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Participation in organized sports is associated with decreased likelihood of unhealthy lifestyle habits in adolescents

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Adolescence is a pivotal time for investing in both present and future health. Thus, it is important to identify arenas for promoting positive adolescent health behaviors and preventing negative ones. The aim of this study was to investigate the associations between organized sports participation (OSP) and a broad range of lifestyle habits in Norwegian adolescents. A comprehensive survey was completed by 13 269 junior high and high school students in southern Norway. Multivariable binary logistic regression models, adjusted for gender, age, and parental education, were used to investigate the associations between OSP and adolescent substance use, dietary habits, physical activity level, passive vs active transportation, screen time, and sleep duration. Inverse associations were found between OSP and adolescent substance use (odds ratio 0.40 [95% confidence interval 0.30-0.52] to 0.68 [0.61-0.76]), irregular consumption of main meals (0.58 [0.53-0.63] to 0.78 [0.70-0.89]), high intake of unhealthy food and beverages (0.55 [0.47-0.65] to 0.86 [0.75-0.98]), low intake of healthy food items (0.57 [0.51-0.63] to 0.77 [0.70-0.84]), low physical activity level (0.15 [0.14-0.17]), high screen-based activity (0.61 [0.55-0.67]), passive vs active transportation (summer; 0.79 [0.72-0.86] and winter; 0.84 [0.77-0.92]), and short sleep duration, during both weekdays (0.57 [0.52-0.63]) and weekends (0.79 [0.69-0.89]). In conclusion, adolescents participating in organized sports had decreased odds for engaging in several unhealthy lifestyle habits compared with non-participants, indicating that organized sports may be a relevant setting for promoting healthy behaviors among adolescents. Future studies are, however, needed to confirm a possible causal relationship.

KEYWORDS

cross-sectional study, exercise, nutrition, risk behaviors, sports activities, youth

1 | INTRODUCTION

Seventy percent of premature adult deaths reflect behaviors initiated or reinforced during the adolescent years.[1] Adolescence is therefore a pivotal time for investments in future public health, because it confers potential for healthy adolescents now, for the adults they become, and for their future children.[2] In terms of enhancing healthy behaviors and preventing risk behaviors during the second decade of life, it is important to identify relevant arenas in which adolescents spend their time.

Organized leisure-time activities represent a wide range of activities outside the regular school curriculum that have been proposed as contributing to healthy youth development.[3-5] A

central aspect of organized leisure-time activities is organized sports activities. During the last 20 years, organized sports participation (OSP) and performing various sports activities have been highlighted as a context of constructive development for youth associated with positive health behaviors,[5,6] including increased health-related physical activity,[7-9] healthy food habits,[10,11] and positive socio-emotional outcomes.[12-14] On the other hand, OSP has also been associated with negative health behaviors such as increased screen time[15] and increased substance use.[3,12,13,16,17] However, there have been methodological challenges to these studies with respect to small sample sizes, selective samples, and inclusion of a single or few outcome measures.

Systematic review studies have summarized evidence on participation in sports and selected health-related behaviors, such as drug and alcohol use,[17] juvenile delinquency,[18] and psychological and social benefits.[14] Few studies to date have, however, reported on various healthy and unhealthy lifestyle behaviors among a large sample of adolescents in relation to OSP.[19-21] Baumert et al[19] included 6849 US adolescents and assessed differences in a number of health-related behaviors between participants and non-participants in organized sports outside of gym class. They concluded that participants in organized sports appeared less likely to smoke cigarettes or marijuana and were more likely to engage in healthy dietary behaviors; they were also at increased risk for accidental injuries compared with non-participants. In a repeated cross-sectional study using data derived from the Centers for Disease Control and Prevention's Youth Risk Behavior Surveys,[20] OSP gave most adolescents multiple health benefits, such as increased engagement in vigorous physical activity and condom use, although OSP was also related to some negative health behaviors in specific subgroups. For example, male athletes were more likely to vomit or use laxatives or pills, consume alcohol, and use chewing tobacco compared with males not participating in organized sports.[20] Furthermore, racial differences were observed, in which consistent associations between OSP and multiple positive health behaviors were found among white adolescents, while fewer associations with positive health behaviors, and some with negative behaviors, were found among minority adolescents.[20] In Australia, Vella et al[21] found a greater likelihood to engage in beneficial obesity-related health behaviors among 12 188 secondary school students participating in organized sports compared with non-participating students. However, OSP was not associated with unhealthy dietary behaviors, including consumption of sugar-sweetened beverages and high-fat foods, or with weight status or adiposity.[21] A recently published study, including 2113 Finnish adolescents, concluded that youth participating in organized sports met the recommendations for physical activity, sleep, and screen time more often than non-participants.[9]

In sum, previous research has yielded conflicting findings and is published 5-20 years ago. There is thus a need for updated research on adolescents that represents both genders, ranges from 8th grade (junior high school) through to the 1st year of high school and assesses a large number of participants across a broad range of lifestyle outcomes. To our knowledge, no such large-scale study including European adolescents has been published. Therefore, the primary study aim was to investigate the association between OSP and substance use, dietary habits, physical activity level, screen time, active vs passive transportation, and sleep duration in a large sample of Norwegian adolescents.

2 | MATERIAL AND METHODS

2.1 | Design and participants

Young Data (Ungdata) is a data collection scheme designed to conduct surveys among adolescents at the municipality level across Norway (see www.ungdata.no).

