

This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Heikkilä, Laura; Korpelainen, Raija; Aira, Tuula; Alanko, Lauri; Heinonen, Olli J; Kokko, Sami; Kujala, Urho; Parkkari, Jari; Savonen, Kai; Valtonen, Maarit; Vasankari, Tommi; Villberg, Jari; Vanhala, Marja

Title: The associations between adolescents' sports club participation and dietary habits

Year: 2021

Version: Published version

Copyright: © 2021 The Authors. Translational Sports Medicine published by John Wiley & Son

Rights: CC BY 4.0

Rights url: <https://creativecommons.org/licenses/by/4.0/>

Please cite the original version:

Heikkilä, L., Korpelainen, R., Aira, T., Alanko, L., Heinonen, O. J., Kokko, S., Kujala, U., Parkkari, J., Savonen, K., Valtonen, M., Vasankari, T., Villberg, J., & Vanhala, M. (2021). The associations between adolescents' sports club participation and dietary habits. *Translational Sports Medicine*, 4(5), 617-626. <https://doi.org/10.1002/tsm2.249>

The associations between adolescents' sports club participation and dietary habits

Laura Heikkilä^{1,2,3} | Raija Korpelainen^{1,2,3} | Tuula Aira⁴ | Lauri Alanko^{5,6} |
Olli J. Heinonen⁷ | Sami Kokko⁴ | Urho Kujala⁴ | Jari Parkkari⁸ | Kai Savonen^{9,10} |
Maarit Valtonen¹¹ | Tommi Vasankari^{12,13} | Jari Villberg⁴ | Marja Vanhala^{1,2,3}

¹Department of Sports and Exercise Medicine, Oulu Deaconess Institute Foundation sr., Oulu, Finland

²Center for Life Course Health Research, Faculty of Medicine, University of Oulu, Oulu, Finland

³Medical Research Center, Oulu University Hospital and University of Oulu, Oulu, Finland

⁴Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland

⁵Sports Medicine Clinic, Foundation for Sports and Exercise Clinic, Helsinki, Finland

⁶Sports and Exercise Medicine Clinic, Central Finland Hospital Nova, Jyväskylä, Finland

⁷Paavo Nurmi Centre & Unit for Physical Activity and Health, University of Turku, Turku, Finland

⁸Tampere Research Center of Sports Medicine, Tampere, Finland

⁹Kuopio Research Institute of Exercise Medicine, Kuopio, Finland

¹⁰Department of Clinical Physiology and Nuclear Medicine, Kuopio University Hospital, Kuopio, Finland

¹¹Research Center for Olympic Sports, Jyväskylä, Finland

¹²UKK Institute of Health Promotion Research, Tampere, Finland

¹³Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland

Correspondence

Laura Heikkilä, Department of Sports and Exercise Medicine, Oulu Deaconess Institute Foundation sr., P.O. Box 365, Oulu FI-90101, Finland.
Email: laura.heikkila@odl.fi

Funding information

The Ministry of Education and Culture, Grant/Award Number: 6/091/2011 and 28/626/2016; The Finnish Cultural Foundation

For adolescent athletes, data on nutrition behaviors are limited. The present study aimed to evaluate the dietary habits of adolescent sports club participants (SPs) compared with those of non-participants (NPs). The cross-sectional study of 1917 adolescents aged 14-16 was based on data from the Finnish Health Promoting Sports Club (FHPSC) study. The health behavior surveys were conducted among SPs ($n = 1093$) and NPs ($n = 824$). Logistic regression was used to test statistical significance of the differences in dietary habits between SPs and NPs. SPs were more likely than NPs to eat breakfast on weekends [89% vs 79%, odds ratio (OR) 1.46, 95% confidence interval (CI) 1.07-2.01] and to report daily consumption of vegetables (46% vs 32%, OR 1.33, 95% CI 1.04-1.69) and fat-free or semi-skimmed milk (72% vs 55%, OR 1.33, 95% CI 1.04-1.68). Dietary habits regarded as unhealthy, such as sugared soft drink consumption, were similar between the groups. The aforementioned healthy dietary habits are more frequent in SPs than NPs, and unhealthy dietary habits are equally frequent in the groups. Both adolescent SPs' and NPs' dietary habits have deficiencies, like inadequate vegetable and fruit consumption. Sports clubs' opportunities for adolescents' healthy eating promotion should be examined.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2021 The Authors. Translational Sports Medicine published by John Wiley & Sons Ltd.

