29 (59.2%)	28 (50%)	57 (54.3%)[a]	16 (32.0%)	23 (41.8%)	39 (37.1%)[a]	6.2(1)	.172	.013
	Post	31 (63.3%)	32 (57.1%)	63 (60.0%)[a]	42 (76.4%)	37 (74.0%)	79 (75.2%)[b]	5.5(1)	.163	.018
Meeting video games guidelines (≤2 hrs per day) (%)	Pre	33 (67.3%)	48 (85.7%)	81 (77.1%)[a]	27 (54.0%)	46 (83.6%)	73 (69.5%)[a]	1.5(1)	.086	.212
	Post	32 (65.3%)	48 (85.7%)	80 (76.2%)[a]	45 (90.0%)	53 (96.4%)	98 (93.3%)[b]	11.9(1)	.238	<.001
Meeting computer guidelines (≤2 hrs per day) (%)	Pre	46 (82.1%)	41 (83.7%)	87 (82.9%)[a]	35 (70.0%)	42 (76.4%)	77 (73.3%)[a]	2.7(1)	.115	.095
	Post	47 (83.9%)	42 (85.7%)	89 (84.8%)[a]	49 (89.1%)	44 (88.0%)	93 (88.6%)[b]	0.6(1)	.056	.417
Meeting mobile phone guidelines (≤2 hrs per day) (%)	Pre	24 (49.0%)	29 (51.8%)	53 (50.5%)[a]	28 (56.0%)	32 (58.2%)	60 (57.1%)[a]	0.9(1)	.067	.333
	Post	22 (44.9%)	27 (48.2%)	49 (46.7%)[a]	41 (82.0%)	42 (76.4%)	83 (79.0%)[b]	23.5(1)	.335	<.001
Meeting 24-hour movement guidelines (PA, sleep duration, and screen time) (n=183)										
Meeting no recommendations (%)	Pre	3 (7.7%)	5 (10.9%)	8 (9.4%)	8 (16.0%)	1 (2.0%)	9 (9.1%)	2.6(2)	.038	.876
	Post	2 (5.1%)	5 (10.9%)	7 (8.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	46.1(2)	.501	<.001
Meeting one recommendation (%)	Pre	25 (64.1%)	35 (76.1%)	60 (70.6%)	30 (60%)	43 (87.8%)	73 (73.7%)	2.6(2)	.038	.876
	Post	28 (71.8%)	35 (76.1%)	63 (74.1%)	11 (22%)	23 (46.9%)	34 (34.3%)	46.1(2)	.501	<.001
Meeting two or three recommendations (%)	Pre	11 (28.2%)	6 (13.0%)	17 20.0%)	12 (24%)	5 (10.2%)	17 (17.1%)	2.6(2)	.038	.876
	Post	9 (23.1%)	6 (13.0%)	15 (17.6%)	39 (78%)	26 (53%)	65 (65.6%)	46.1(2)	.501	<.001
(Un)healthy diet										
Non-soft drinkers (%)	Pre	5 (10.2%)	5 (8.9%)	10 (9.5%)	5 (10.0%)	4 (7.3%)	9 (8.6%)	.160(3)	.028	.984
	Post	3 (6.1%)	4 (7.1%)	7 (6.7%)	11 (22.0%)	14 (25.5%)	25 (23.8%)	28.219(3)	.367	<.001
Sporadic soft-drinkers (%)	Pre	31 (63.3%)	33 (58.9%)	64 (61%)	32 (64.0%)	34 (61.8%)	66 (62.9%)	.160(3)	.028	.984
	Post	33 (67.3%)	32 (57.1%)	65 (61.95)	28 (56.0%)	30 (54.5%)	58 (55.2%)	28.219(3)	.367	<.001
Weekly soft-drinkers (%)	Pre	3 (6.1%)	4 (7.1%)	7 (6.7%)	2 (4.0%)	4 (7.2%)	6 (5.7%)	.160(3)	.028	.984
	Post	4 (8.2%)	8 (14.3%)	12 (11.4%)	9 (18.0%)	11 (22.0%)	20 (19.0%)	28.219(3)	.367	<.001
Soft-drinkers (%)	Pre	10 (20.4%)	14 (25.0%)	24 (22.9%)	11 (22.0%)	13 (23.6%)	22 (22.9%)	.160(3)	.028	.984
	Post	9 (18.4%)	12 (21.4%)	21 (20%)	2 (4.0%)	0 (0.0%)	2 (1.9%)	28.219(3)	.367	<.001
Taking breakfast (%)	Pre	48 (98%)	50 (89.3%)	98 (93.3%)[a]	46 (92.0%)	48 (87.3%)	94 (89.5%)[a]	0.9(1)	.068	.324
	Post	47 (95.5%)	48 (85.7%)	95 (90.5%)[a]	50 (100%)	53 (96.4%)	103 (98.1%)[b]	5.6(1)	.164	.017
Substance consumption										
Drinking										
Non-drinkers (%)	Pre	46 (93.9%)	54 (96.4%)	100 (95.2%)[a]	49 (98%)	54 (98.2%)	103 (98.1%)[a]	1.3(1)	.080	.249

	Post	43 (87.8%)	40 (71.4%)	83 (79%)[b]	50 (100%)	51 (92.7%)	101 (96.2%)[a]	14.2(1)	.260	<.001
Smoking										