In this study, junior high school students (grades 8-10, age range 13-16 years) and high school students (grade 11 (1st-year high school), age range 16-17 years) across all 30 municipalities and all 70 schools in the southern region of Norway were invited to participate. The data collection period was February to March 2016, and 15 651 students (11 042 junior high school students and 4609 high school students) were invited to participate. Online questionnaires were administered during school hours, with at least one member of the project group present to answer upcoming questions. The questionnaire was designed in the web-based online platform SurveyXact™ (Rambøll, Management Consulting, Oslo, Norway). To access the questionnaire, the participants had to open a webpage and enter the provided identification key, and the students used approximately 30-45 minutes to complete the questionnaire. The questionnaire is based on national surveys in Norway (Ung i Norge) in 1992, 2002, and 2010, and from 2011 in the municipality-based surveys through Young Data. Inclusion of previously used phrasings was chosen as it permits for comparisons across studies using the same items. Several items applied in this current study have also been included in other large surveys such as Health Behaviour in School-aged Children (HBSC)[22] and the European School survey Project om Alcohol and other Drugs (ESPAD).[23] A total of 13 635 students completed the questionnaire, giving an overall participation rate of 90% among junior high school students and 80% among high school students. Data from 189 participants were removed due to incomplete responses, leaving 9805 junior high school students and 3464 high school students (N = 13 269) upon which analyses were conducted.

Legal responsibility for the Young Data survey is held by the NOVA research center of Norwegian Social Research, Oslo and Akershus University College of Applied Sciences. The study was conducted in line with the Declaration of Helsinki. All students gave informed consent before study

participation and parents were given information regarding the survey and provided with the opportunity to withdraw their children from participation. All data were collected anonymously and analyzed by independent researchers who did not participate in the data collection. As stated by the guidelines of the Data Protection Official for Research (The Norwegian Centre for Research Data/NSD), this study was not subject to notification because it did not include personal data according to the Personal Data Act.

2.2 | Measures

All measures used adolescent self-reports.

2.2.1 | Exposure variable

We defined organized sports participation in accordance with Geidne et al,[6] as voluntary participation in ongoing organized athletic activity outside of regular school curricula. "Participation in organized sports activities" was measured by asking respondents how often they participate in any organized leisure-time sports activities. Response options were as follows: never, rarely, 1-2 times/month, 1-2 times/wk, 3-4 times/wk, and at least 5 times/wk. The variable was dichotomized as never participate in organized sports activities (0) vs participate in organized sports activities (all other categories; 1, ref.). For parts of the analysis, the response options were dichotomized differently; A) *seldom* participate (never, rarely, 1-2 times/month (0)) vs *often* participate (1-2 times/wk, 3-4 times/wk and at least 5 times/wk (1)) in organized sports activities, and B) *not very often* participate (3-4 times/wk or less (0)) vs *very often* participate (at least 5 times/wk (1)) in organized sports activities.

2.2.2 | Outcome variables

"Intoxication" was based on how many times adolescents reported having been intoxicated during the past 12 months.[22,23] Response options were as follows: never, once, 2-5 times, 6-10 times, and more than 11 times. This variable was dichotomized as any intoxication episode (1) vs no intoxication episodes (0, ref.). The reliability of this question in terms of inconsistency was assessed as very low (average 0%) in relation to the European School Survey Project on Alcohol and other Drugs (ESPAD).[23]

"Cannabis use" was assessed by asking respondents how many times they had used hashish/marijuana/cannabis during the past 12 months.[23] Response options were as follows: never, once, 2-5 times, 6-10 times, and more than 11 times, and the threshold for risky cannabis use was set to any use (1) vs no use last 12 months (0, ref.). Reliability assessment in ESPAD shows that inconsistency rates were only 1% related to adolescent consumption of cannabis.[23]

"Smoking" was measured by asking respondents whether they smoke tobacco, as previously shown to be a valid method among adolescents.[24] Response options included the following: 1. Have never smoked; 2. Smoked previously but quit; 3. Smoke less than once a week; 4. Smoke weekly but not daily; and 5. Smoke daily. Participants were dichotomized as current smokers (categories 3-5; 1) and not current smokers (categories 1-2; 0, ref.).[25] In this study, "current" includes experimental, frequent, and daily patterns of cigarette use.

"Smokeless tobacco" was assessed by asking respondents whether they use smokeless tobacco/snuff, as previously shown to be a valid method among adolescents.[24] Response options were as follows: (a) Have never used smokeless tobacco; (b) Used smokeless tobacco previously but quit; (c) Use smokeless tobacco less than once a week; (d) Use smokeless tobacco weekly but not daily; and (e) Use smokeless tobacco daily. This variable was dichotomized as current use (categories 3-5; 1) vs no current use (categories 1-2; 0, ref).

"Meal frequency" was based on respondents' self-report about how often they ate breakfast, lunch, dinner, and evening meals each week.[26] Response options were as follows: (a) Never or seldom; (b) Once a week; (c) 2-5 times per week; and (d) Daily. Each meal type was dichotomized as: having this meal daily (1) vs less often (0, ref.). Meal types were then combined to create a dichotomous summary variable "irregular total meal pattern," which classified adolescents as skipping at least one main meal at least once a week (1) vs eating all meals every day (0, ref.).