KEYWORDS

athlete, cross-sectional, eating behavior, food frequency questionnaire, sports nutrition

1 | INTRODUCTION

Health behaviors, such as eating habits and physical activity, usually change in adolescence.^{1,2} Healthy dietary behaviors include high consumption of vegetables, fruit, and whole grains, and low intake of food and drinks including high in fats, sugars, or salt.³ Approximately half of European and American 15-year-old adolescents eat breakfast every weekday, and 34% consume vegetables, 44% fruits, 24% sweets, and 19% sugared soft drinks daily.⁴ Adolescents' eating habits tend to be maintained into adulthood,^{5,6} and poor dietary habits in adolescence are associated with cardiovascular and metabolic syndrome risk factors in later stages of life.^{7,8}

Although most adolescents do not meet the daily recommendation for physical activity, participation in sports clubs is common: On average, 40%-59% of children and youth participate in organized sports worldwide.^{9,10} In Finland, 44% of 15-year-old adolescents exercise in sports clubs.¹¹ Participation in a sports club is generally linked to good health behavior, but research findings support this assumption only in part. Previously sports club participation has been associated with higher physical activity,¹² possibly due to clubs' sport activities or active adolescents' tendency to participate in sports clubs. However, adolescent athletes have also been found to, for example, binge-drink and use unnecessary dietary supplements.^{13,14} Youth sports clubs are complex multilevel settings, and not only training but also social, cultural, economic, and environmental determinants of them can affect adolescents participants' behaviors.¹⁵

The existing research suggests that participation in organized sports is associated with healthy dietary habits.¹² Among Norwegian adolescents, participants in organized sports had decreased odds than non-participants for low intake of healthy food and high intake of unhealthy food and beverages.¹⁶ In Sweden, von Rosen et al¹⁷ found that elite adolescent athletes had a more varied diet than adolescents not involved in elite sports. Sports club participation has been found to predict larger vegetable and fruit consumption but the existing literature is limited.^{12,18} Also, studies on unfavorable dietary habits, such as sugar-sweetened beverage and fast food consumption, are contradictory.^{12,19,20} Only few studies have previously examined adolescent sports club participants' dietary habits in large national samples.^{16,18,19} For the first time, this wide national multicenter study evaluated dietary habits of Finnish adolescent sports club participants (SPs) compared with those of non-participants (NPs) and associations between participants' characteristics and dietary habits.

2 | MATERIALS AND METHODS

2.1 | Study design and participants

This cross-sectional study was based on data from the Finnish Health Promoting Sports Club (FHPSC) study.²¹ The FHPSC study conducted multicenter research in cooperation with the University of Jyväskylä, UKK Institute, and six national Sports and Exercise Medicine Centres of Excellence in Finland. The study population comprised Finnish boys and girls aged between 14 and 16. The study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the Ethics Committee of the Health Care District of Central Finland (record number 23U/2012). Written informed consent was obtained from all subjects.

The sampling of data was performed in two stages.²¹ First, the clubs were grouped with two criteria: winter and summer sports (depending on the main competition season) and team and individual sports. The ten most popular sports disciplines in Finland were included in the study: basketball, cross-country skiing, floorball, ice hockey, skating, football (soccer), gymnastics, orienteering, swimming, and track and field. Twenty-four clubs from each discipline were targeted and 11 to 22 clubs participated. The participating sports clubs were stratified depending on geographical location, area type (city or countryside), magnitude (larger or smaller), and certification by the Young Finland Association (yes or no). The sampling was discretionary in order to reach a representative sample of Finnish sports clubs. The data were collected in the middle of the main competition season from January to May 2013 for winter sports and from August to December 2013 for summer sports. Fifty-seven percent (156/272) of the invited youth sports clubs participated in the study.

The second stage focused on the youth participating in the sports clubs. Of the team sports clubs, one team was randomly selected, and if a club only had one team, that team was automatically chosen. Thereafter, the researchers randomly selected the individuals from team participant lists provided by clubs. For individual sports clubs, individuals were randomly selected from name lists given to the researchers. Forty percent of the invited SPs (759/1889) completed the questionnaire. Fifteen-year-old adolescents were targeted, but those 14-16-year-olds were accepted for the data analyses.

Non-participant data were collected via schools similarly in two stages between January and December 2013. Ten secondary schools from every district of the six sports and exercise medicine centers were targeted to take part in the

study. The schools were also stratified depending on geographical location, area type, and magnitude. In total, 159 schools were contacted, and 100 participated (63%). One randomly selected class of ninth graders was asked to participate from each school. Eighty percent of the pupils (1650/2074) completed the study. Complementary data, including SPs and NPs, were compiled between January and May 2014. Figure 1 shows the study's data collection.

A total of 2409 adolescents completed the FHPSC study: 759 via sports clubs and 1650 via schools. In total, 492 participants were excluded due to the following criteria: (a) adolescents who answered twice; (b) adolescents who did not fill out the questionnaire seriously; (c) adolescents who disallowed their answers' use for research purposes; (d) adolescents with missing data concerning sports club participation, gender, age, body mass index, and/or physical activity and (e) 13- or 17-year-old participants. Subjects of the school-based sample who answered as being a sports club member and participating with a sports club ($n = 498$) were treated as sports club members. Sports club participation was asked using the question: Are you currently a member of any sports club? (no / yes, and I participate in training sessions / yes, but I do not participate in training sessions). This study included 1917 adolescents aged 14–16 years: 1093 SPs (57%) and 824 NPs (43%).