Non-smokers (%)	Pre	43 (87.8%)	50 (89.3)	93 (88.6%)	49 (98.0%)	54 (98.2%)	103 (98.15%)	9.177(2)	.200	.010
	Post	41 (83.7%)	49 (87.5%)	90 (85.7%)	50 (100%)	1 (1.8%)	105 (100%)	16.154(2)	.277	<.001
Occasional smokers (%)	Pre	3 (6.1%)	1 (1.8%)	4 (3.8%)	1 (2.0%)	55 (100%)	2 (1.9%)	9.177(2)	.200	.010
	Post	6 (12.2%)	2 (3.6%)	8 (7.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	16.154(2)	.277	<.001
Smokers (%)	Pre	3 (6.1%)	2 (8.9%)	8 (7.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9.177(2)	.200	.010
	Post	2 (4.1%)	5 (8.9%)	7 (6.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	16.154(2)	.277	<.001

Note: The contrast between schools has been made with all students from both experimental and control schools. Within-group comparisons are shown in the Table 2 with different superscripts (a, b). A mean is significantly different from another mean if they have different superscripts.

Table 3. *Interventions effects by gender of health-related behaviours.*

Study variables	Time test / Groups	Pre-test: Control school	Pre-test: Experimental school	Post-test: Control school	Post-test: Experimental school
		M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Physical activity (min per day)					
Girls (control school): Wilks' Lambda = .985; F (4,174) = 0.665; *p* = .302; η_p^2 = .015					
Boys (control school): Wilks' Lambda = .973; F (4,174) = 1.226; *p* = .617; η_p^2 = .027					
Girls (experimental school): Wilks' Lambda = .612; F (4,174) = 27.550; *p* < .001; η_p^2 = .388					
Boys (experimental school): Wilks' Lambda = .547; F (4,174) = 36.059; *p* < .001; η_p^2 = .453					
Daily light PA levels	Boys	153.9 (47.4)	155.5 (37.7)	155.5 (44.5)	175.6 (38.7)
	Girls	147.1 (32.8)	140.3 (35.4)	149.1 (31.4)	161.1 (46.1)
Daily MVPA levels	Boys	50.6 (18.5)	53.8 (18.8)	49.7 (18.4)	75.4 (21.3)
	Girls	43.1 (14.8)	40.1 (14.3)	42.6 (14.6)	59.0 (16.3)
Weekday MVPA	Boys	57.2 (21.8)	59.5 (21.3)	53.2 (20.4)	79.7 (23.3)
	Girls	46.6 (16.3)	45.1 (14.9)	48.0 (15.4)	64.3 (17.4)
Weekend day MVPA	Boys	32.6 (26.9)	37.4 (25.2)	39.9 (26.0)	61.7 (28.6)
	Girls	33.7 (27.4)	23.0 (20.6)	28.2 (22.4)	43.8 (25.6)
Sedentary time (min per day)					
Girls (control school): Wilks' Lambda = .964; F (3,176) = 0.075; *p* = .973; η_p^2 = .001					
Boys (control school): Wilks' Lambda = .944; F (3,176) = 1.191; *p* = .315; η_p^2 = .020					
Girls (experimental school): Wilks' Lambda = .983; F (3,176) = 1.031; *p* = .380; η_p^2 = .017					
Boys (experimental school): Wilks' Lambda = .897; F (3,176) = 6.707; *p* < .001; η_p^2 = .103					
Daily ST levels	Boys	529.1 (56.4)	517.1 (48.1)	531.6 (57.9)	481.9 (64.3)
	Girls	533.4 (52.0)	521.0 (49.0)	533.6 (40.4)	510.4 (71.4)
Weekday ST levels	Boys	538.7 (61.3)	528.4 (58.5)	547.8 (64.5)	499.1 (69.9)
	Girls	551.8 (54.0)	534.5 (58.7)	553.7 (47.5)	529.0 (71.2)
Weekend ST levels	Boys	499.0 (75.3)	485.6 (51.6)	487.4 (71.4)	426.6 (93.8)
	Girls	485.0 (84.6)	484.6 (49.6)	479.8 (76.9)	458.8 (96.3)