"Diet and beverage intake" was measured by asking respondents how often they eat vegetables, fruit, fish, salty snacks, candy, and how often they drink sugar-sweetened beverages, diet beverages, and energy drinks. Each item had 10 response options, from never to more than once a day. Intake of unhealthy foods and beverages, including soft drinks, candy, and salty snacks, was dichotomized as: four times a week or more (high intake; 1) vs less than four times a week (0, ref.), in which the latter mentioned category was considered as an acceptable frequency of consumption. Accordingly, a consumption of once a day or more was considered as an acceptable frequency of consumption for fruit, berries, and vegetables. Thus, intake of these healthy food items was dichotomized as: once a day and more (0, ref.) vs less than once a day (low intake; 1). Intake of fish was dichotomized as: once a week or more (0, ref.) vs less than once a week (low intake; 1). These cutoff values for meal frequency and consumption of healthy and unhealthy food and beverages have previously been used among similar population groups and the questions have shown good test-retest reliability.[26,27]

"Physical activity level" was assessed by asking respondents how much time each week they were physically active to the level of getting warm and breathless (including physical education, leisure-time exercise, family activities, and self-organized activity). Response options ranged from less than 1 hour to 13 or more hours and were dichotomized into

less than 7 h/wk (low physical activity level; 1) vs 7 h/wk or more (0, ref.). The dichotomization was based on the current physical activity recommendations where adolescents are recommended to be active of at least moderate intensity 60 minutes or more per day.[28] Reporting 7 h/wk or more indicate meeting the recommendations for physical activity level for this age group, while reporting less than 7 h/wk indicate not meeting the recommendations.

"Active commuting" was assessed using the question: "How do you usually commute to school in the winter season, and likewise in the summer season?" Response options were as follows: on foot, bicycle, electric bicycle, car, motorbike, public transport (eg, bus, taxi), and other. This variable was dichotomized into active commuting (ie, walking or cycling; 0, ref.) vs passive commuting (all other options; 1).[29]

"Screen time" was based on participant information about how much time they spent daily on screen-based activities (ie, TV, computer, tablet, mobile) outside of school time. Response categories ranged from no time spent to more than 3 hours and were dichotomized as 2 h/d or more (high screen time; 1) vs less than 2 hours screen time daily (0, ref.) according to the American Academy of Paediatrics' recommendation of screen time limits for children and adolescents.[30]

Information about "sleep duration" was solicited by asking how many hours respondents normally sleep during weekdays and weekends. Short sleep duration during weekdays and weekends was defined as less than 8 hours per day (1) vs 8 hours or more per day (0, ref.) based on recommendations by the American National Sleep Foundation.[31]

2.2.3 | Possible confounders

"Parental education" was based on respondents' reports of whether their mother and father had received a college/university-level education. Response categories were dichotomized as no (1, ref.) vs yes (0) for maternal and likewise for paternal education. Class level was used as a proxy for adolescent "age"; this was included as a continuous variable in the analyses. "Gender" was determined by asking whether respondents were male (0) or female (1, ref.).

2.3 | Statistical analyses

Descriptive analyses were calculated to provide an overview of the data.

Multivariable binary logistic regression analyses were used to investigate possible associations between OSP and any of the reported risky lifestyle habits: intoxication episodes; current smoking and/or use of smokeless tobacco; high consumption of energy drinks, sugar-sweetened beverages, candy, salty snacks, and diet beverages; low consumption of vegetables, fruit, fish; irregular meal patterns specific to breakfast, lunch, dinner, and evening meals; irregular total meal pattern; physical activity level; screen time; using active transportation to school; and sleep duration. Multivariable analyses were adjusted for parental education, age, and gender. Results are reported as odds ratios (ORs); confidence intervals (CIs) were set to 95%. *P*-values required for statistical significance were set at 0.05.

3 | RESULTS

3.1 | Descriptive characteristics

Results in Table 1 indicate that a higher number of boys than girls participated in organized sports activities (58% vs 42%; $P < 0.001$). In addition, the number of adolescents taking part in organized sports activities decreased with age (from 67% in 8th grade to 40% in the 1st year of high school) and OSP was associated with higher paternal and maternal education (all $P < 0.001$).

Univariate data (Table 2) indicate that OSP, regardless of participation frequency, was consistently and significantly associated with decreased odds of unhealthy lifestyle habits, including: substance use, irregular meal patterns, higher intake of unhealthy food and beverages, lower intake of healthy food, lower physical activity level, higher screen time, using

TABLE 1 Descriptive characteristics of adolescents participating (n = 6545) and not participating (n = 5493) in organized sports

	Participating in organized sports (n = 6545) n (%)	Not participating in organized sports (n = 5493) n (%)	*P*-value[a]
Girls (%)	2997 (51)	2889 (49)	
Boys (%)	3352 (58)	2462 (42)	<0.001
Age groups (%)			
8th grade	1949 (67)	962 (33)	
9th grade	1840 (63)	1078 (37)	
10th grade	1475 (49)	1554 (51)	
1st y of high school	1281 (40)	1899 (60)	<0.001
Parental education (%)			
Paternal education, low	1666 (47)	1875 (53)	<0.001
Maternal education, low	1330 (43)	1735 (57)	<0.001

[a]Differences in gender, age, and parental education were analyzed using chi-square tests.