2.2 | Dietary habits

Health behaviors, including dietary habits, were collected by two Internet-based surveys: the first one for the SPs and the second one for the NPs. The SPs' questionnaire included

extra questions related to training characteristics. Both questionnaires comprised four nutrition questions:

- How often do you usually have breakfast (more than a glass of milk or fruit juice) on weekdays? (I never have breakfast during the week / 1 day / 2 days / 3 days / 4 days / 5 days)
- How often do you usually have breakfast (more than a glass of milk or fruit juice) on weekends? (I never have breakfast during the weekend / I usually have breakfast on only 1 day of the weekend / I usually have breakfast on both weekend days)
- How often do you usually skip school lunch during a school week? (Never, I usually always eat school lunch / 1 day / 2 days / 3 days / 4 days / 5 days)
- How many times a week do you usually eat or drink the following foods? Salad, fruits, vegetables, sweets, sugar-sweetened soft drinks, brown bread, hamburgers or hot dogs, pizza, potato or corn crisps, fat-free or semi-skimmed milk (Never / less than once a week / once a week / 2–4 days a week / 5–6 days a week / every day, once a day / every day, more than once)

The nutrition questions were based on a previously validated food frequency questionnaire in the Health Behaviour in School-aged Children (HBSC) study and on the School Health Promotion (SHP) study.^{22,23} The food frequency questions were recoded into dichotomous variables, such as “eat breakfast daily on school days” (yes/no).

Dietary habits were also evaluated with healthy and unhealthy eating indices.²⁴ In the healthy eating index, two items on fruit and vegetable consumption were recoded from an ordinal to a ratio scale and then summed together:

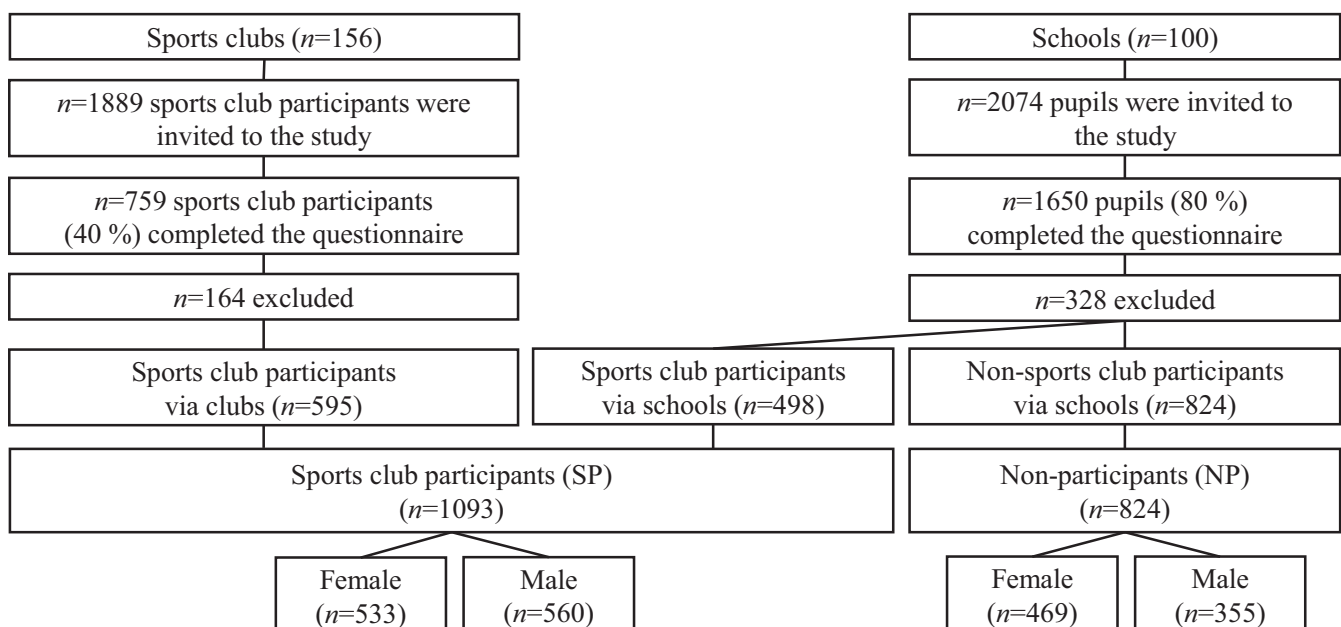


FIGURE 1 Study data collection

'never' = 0, 'less than once a week' = 0.25, 'once a week' = 1, '2-4 days a week' = 3, '5-6 days a week' = 5.5, and 'once a day, every day' and 'more than once a day, every day' = 7. The index ranges from 0 to 14: Value 0 denotes no fruit and vegetable consumption, and value 14 both fruit and vegetable consumption at least once a day. In the unhealthy eating index, two items on sweet and sugared soft drink consumption were recoded as follows: 'never' = 7, 'less than once a week' = 5.5, 'once a week' = 3, '2-4 days a week' = 1, '5-6 days a week' = 0.25, and 'once a day, every day' and 'more than once a day, every day' = 0. Value 0 indicates consuming both sweets and sugared soft drinks at least once a day, and 14 never eating sweets and sugared soft drinks.