Sedentary screen time (min per day)					
Girls (control school): Wilks' Lambda = .979; F (5,200) = 1.095; *p* = .365; η_p^2 = .027					
Boys (control school): Wilks' Lambda = .963; F (5,200) = 1.535; *p* = .181; η_p^2 = .037					
Girls (experimental school): Wilks' Lambda = .834; F (5,200) = 7.982; *p* < .001; η_p^2 = .166					
Boys (experimental school): Wilks' Lambda = .644; F (5,200) = 22.153; *p* < .001; η_p^2 = .356					
Daily total screen time	Boys	414.0 (199.4)	452.2 (204.1)	380.1 (117.6)	289.7 (102.5)
	Girls	375.2 (159.8)	367.5 (160.6)	363.5 (102.3)	273.3 (87.9)
Weekday total screen time	Boys	361.7 (195.2)	406.0 (194.5)	331.1 (114.6)	251.4 (96.7)
	Girls	328.3 (156.2)	327.9 (159.0)	313.2 (101.0)	237.1 (81.6)
Weekend total screen time	Boys	545.0 (228.0)	567.8 (233.4)	502.8 (135.0)	385.6 (120.2)
	Girls	492.7 (201.0)	466.7 (169.3)	489.2 (116.8)	363.7 (107.9)
Daily TV viewing	Boys	112.8 (69.1)	136.9 (67.0)	107.6 (41.4)	86.4 (37.9)
	Girls	119.5 (69.4)	124.4 (71.4)	114.4 (36.6)	92.3 (32.5)
Daily video game playing	Boys	89.4 (78.9)	122.1 (91.8)	86.1 (57.5)	65.2 (39.8)
	Girls	52.9 (63.0)	49.1 (59.9)	58.2 (50.4)	35.1 (38.6)
Daily computer use	Boys	70.4 (75.9)	82.1 (75.9)	62.7 (49.9)	55.4 (41.4)
	Girls	70.3 (76.6)	83.0 (76.8)	62.8 (46.8)	57.5 (39.4)
Daily mobile phone use	Boys	141.3 (93.5)	111.0 (67.9)	123.5 (43.1)	82.6 (39.0)
	Girls	132.3 (88.0)	110.9 (74.5)	127.9 (49.1)	88.3 (39.8)
Sleep duration (min per day)					
Girls (control school): Wilks' Lambda = .833; F (3,202) = 13.508; *p* < .001; η_p^2 = .167					
Boys (control school): Wilks' Lambda = .844; F (3,202) = 12.407; *p* = .986; η_p^2 = .156					
Girls (experimental school): Wilks' Lambda = .883; F (3,202) = 8.930; *p* < .001; η_p^2 = .117					
Boys (experimental school): Wilks' Lambda = .930; F (3,202) = 5.062; *p* < .002; η_p^2 = .070					
Daily sleep duration	Boys	531.4 (44.2)	511.6 (63.4)	512.1 (30.7)	523.4 (22.5)
	Girls	539.7 (39.3)	539.0 (27.73)	517.2 (35.7)	528.3 (20.8)
Weekday sleep duration	Boys	516.5 (43.3)	495.1 (65.3)	487.6 (34.4)	512.8 (26.7)
	Girls	514.0 (47.2)	513.0 (32.8)	484.4 (34.5)	512.8 (27.9)
Weekend sleep duration	Boys	570.3 (84.4)	554.5 (93.6)	574.9 (64.5)	551.4 (41.6)
	Girls	605.2 (83.7)	605.5 (53.0)	600.5 (72.4)	568.6 (33.9)
(Un)healthy diet (Score: 0-6)					
Girls (control school): Wilks' Lambda = .919; F (2,203) = 8.956; *p* < .001; η_p^2 = .081					
Boys (control school): Wilks' Lambda = .980; F (2,203) = 2.038; *p* = .113; η_p^2 = .020					
Girls (experimental school): Wilks' Lambda = .882; F (2,203) = 13.561; *p* < .001; η_p^2 = .118					
Boys (experimental school): Wilks' Lambda = .762; F (2,203) = 31.692; *p* < .001; η_p^2 = .238					
Healthy diet	Boys	4.5 (0.9)	4.4 (1.0)	4.3 (0.8)	4.9 (0.8)
	Girls	4.7 (1.0)	4.3 (0.9)	4.4 (1.0)	4.6 (0.9)
(Un)healthy diet	Boys	2.9 (1.3)	2.9 (1.4)	3.1 (1.3)	2.6 (1.3)
	Girls	2.8 (1.3)	2.5 (1.2)	3.0 (1.3)	2.3 (1.1)