TABLE 2 Prevalence of unhealthy lifestyle habits in adolescents participating and not participating in organized sports

	Exposure variable						
	Risk behaviors	Participating in organized sports[a] n (%)	Not participating in organized sports n (%)	*P*-value[b]	Often participating in organized sports[c] (%)	Seldom participating in organized sports n (%)	*P*-value[b]
Outcome variables	Alcohol intoxication last 12 mo	800 (12)	1254 (23)	<0.001	608 (11)	2152 (17)	<0.001
	Cannabis use last 12 mo	99 (2)	258 (5)	<0.001	71 (1)	389 (3)	<0.001
	Current smoking	310 (5)	615 (11)	<0.001	222 (4)	1007 (8)	<0.001
	Current use of smokeless tobacco	360 (6)	631 (12)	<0.001	267 (5)	1074 (9)	<0.001
	Irregular breakfast	1601 (25)	2179 (40)	<0.001	1209 (23)	3907 (32)	<0.001
	Irregular lunch	1945 (30)	2302 (42)	<0.001	1541 (29)	4381 (36)	<0.001
	Irregular dinner	762 (12)	913 (17)	<0.001	588 (11)	1724 (14)	<0.001
	Irregular evening	2829 (48)	2970 (60)	<0.001	2265 (46)	5898 (53)	<0.001
	Irregular all four meals	3677 (63)	3776 (77)	<0.001	2948 (61)	7564 (69)	<0.001
	High intake of salty snacks	646 (11)	639 (13)	<0.001	505 (10)	1320 (12)	<0.001
	High intake of candy	834 (14)	869 (18)	<0.001	658 (13)	1740 (16)	<0.001
	High intake of sugar-sweetened beverages	1477 (25)	1513 (30)	<0.001	1181 (24)	3051 (27)	<0.001
	High intake of diet beverages	1029 (17)	1064 (21)	<0.001	824 (17)	2135 (19)	<0.001
	High intake of energy drinks	341 (6)	448 (9)	<0.001	255 (5)	813 (7)	<0.001
	Low intake of vegetables	3799 (66)	3473 (73)	<0.001	3103 (66)	7412 (69)	<0.001
	Low intake of fruit	4086 (70)	3887 (79)	<0.001	3328 (69)	8124 (74)	<0.001
	Low intake of fish	1088 (18)	1442 (29)	<0.001	854 (18)	2570 (23)	<0.001
	Low physical activity level	2823 (46)	4327 (84)	<0.001	2046 (41)	7300 (64)	<0.001
	High screen time	4657 (72)	4449 (82)	<0.001	3835 (72)	9311 (77)	<0.001
	No use of active transportation, summer	2379 (40)	2712 (53)	<0.001	1888 (38)	5213 (46)	<0.001
	No use of active transportation, winter	3553 (59)	3448 (68)	<0.001	2885 (58)	7162 (63)	<0.001
	Low sleep duration, weekdays	2638 (47)	3136 (66)	<0.001	2092 (45)	5886 (56)	<0.001
	Low sleep duration, weekends	771 (14)	800 (17)	<0.001	603 (13)	1608 (16)	<0.001

[a]The variable was dichotomized as never participate in organized sports activities vs participate (all other categories) in organized sports activities.

[b]Chi-square tests were used to investigate differences in the prevalence of unhealthy lifestyle habits among adolescents participating in organized sports and their peers.

[c]The variable was dichotomized as seldom participate (never, rarely, 1-2 times/mo) vs often participate (1-2 times/wk, 3-4 times/wk, and at least 5 times/wk) in organized sports activities.

passive rather than active transportation and short sleep duration (all $P \leq 0.001$).

3.2 | Multivariable models

Adjusted ORs for each lifestyle habit in relation to OSP are shown in Figure 1. Tables 3-7 present multivariable analyses of unhealthy lifestyle variables relative to OSP. All analyses were adjusted for gender, age, and paternal and maternal education. The results show decreased odds of alcohol intoxication (OR 0.67; 95% CI 0.61-0.76), using cannabis (0.40; 0.30-0.52), using smokeless tobacco (0.59; 0.51-0.69) and smoking cigarettes (0.54; 0.46-0.63) among adolescents participating in organized sports activities (Table 3).

Further, the results show that OSP is associated with decreased odds of having irregular intake of meals overall (total irregular meal pattern: 0.56; 0.51-0.62), and specifically irregular intake of each of the four main meals: breakfast (0.58; 0.53-0.63), lunch (0.62; 0.57-0.68), dinner (0.79; 0.70-0.89), and evening meal (0.70; 0.60-0.72) (Table 4).

Tables 5 and 6 also show that OSP is associated with healthier food choices, with decreased odds for high intake of salty snacks (0.86; 0.75-0.98), candy (0.85; 0.79-0.96), sugar-sweetened beverages (0.80; 0.73-0.88), diet beverages (0.79; 0.71-0.88) and energy drinks (0.55; 0.47-0.65), and decreased odds for low intake of vegetables (0.77; 0.70-0.84), fruit and berries (0.62; 0.56-0.68), and fish (0.57; 0.51-0.63) among adolescents participating in organized sports activities.

Finally, those participating in organized sports activities showed decreased odds for low physical activity level (0.15; 0.14-0.17), high screen time (0.61; 0.55-0.67), use of passive vs active transportation to school during both the summer (0.79; 0.72-0.86) and winter (0.84; 0.77-0.92), and short sleep duration during both weekdays (0.57; 0.52-0.63) and weekends (0.79; 0.69-0.89) (Table 7).

Furthermore, additional multivariable logistic regression analyses with different dichotomization of participation frequency showed statistically significant results for all variables ($P < 0.001$), but the associations between OSP and lifestyle habits were somewhat weaker comparing "often" to "seldom" as opposed to comparing "never" to "ever" OSP. This finding also applied for the categorization "not very often" vs "very often" (data shown in supplementary information).

4 | DISCUSSION

The findings of this study indicate that adolescent OSP is consistently associated with significantly decreased odds of unhealthy lifestyle habits, including: substance use, irregular meal patterns, high intake of unhealthy food and beverages, low intake of healthy food, low physical activity level, high screen time, using passive transportation, and having a short sleep duration, compared with adolescents not participating in organized sports.