2.3 | Other variables

Date of birth, gender, height, weight, and residence were asked, and other variables were formed from the questions as follows:

- Body image: What do you think about your body? (too thin / slightly too thin / about the right size / slightly too fat / too fat). The answer options were recoded into three categories (too thin / about the right size / too fat).
- Self-rated health: Would you say your health is ...? (excellent / good / moderate / poor). The options moderate and poor were combined in the analyses.
- School grade average: What was your grade average (all subjects) in your last report? The grading scale 4-10 was divided into eight answer options (< 6.5 / 6.5-6.9 / 7.0-7.4 / 7.5-7.9 / 8.0-8.4 / 8.5-8.9 / 9.0-9.4 / 9.5-10.0). The grade averages under 8.0 were defined as adequate to satisfactory and 8.0-10.0 as good to excellent.
- Leisure time vigorous physical activity (VPA): Outside school hours: how many hours a week do you usually exercise in your free time so much that you get out of breath or sweat? (none / about half an hour / about 1 hour / about 2-3 hours / about 4-6 hours / about 7 hours or more). The responses were divided into two groups: under or at least 4 hours a week.

2.4 | Statistical analyses

Normality of the continuous variables was tested. Differences in characteristics between SPs and NPs were assessed with cross-tabs and Chi-squared tests and *t* tests when appropriate. Binary logistic regression was performed to test statistical significance of the differences in dietary habits between SPs and NPs and to identify significant associations between participants' characteristics and dietary habits. Logistic regression models included

sports club participation, gender, leisure time VPA, educational achievement, self-rated health, and body image as covariates. Healthy and unhealthy eating indices were compared between the groups using the Mann-Whitney U test. ORs are reported with 95% CIs. A *P*-value .05 was considered statistically significant. Statistical analyses were performed with IBM SPSS Statistics, version 24 (IBM Corporation).

3 | RESULTS

This study included 1917 adolescents: 51% of the SPs (*n* = 1093) and 43% of the NPs (*n* = 824) were males. SPs were taller and had lower body mass than NPs (*P* < .01). SPs more commonly had urban surroundings, leisure time VPA of at least four hours per week, normal body image, good or excellent self-rated health, and good to excellent school grade average than NPs. Table 1 presents study characteristics and differences between SPs and NPs.

The healthy eating index was higher for SPs than NPs (*P* < .001), and the unhealthy eating index was similar between the groups (*P* = .227) (Figure 2). Also among males, SPs scored higher in healthy eating index than NPs (*P* < .001), and there was no difference in the unhealthy eating index between the groups (*P* = .893). Among females, both the healthy eating index (*P* < .001) and unhealthy eating index (*P* = .003) were higher in SPs compared to NPs.

In multivariable models, SPs more likely ate breakfast every weekend day (*P* = .019) than NPs (Table 2). Breakfast consumption on school days (*P* = .566) and eating school lunch (*P* = .196) were equally frequent between the groups. Eating school lunch daily on school days (*P* = .001) was more common in boys than girls, but there was no gender difference in breakfast consumption on school days (*P* = .434) and on weekend days (*P* = .560).

SPs had more frequent daily consumption of vegetables (*P* = .024) and fat-free or semi-skimmed milk (*P* = .021) than NPs. Although daily vegetable consumption was more common in SPs compared with NPs, 46% of them ate vegetables and 36% fruits daily. Also, 30% of SPs did not eat breakfast and 24% school lunch every school day. Consumption of sweets (*P* = .067), sugared soft drinks (*P* = .760), fast food (*P* = .403), and crisps (*P* = .152) more often than once a week was similar between the groups.

Gender wise, female SPs ate breakfast on weekends (*P* = .040) and school lunch on school days (*P* = .018) more frequently than female NPs. Female SPs were also more likely to consume sweets than female NPs (*P* = .012). In males, sports club participation was only associated with daily vegetable consumption (*P* = .015).

In addition to sports club participation, daily vegetable consumption was positively associated with female gender, leisure time VPA, educational achievement, and self-rated

TABLE 1 Characteristics by sports club participation and gender

	Male (n = 915)		Female (n = 1002)		Total (n = 1917)	
	SP (n = 560)	NP (n = 355)	SP (n = 533)	NP (n = 469)	SP (n = 1093)	NP (n = 824)
Age (y), mean (SD)	15.0 (0.5)	15.0 (0.5)	14.9 (0.5)	15.0 (0.5)	15.0 (0.5)	15.0 (0.5)
Height (cm), mean (SD)	174.9 (7.6)	174.7 (7.9)	166.3 (6.0)***	164.7 (6.2)	170.7 (8.1)***	169.0 (8.5)
Weight (kg), mean (SD)	64.3 (10.1)	65.6 (11.7)	57.0 (8.1)	57.5 (11.4)	60.7 (9.9)	61.0 (12.2)
BMI (kg/m ²), mean (SD)	20.9 (2.4)*	21.4 (3.3)	20.6 (2.5)**	21.1 (3.6)	20.8 (2.4)**	21.3 (3.5)
Residence: urban vs. rural, n (%)	413 (73.8)***	198 (55.8)	376 (70.5)***	264 (56.3)	789 (72.2)***	462 (56.1)
Leisure time VPA: 4 h/wk or more vs. less, n (%)	456 (81.4)***	110 (31.0)	443 (83.1)***	117 (24.9)	899 (82.3)***	227 (27.5)
Body image: about the right size vs. thin or fat, n (%)	392 (70.0)**	210 (59.2)	342 (64.2)***	212 (45.2)	734 (67.2)***	422 (51.2)
Self-rated health: good to excellent vs. poor to moderate, n (%)	542 (96.8)***	287 (80.8)	493 (92.5)***	356 (75.9)	1035 (94.7)***	643 (78.0)
School grade average: good to excellent vs. adequate to satisfactory, n (%)	341 (60.9)***	151 (42.5)	451 (84.6)***	273 (58.2)	792 (72.5)***	424 (51.5)

Note: The values are means (SD) or absolute (%) numbers of subjects. *P*-values are for differences between SPs and NPs: **P* < .05; ***P* < .01; ****P* < .001.

Abbreviations: NP, non-sports club participant; SP, sports club participant; VPA, vigorous physical activity.

excellent health (Table 3). Daily fruit consumption also correlated with female gender, leisure time VPA, and self-rated health, but not with educational achievement. Females and adolescents with higher educational achievement had a lower probability of consuming sugared soft drinks.

Adolescents with leisure time VPA at least 4 hours a week were more likely to consume daily vegetables (*P* = .016), fruit (*P* = .007), brown bread (OR 1.34, 95% CI 1.05-1.72, *P* = .020), and fat-free or semi-skimmed milk (OR 1.32, 95% CI 1.05-1.67, *P* = .020). Consumption of fast food (OR 0.58, 95% CI 0.39-0.86, *P* = .007) and crisps (OR 0.54, 95% CI 0.35-0.83, *P* = .005) more than once a week was negatively correlated with leisure time VPA.

4 | DISCUSSION

This cross-sectional study evaluated dietary habits of adolescent SPs compared with adolescents not involved in organized sports. We found that SPs ate breakfast on weekends more often and had more frequent vegetable and fat-free or semi-skimmed milk consumption compared with their non-participating peers. Other adolescents' dietary habits were not associated with sports club participation. Both SPs' and NPs' dietary habits had deficiencies, such as meal skipping and low vegetable and fruit intake. Female gender, leisure

time VPA, and self-rated health were positively related to adolescents' daily vegetable and fruit consumption.

Our findings are in accordance with earlier studies reporting more frequent vegetable consumption among adolescent SPs than NPs.^{16,18-20} Gender wise, we found the association only in males. Few previous studies have examined SPs' vegetable consumption separately among males and females, and reported findings have varied between genders, ethnic groups, and survey years.^{18,25} Previous research also supports our finding that females have more frequent vegetable consumption than males.^{16,20} In this study, SPs were more likely than NPs to drink fat-free or semi-skimmed milk daily, but the association was not found separately for males and females. Cavadini et al²⁶ observed higher milk consumption among athletic than non-athletic boys but not consistently in all ages or among girls. Breakfast consumption has also been associated with sports club participation in some earlier studies.^{16,20} We found that SPs were more likely than NPs to eat breakfast on weekends, but breakfast consumption was similar on school days. Participation in organized sports usually includes scheduled trainings and competitions on weekends that may explain the different weekend breakfast habits between SPs and NPs.

Although we found SPs to have some healthier dietary habits than NPs, only approximately half of them (46%) ate vegetables and one third (36%) fruits daily. Similar findings were reported among elite German adolescent athletes and