Previous research has yielded contradictory findings regarding the association between organized leisure-time

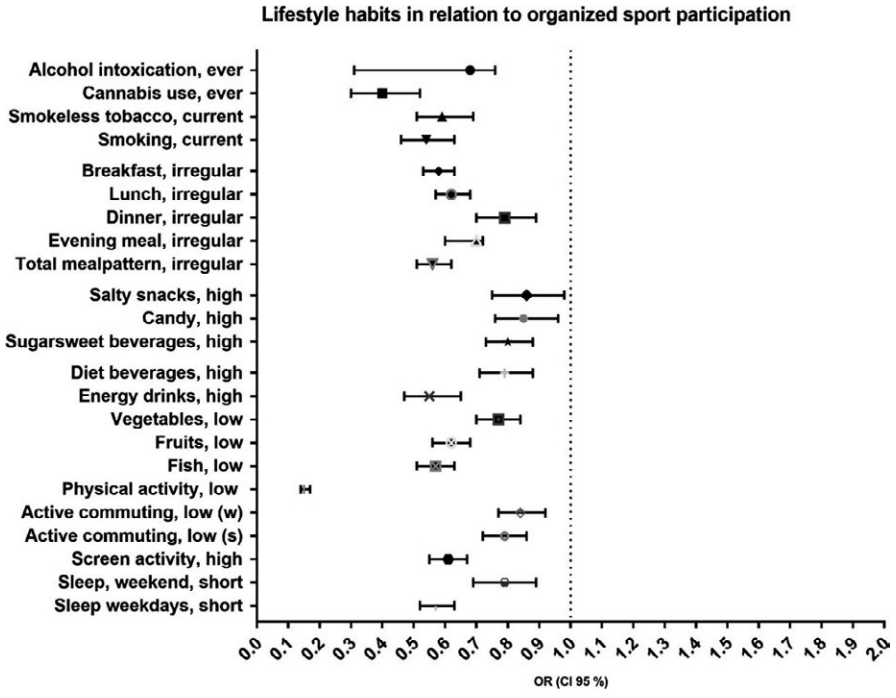

FIGURE 1 Adjusted odds ratio (OR) and 95% confidence interval (CI) for various lifestyle habits in relation to participation in organized sports. w, winter; s, summer

activities and substance use risk behaviors as well as between OSP and substance use risk behaviors.[3,12,32] Our findings, after adjusting for covariates, were consistent for all measured substance use risk behaviors as OSP was significantly associated with decreased odds of both alcohol intoxication, cannabis use, smokeless tobacco use, and smoking. Some research supports our findings that athletes are less likely to smoke cigarettes or use cannabis,[19,32,33] while others show no associations between OSP and binge drinking.[20] McCabe et al[3] recently demonstrated that sports participation was related to risky substance use (a composite measure combining binge drinking, getting drunk, and illegal drug use), and these findings are also consistent with other reports.[12,13,16,34] A longitudinal study by Wichstrom and Wichstrom[16] showed that adolescents initially involved in team sports had greater increases in alcohol intoxication, but lower increases in tobacco and cannabis use, during their adolescence and early adulthood compared with those involved in technical or strength sports. They also showed that participating in endurance sports, as opposed to technical or strength sports, predicted reduced growth in alcohol intoxication and tobacco use.[16] These inconsistencies suggest that there may be a more complex association between OSP and substance use risk behavior than we were able to explore in our analyses. The type

TABLE 3 Adjusted odds ratio (OR) and 95% confidence interval (CI) for adolescent substance use risk behavior in relation to participation in organized sports[a]

		Alcohol, intoxication	Cannabis	Smokeless tobacco	Smoking
		OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Exposure variable	Participation in organized sports				
	No	1.00	1.00	1.00	1.00
	Yes	0.68 (0.61-0.76)***	0.40 (0.30-0.52)***	0.59 (0.51-0.69)***	0.54 (0.46-0.63)***
Control variables	Gender, girls	1.04 (0.93-1.16)	0.60 (0.47-0.76)***	0.82 (0.70-0.95)**	0.71 (0.61-0.83)***
	Age, high	2.45 (2.30-2.61)***	1.63 (1.44-1.85)***	1.86 (1.72-2.01)***	1.82 (1.68-1.97)***
	Paternal education, low	1.10 (1.00-1.25)	1.20 (0.92-1.58)	1.22 (1.03-1.44)*	1.11 (0.93-1.32)
	Maternal education, low	1.24 (1.09-1.42)**	1.29 (0.98-1.71)	1.44 (1.21-1.70)***	1.53 (1.28-1.82)***

*$P < 0.05$; **$P < 0.010$; ***$P < 0.001$.

[a]Multivariable binary logistic regression analyses were used to investigate possible associations. All analyses were adjusted for parental education, age, and gender.