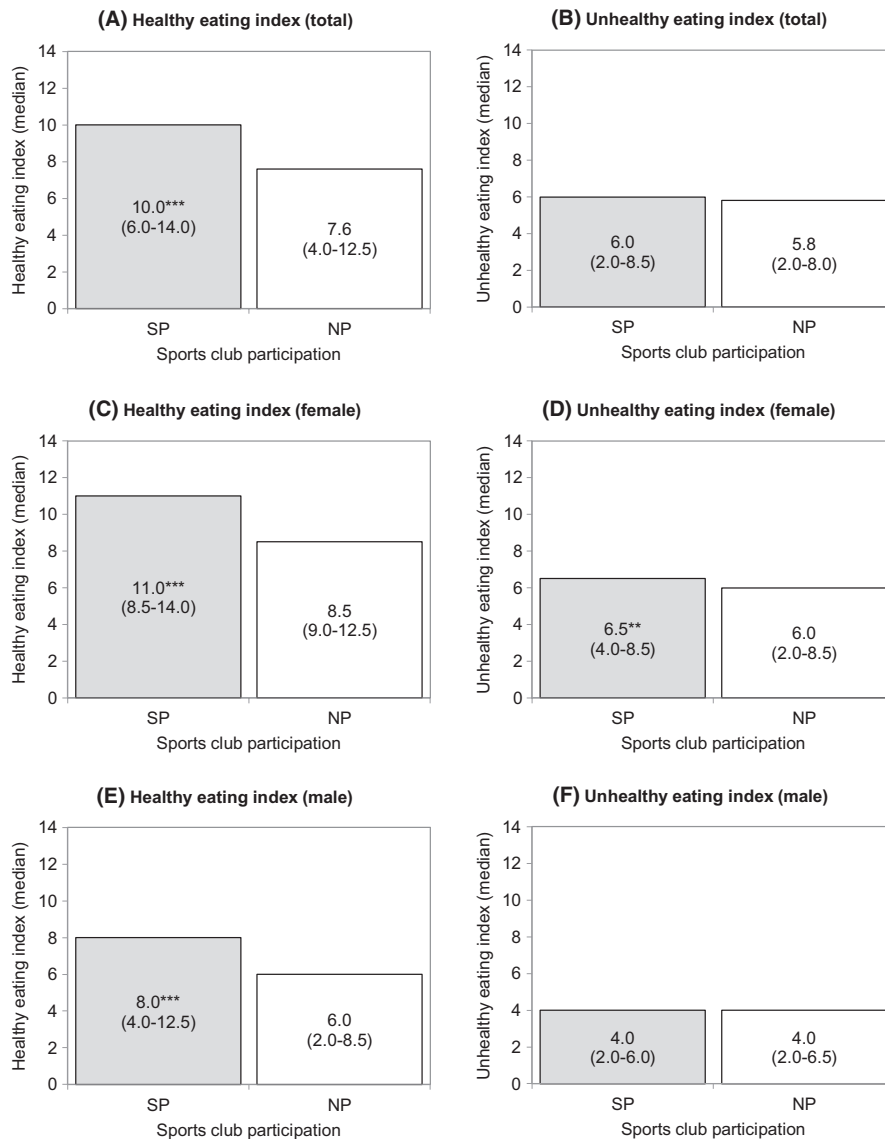


FIGURE 2 Healthy eating and unhealthy eating indices between sports club participants (SP; $n = 1093$) and non-participants (NP; $n = 824$). Values are medians (25th–75th percentiles). P -values are for differences between SPs and NPs estimated using the Mann-Whitney U test: * $P < .05$, ** $P < .01$, *** $P < .001$

Flemish sprint athletes but not among young Italian competitive athletes.^{27–29} We also observed that one quarter (24%) of the SPs did not eat daily school lunch although Finnish adolescents' school lunch has been shown to be nutritionally superior to the other daily meals.³⁰ The school lunch meal based on national nutrition recommendations is free for all pupils in Finland, and the opportunity to eat it should not depend on a family's economic circumstances. However, having a fast food outlet or grocery store near school has been previously linked to students' skipping the free school lunch.³¹ These findings suggest that healthy eating promotion practices would benefit both SPs and NPs.

Unhealthy dietary habits, such as daily consumption of sweets and sugared beverages, are typical for adolescents.⁴ We found no association between adolescents' sports club participation and unhealthy dietary habits, except sweets consumption among females. Previously, SPs have been found to consume more sport drinks than NPs, but studies on other sugar-sweetened beverages are contradictory.^{12,16,19,20}

Divergent results have also been reported concerning chocolate and other sweets consumption.^{20,28} In contrast to our findings, fast food consumption has been positively associated with sports club participation among adolescent males.^{32,33} SPs, males in particular, usually have higher energy expenditure and need larger amounts of food to fulfil their energy and nutrient requirements than NPs. Alterations in energy expenditure may explain the differences in fast food consumption but also in the other dietary habits between SPs and NPs. Definitions of unhealthy dietary habits, such as the frequency regarded as unhealthy, have varied among studies. Different definitions as well as varying methods and samples may have resulted in divergent findings.