TABLE 4 Adjusted odds ratio (OR) and 95% confidence intervals (CI) for irregular meal pattern in relation to participation in organized sports[a]

		Irregular breakfast	Irregular lunch	Irregular dinner	Irregular evening meal	Irregular all four meals
		OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Exposure variable	Participation in organized sports					
	No	1.00	1.00	1.00	1.00	1.00
	Yes	0.58 (0.53-0.63)***	0.62 (0.57-0.68)***	0.79 (0.70-0.89)***	0.70 (0.60-0.72)***	0.56 (0.51-0.62)***
Control variables	Gender, girls	1.52 (1.39-1.66)***	1.13 (1.04-1.22)**	1.60 (1.42-1.80)***	1.69 (1.56-1.84)***	1.59 (1.45-1.74)***
	Age, high	1.18 (1.14-1.23)***	0.99 (0.96-1.03)	1.07 (1.01-1.13)*	1.19 (1.05-1.13)***	1.10 (1.05-1.14)***
	Paternal education, low	1.18 (1.07-1.31)**	1.14 (1.04-1.26)**	1.18 (1.03-1.35)*	1.07 (0.97-1.19)	1.22 (1.09-1.37)***
	Maternal education, low	1.57 (1.42-1.75)***	1.32 (1.19-1.46)***	1.61 (1.40-1.85)***	1.06 (0.95-1.18)	1.24 (1.11-1.40,)***

*$P < 0.05$; **$P < 0.010$; ***$P < 0.001$.

[a]Multivariable binary logistic regression analyses were used to investigate possible associations. All analyses were adjusted for parental education, age, and gender.

of sport (eg, individual vs team), sport season, and competitive level may further explain such an association. In addition, cross-national differences may also reflect the differing policy contexts in each country.[35]

Few studies have focused on sports participation and dietary behaviors, and only one has investigated the associations between OSP and meal frequency among adolescents.[36] Croll et al[36] observed that females who were active in weight-related sports ate breakfast more frequently than females not involved in sports, and that sports-involved males reported more frequent consumption of both breakfast and lunch compared with males not involved in sports. These results are similar to our findings, although we observed that OSP was associated with a 40% reduced odds of having irregular intake of all four main meals, and decreased odds for irregular intake of each meal specifically. Further research to investigate this possible association is thus warranted.

Although a systematic review reported somewhat inconsistent associations between sports participation and dietary intake,[37] youth involved in sports appeared more likely to consume greater numbers of calories and were more likely to consume certain unhealthy food and beverages, such as fast food, compared with those not involved in sports. These findings contrast with our results, which demonstrated a consistently positive association between OSP and healthy food consumption. Specifically, our analysis showed decreased

TABLE 5 Adjusted odds ratio (OR) and 95% confidence interval (CI) for high intake of salty snacks, candy, sugar-sweetened beverages, diet beverages, and energy drinks in relation to participation in organized sports[a]

		High salty snacks	High candy	High sugar-sweetened beverages	High diet beverages	High energy drinks
		OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Exposure variable	Participation in organized sports					
	No	1.00	1.00	1.00	1.00	1.00
	Yes	0.86 (0.75-0.98)*	0.85 (0.76-0.96)**	0.80 (0.73-0.88)***	0.79 (0.71-0.88)***	0.55 (0.47-0.65)***
Control variables	Gender, girls	0.92 (0.81-1.04)	1.19 (1.06-1.33)**	0.72 (0.66-0.79)***	0.91 (0.82-1.01)	0.35 (0.30-0.42)**
	Age, high	1.03 (0.97-1.09)	1.12 (1.06-1.18)***	1.08 (1.03-1.12)**	1.15 (1.09-1.21)***	1.05 (0.97-1.13)
	Paternal education, low	1.06 (0.91-1.23)	0.99 (0.86-1.13)	1.08 (0.97-1.21)	1.00 (0.89-1.14)	0.96 (0.79-1.16)
	Maternal education, low	1.44 (1.23-1.68)***	1.35 (1.18-1.55)***	1.51 (1.35-1.69)***	1.21 (1.07-1.38)**	1.45 (1.20-1.76)***

*$P < 0.05$; **$P < 0.010$; ***$P < 0.001$.

[a]Multivariable binary logistic regression analyses were used to investigate possible associations. All analyses were adjusted for parental education, age, and gender.

TABLE 6 Adjusted odds ratio (OR) and 95% confidence interval (CI) for low intake of vegetables, fruit and berries, and fish in relation to participation in organized sports[a]

		Low vegetables	Low fruit and berries	Low fish
		OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Exposure variable	Participation in organized sports			
	No	1.00	1.00	1.00
	Yes	0.77 (0.70-0.84)***	0.62 (0.56-0.68)***	0.57 (0.51-0.63)***
Control variables	Gender, girls	0.56 (0.51-0.61)***	0.48 (0.43-0.53)***	1.00 (0.90-1.10)
	Age, high	0.99 (0.95-1.03)	1.07 (1.03-1.12)**	0.95 (0.91-0.99)*
	Paternal education, low	1.40 (1.25-1.57)***	1.27 (1.13-1.43)***	1.37 (1.22-1.53)***
	Maternal education, low	1.33 (1.18-1.49)***	1.25 (1.11-1.42)***	1.31 (1.16-1.47)***

*$P < 0.05$; **$P < 0.010$; ***$P < 0.001$.

[a]Multivariable binary logistic regression analyses were used to investigate possible associations. All analyses were adjusted for parental education, age, and gender.

TABLE 7 Adjusted odds ratio (OR) and 95% confidence interval (CI) for low physical activity level, high screen time, use of passive transportation, and short sleep duration in relation to participation in organized sports[a]

		Low physical activity level	High screen time	Passive transportation summer	Passive transportation winter	Short sleep duration weekdays	Short sleep duration weekends
		OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Exposure variable	Participation in organized sports						
	No	1.00	1.00	1.00	1.00	1.00	1.00
	Yes	0.15 (0.14-0.17)***	0.61 (0.55-0.67)***	0.79 (0.72-0.86)***	0.84 (0.77-0.92)***	0.57 (0.52-0.63)***	0.79 (0.69-0.89)***
Control variables	Gender, girls	1.33 (1.21-1.45)***	0.82 (0.74-0.90)***	1.11 (1.02-1.21)*	1.23 (1.13-1.34)***	1.27 (1.17-1.39)***	0.79 (0.70-0.89)***
	Age, high	0.86 (0.83-0.90)***	0.17 (0.13-0.23)***	1.76 (1.69-1.84)***	1.34 (1.28-1.39)***	1.57 (1.51-1.64)***	0.87 (0.82-0.92)***
	Paternal education, low	1.19 (1.06-1.33)**	1.14 (1.02-1.28)*	1.43 (1.29-1.58)***	1.37 (1.24-1.52)***	1.10 (0.99-1.23)	1.10 (0.95-1.26)
	Maternal education, low	1.35 (1.20-1.52)***	1.03 (0.91-1.16)	1.25 (1.12-1.39)***	1.25 (1.12-1.39)***	1.20 (1.07-1.34)**	1.28 (1.11-1.48)**

*$P < 0.05$; **$P < 0.010$; ***$P < 0.001$.

[a]Multivariable binary logistic regression analyses were used to investigate possible associations. All analyses were adjusted for parental education, age, and gender.

odds for intake of salty snacks, candy, sugar-sweetened beverages, diet beverages and energy drinks, and decreased odds for low intake of vegetables, fruit and berries, and fish among adolescents participating in organized sports activities compared to those not participating in organized sport activities. Our findings are consistent with those from a large study of 4746 US adolescents, from which Croll et al[36] concluded that sports-involved adolescents have healthier eating habits and nutrient intakes than their peers not involved in sports. Furthermore, from a cross-sectional study of more than 5000 ethnically diverse fourth graders, Dortch et al[38] concluded that sports participation is associated with increased consumption of fruit and vegetables and lower consumption of soda. This was also partly confirmed by Vella et al[21] who observed that higher levels of OSP are associated with increased likelihood of complying with fruit and vegetable consumption guidelines among more than 12 000 Australian adolescents. However, they did not observe any association between OSP and consumption of sugar beverages or high-fat foods.[21]

National and international guidelines recommend that children and adolescents engage in regular physical activity, of moderate-to-vigorous intensity, for at least 60 minutes per day; however, many adolescents do not meet this quantity or quality.[39] OSP has the potential to help adolescents establish lifelong, healthy physical activity patterns.[40] In the present study, adolescents participating in organized sports activities had decreased odds for low physical activity levels and use of passive instead of active transportation to school. To our best knowledge, no study has investigated all of these activity-related behaviors within a single adolescent sample, although Vella et al[21] also found that higher levels of OSP were associated with increased likelihood of complying with physical activity guidelines among Australian adolescents and Mäkelä et al[9] found a higher proportion of Finnish youth reaching the physical activity guidelines among those participating in organized sport (24.3%) compared to non-participants (14.5%). Although the association between OSP and active transportation is an understudied area, a recent study among children found a positive association between OSP and active transportation to school,[15] which is consistent with our results. Interestingly, a Danish study indicated that OSP was associated with increases of 5-20 minutes in daily moderate-to-vigorous physical activity and 3- to 15-fold increased odds of meeting recommended physical activity guidelines.[7] Given that these findings in children are likely to persist into adolescence, OSP may be an effective strategy for increasing health-related physical activity in a group in which less than half meet physical activity guidelines.[39] In their systematic review, Nelson et al[37] concluded that both cross-sectional and longitudinal studies consistently show that youth participating in sports are more likely than non-participants to be physically active.

However, these authors also emphasize that study design limitations prevent determining whether sports participation causes youth to be more active or whether youth who are more active participate in sports activities.

Over the last decade, prolonged screen times among adolescents have increased in several countries worldwide[41]; however, only a few studies have investigated the association between OSP and screen time. We found that adolescents participating in organized sports had a 40% reduced odds for prolonged screen time compared to those not participating in organized sport. This is consistent with findings in Australian adolescents, among whom higher levels of sports participation were associated with increased likelihood of complying with screen time guidelines,[21] and among Finnish youth where sport club participants reported 0.5 hour less daily screen time than non-participants.[9] A smaller US study also found that sports program participants spent less time watching television compared with non-participants.[42] The findings from these four studies of adolescents are important, given the relative dearth of research in this area and the knowledge that sedentary behaviors may be adversely associated with metabolic and mental health across the life course.[43] However, more research is needed to explore whether OSP plays a causal role in reducing sedentary behaviors, such as screen time, among adolescents.

Insufficient sleep poses an important and complicated set of health risks for adolescents.[44] However, to our knowledge, the associations between OSP and sleep habits among adolescents have been sparsely investigated. We found that adolescents participating in organized sports activities had 20% and 40% reduced odds for short sleep duration during weekends and weekdays, respectively, compared to those not participating in organized sport activities. This is somewhat in accordance with another Nordic study where participation in sports clubs was positively associated with longer sleeping hours during weekends, but not during weekdays, compared to non-participants.[9] These findings may have an important impact on our understanding of adolescent health as inadequate sleep has been related to inattentiveness, reduction in executive functioning, increased risk of obesity and mood disturbances, and occupational- and sports-related injuries.[44]