Our findings suggest that female gender, leisure time VPA, and self-rated excellent health are positively related to adolescents' healthy dietary habits. In addition, educational achievement was positively associated with daily vegetable consumption. These findings are consistent with current literature on adolescents that generally associates healthy

TABLE 2 Odds ratios (OR) and 95% confidence intervals (CI) for dietary habits by sports club participation and gender

	Male (n = 915)			Female (n = 1002)			Total (n = 1917)		
	SP (n = 560)		NP (n = 355)	SP (n = 533)		NP (n = 469)	SP (n = 1093)		NP (n = 824)
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Breakfast daily on school days	397 (70.9)	214 (60.3)	1.10 (0.78-1.55)	368 (69.0)	280 (59.7)	1.03 (0.73-1.45)	765 (70.0)	494 (60.0)	1.07 (0.84-1.37)
Breakfast daily on weekend days ^a	457 (89.4)	285 (80.3)	1.32 (0.83-2.11)	440 (87.8)	363 (77.4)	1.58 (1.02-2.44)*	897 (88.6)	648 (78.6)	1.46 (1.07-2.01)*
School lunch every school day	427 (76.3)	250 (70.4)	0.87 (0.60-1.27)	400 (75.0)	268 (57.1)	1.52 (1.07-2.15)*	827 (75.7)	518 (62.9)	1.18 (0.92-1.52)
Vegetables daily	189 (33.8)	66 (18.6)	1.61 (1.10-2.35)*	317 (59.5)	197 (42.0)	1.15 (0.83-1.59)	506 (46.3)	263 (31.9)	1.33 (1.04-1.69)*
Fruits daily	139 (24.8)	56 (15.8)	1.38 (0.92-2.08)	252 (47.3)	153 (32.6)	1.02 (0.73-1.43)	391 (35.8)	209 (25.4)	1.18 (0.91-1.52)
Brown bread daily	158 (28.2)	77 (21.7)	1.13 (0.78-1.63)	235 (44.1)	134 (28.6)	1.38 (0.99-1.93)	393 (36.0)	211 (25.6)	1.28 (1.00-1.64)
Fat-free or semi-skimmed milk daily	421 (75.2)	211 (59.4)	1.36 (0.96-1.93)	365 (68.5)	243 (51.8)	1.31 (0.94-1.82)	786 (71.9)	454 (55.1)	1.33 (1.04-1.68)*
Sweets more often than once a week	270 (48.2)	168 (47.3)	1.00 (0.73-1.38)	252 (47.3)	213 (45.4)	1.52 (1.10-2.11)*	522 (47.8)	381 (46.2)	1.24 (0.99-1.55)
Sugared soft drinks more often than once a week	286 (51.1)	188 (53.0)	1.00 (0.72-1.38)	131 (24.6)	166 (35.4)	0.95 (0.67-1.36)	417 (38.2)	354 (43.0)	0.96 (0.76-1.22)
Fast food (hamburgers, hot dogs, or pizza) more often than once a week	58 (10.4)	53 (14.9)	1.04 (0.64-1.70)	16 (3.0)	42 (9.0)	0.54 (0.26-1.11)	74 (6.8)	95 (11.5)	0.84 (0.57-1.26)
Crisps more often than once a week	54 (9.6)	38 (10.7)	1.39 (0.81-2.38)	18 (3.4)	24 (5.1)	1.40 (0.64-3.06)	72 (6.6)	62 (7.5)	1.38 (0.89-2.15)

Note: P-values are for ORs: * $P < .05$, ** $P < .01$, *** $P < .001$.

Abbreviations: NP, non-sports club participant; SP, sports club participant.

^aNumbers do not match due to missing values.

TABLE 3 Logistic regression models for participants' characteristics and vegetable, fruit, sweets, and sugared soft drink consumption

	Vegetables daily	Fruits daily	Sweets more often than once a week	Sugared soft drinks more often than once a week
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sports club participation				
Yes	1.33 (1.04-1.69)*	1.18 (0.91-1.52)	1.24 (0.99-1.55)	0.96 (0.76-1.22)
No	1.00	1.00	1.00	1.00
Gender				
Male	0.34 (0.28-0.43)***	0.36 (0.29-0.45)***	0.98 (0.81-1.19)	2.34 (1.91-2.87)***
Female	1.00	1.00	1.00	1.00
Leisure time VPA				
At least 4 h/week	1.35 (1.06-1.72)*	1.42 (1.10-1.82)**	0.82 (0.66-1.03)	0.87 (0.69-1.10)
Under 4 h/week	1.00	1.00	1.00	1.00
School grade average				
Good to excellent	1.93 (1.55-2.40)***	1.25 (0.99-1.57)	0.83 (0.68-1.02)	0.54 (0.44-0.66)***
Adequate to satisfactory	1.00	1.00	1.00	1.00
Self-rated health				
Excellent	2.62 (1.77-3.87)***	3.28 (2.14-5.01)***	0.87 (0.61-1.23)	0.74 (0.51-1.08)
Good	1.32 (0.95-1.85)	1.83 (1.26-2.65)**	1.03 (0.77-1.38)	0.99 (0.73-1.35)
Moderate or poor	1.00	1.00	1.00	1.00
Body image				
Too fat	1.22 (0.96-1.56)	1.15 (0.90-1.47)	0.82 (0.65-1.02)	0.81 (0.64-1.04)
Too thin	0.95 (0.69-1.30)	0.91 (0.65-1.27)	1.11 (0.84-1.47)	1.00 (0.74-1.33)
About the right size	1.00	1.00	1.00	1.00

Note: *P*-values are for ORs: **P* < .05, ***P* < .01, ****P* < .001.