The main aim of our study was to investigate whether participation in organized sport, regardless of frequency of participation, was associated with a broad range of lifestyle outcomes. To elucidate a possible dose-response relationship, additional analyses were performed to investigate adolescents who "seldom" vs "often" participated in organized sport, as well as "not very often" vs "very often." Interestingly, we found the same highly significant differences in all outcome variables regardless of frequency of participation. Furthermore, the multivariable logistic regression analyses also showed the same statistically significant results, only somewhat weaker associations indicating that most importantly is to participate in organized sports, even with low frequency. These results imply that an increased frequency (dose) of organized sports participation does not seem to strengthen the associations with healthy and unhealthy lifestyle habits (response) in our sample. Therefore, findings from the present study indicate that even a modest level of participation in organized sport for adolescents is associated with improved prosocial health. These findings are in line with Eime et al,[14] and it substantiates the assumption that participation in organized sport is associated with improved lifestyle habits, above and beyond other forms of leisure-time physical activity. Moreover, the present study included adolescents from both organized individual and team sports, and the participation in organized sport with involvement from peers and adults, and especially due to the social nature of team sport, may enhance health benefits and the development of prosocial health in a better way than other individual leisure-time activities.[14] In fact, the findings suggest that OSP could prove to be an important investment for adolescents meeting health-related challenges throughout the lifespan.

Interestingly, though, are the reflections put forward by Paakkari et al,[45] that sports clubs recognized as possible health-promoting settings may also be questioned concerning their equal accessibility. In our study, we controlled for parental education as a possible confounding factor, but we recommend future studies to further investigate family socioeconomic status as a possible explaining factor for health-enhancing behaviors observed in the organized sports setting.

The associations we observed in our sample may be attributable, in part, to the organizational structure and cultural norms that characterize sports participation. For example, OSP may promote positive health behaviors and deter negative health behaviors by placing a premium on personal health and fitness as prerequisites to optimal sports performance. This unprecedented potential may be reinforced if the organized sports activities were led to some extent by experts in both sports and health promotion. Meganck et al[46] found that health promotion was not a priority of the board of the youth sports clubs in their study and combined with lack of expertise these factors were identified as the most important barriers for health promotion. Furthermore, we also recognize that the extent to which organized sports activities are beneficial for children and adolescents depends on their quality and content.[5] Still, it is possible that OSP promotes health by placing adolescents in prosocial environments during times of the day that would otherwise be available for participating in risk behaviors.[10] However, it should be noted that nearly 70% of students in our 8th grade sample (13-14 years of age)

participated in organized sports; this decreased to less than 50% in the 10th grade (15-16 years of age) and 40% in the 1st year of high school (16-17 years of age). This downward trend is of concern and should be addressed, especially considering the possible preventive effects that OSP may have on unhealthy lifestyle habits, as indicated in our study.

4.1 | Strengths and limitations

To our best knowledge, this study is one of the largest to date investigating lifestyle outcomes among young people in relation to whether they are participants or non-participants in organized sports. Moreover, the study included expanded assessment measures compared with previous research. Other study strengths were the high response rates and that the study was carried out within the school environment.[47] Furthermore, all outcome variables were based on valid questions and/or questions used in previous international research. Finally, these analyses were controlled for possible confounding factors, including parental education and adolescent age and gender.

However, these study results should also be interpreted in light of certain methodological limitations. First, the data were from a cross-sectional study design, limiting deductions of causality. It may be that adolescents who engage in fewer health risk behaviors are more likely to participate in organized sports. Second, we cannot exclude the possibility that some participants may have under- or over-reported their rate of participation in socially undesirable or desirable health behaviors, respectively. Third, we did not explore other dimensions of OSP, such as duration, intensity, or quality. Such dimensions may have affected these associations. Furthermore, the questionnaire did not include information about participation in specific sports; hence, we were unable to assess whether the association between OSP and health risk behaviors varies across sports, or between team and individual sports. Such an impact is likely, given that certain risk behaviors (eg, alcohol consumption) are more prevalent among those in team sports compared with those in individual sports.[16] Fourth, because we were interested in examining the associations between OSP and various health risk behaviors, multiple statistical comparisons were carried out. Thus, another possible limitation is that a small number of the associations we found to be statistically significant may have been due to chance. Finally, the use of some non-validated instruments is a limitation of our study, and our sample of Norwegian adolescents may not be generalizable to those in other countries.

In conclusion, we found that OSP is associated with a reduced likelihood of engaging in several risk behaviors that jeopardize adolescent health, and that may have implications for later adult health. Based on these findings, we advocate for prospective, longitudinal, and/or experimental studies focusing on the relation between OSP and lifestyle behaviors. Such studies are warranted to fully delineate the public health impacts of adolescents' participation in organized sports.

5 | PERSPECTIVE

Adolescence is a developmental period characterized by risks and dangers, as well as being a great opportunity for sustained health and well-being. Here, we demonstrated that compared with non-participants, adolescents who participate in organized sports have decreased odds for engaging in a broader range of health risk behaviors than previously examined. There are reasons to believe that organized sport activities are important contexts that seem to help youth build competencies and successfully negotiate the salient developmental tasks of childhood and adolescence. These findings may have important implications for healthcare providers because they indicate that the organized sports arena may be a valuable venue in which to focus preventive efforts. Our findings were consistent across all lifestyle measures assessed in this large cohort, which we hope will promote future research, including high-quality longitudinal and intervention studies. We recommend that future studies include objective assessment of variables such as physical activity level and sleep duration, in addition to subjective measures. Given the established important link between adolescent and adult health, as well as the positive findings from this study, we suggest that healthy adolescent development, including increasing motivation for continuous participation in organized sport, would be a wise investment.

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CONFLICT OF INTERESTS

The authors have no conflict of interests in this study.

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SUPPORTING INFORMATION

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