Abbreviation: VPA, vigorous physical activity.

[Correction added on 26 June after first online publication: the layout of Table 3 was corrected in this version.]

dietary habits with a positive self-rated health status and academic achievement.^{34,35} Physical activity has previously been shown to be correlated with healthy diet in children but not consistently among adolescents, possibly due to complexity of adolescents' health behaviors and the methodological limitations in previous studies.³⁶ Among athletes, sports performance and competitive priorities have been suggested as important factors in food choice.³⁷ Adolescents participating in organized sports may employ healthy dietary habits to improve sports performance and achieve competitive goals. Getting information from a nutritionist and having a nutrition plan previously have been associated with consumption of vitamin- and fiber-rich foods, such as vegetables, fruits, and brown bread, in adolescent elite athletes.²⁸

Health behaviors tend to cluster together and are related to social and residential environments. Adolescents' sports club participation is positively associated with their socioeconomic circumstances and family support.³⁸ Parents with higher socioeconomic status commonly have a higher education level and appreciate favorable health behaviors, like healthy dietary habits. Higher income also enables

participation in sports clubs. On the other hand, sports club participation itself and growing into an athlete may change adolescents' health behaviors regardless of their socioeconomic status. Regarding residential environments, urban surroundings were more common among SPs than NPs in our data, and different food environments, such as the availability of grocery stores, can influence adolescents' dietary habits.

According to descriptive healthy and unhealthy eating indices, healthy dietary habits were more common in SPs than NPs and unhealthy eating was similar between the groups. In the multivariable models, sports clubs participation was positively associated with vegetable and fat-free or semi-skimmed milk consumption but not consistently with adolescents' healthy dietary habits. Our findings are contradictory to some previous studies that have reported healthier diet among SPs or elite athletes compared with NPs.^{16,17} However, in the aforementioned studies, analyses were not adjusted for physical activity to specifically reveal the impact of sports participation on eating habits. Taliaferro et al¹⁸ reported divergent results on adolescents' vegetable and fruit consumption when VPA was included in the analyses.

According to our results, adolescents' dietary habits are determined more strongly by leisure time VPA than sports club participation. Earlier studies on the associations between adolescents' physical activity and healthy dietary habits have reported inconsistent findings.³⁶ Adolescents' physical activity and dietary habits are complex behaviors and influenced by several possible factors. Hence, future studies focusing on SP' dietary habits should consider the amount of overall physical activity and take into account other possible confounding factors, such as family background.

Our results suggest that both adolescent SPs and NPs have some similar unhealthy eating behaviors, like meal skipping. Organized sports clubs reach approximately half of adolescents and are a potential setting for health promotion.^{10,15} However, this potential is incompletely used, and research on nutrition education practices in sports clubs is insufficient.³⁹ Understanding young athletes' dietary habits and sports clubs' health promotion orientation enables professionals to develop new practices for adolescents' nutrition education and health promotion on a population level. Nutrition and health promotion interventions targeted to sports clubs might promote adolescent athletes' health behaviors and prevent lifestyle diseases in their later years. In addition, improved dietary habits could support young athletes' training, progression, and recovery.

The strength of this study was a representative sample of Finnish adolescents from different regions divided into SPs and NPs. The sports club data comprised the ten most popular sports in Finland: both winter and sports and individual and team sports were involved. The food frequency questions used in this study were based on a previously validated questionnaire and were found to have sufficient reliability among adolescents.²² The SPs filled out the questionnaire in their spare time, and the controls did so in class during a school day. Possibly due to that, a smaller portion of the SPs than NPs (40% vs 80%) completed the questionnaire, which may have resulted in sampling bias. We have no further details about the non-respondents, but they may be less interested in health behaviors and have more unhealthy dietary habits. Physical activity questionnaires used in this study were based on self-reported data and have been found to underestimate physical activity compared with objectively measured values among school-aged children and adolescents.⁴⁰ Due to many statistical tests, some significant associations may have occurred by chance.

4.1 | Perspectives

Adolescence is a critical period in respect of health behaviors, and dietary patterns in adolescence are associated with cardiovascular risk factors in later stages of life.⁷ Participation in youth sports clubs is common, but research on adolescent sports club participants' dietary habits is limited. Our results

suggest that adolescent sports club participants are more likely than non-participants to eat breakfast on weekends and to have daily vegetable and fat-free or semi-skimmed milk consumption. Unhealthy dietary habits are equally frequent in the groups. It seems that adolescents' dietary habits are more strongly associated with overall leisure time VPA instead of sports club participation itself. In this study, adolescents' dietary habits had deficiencies, such as low vegetable and fruit consumption and meal skipping. Sports clubs form a potential setting for health promotion, but sports clubs' opportunities for promoting healthy eating among adolescents are not known and should be examined.

ACKNOWLEDGMENTS

This work was supported by The Ministry of Education and Culture [grant numbers 6/091/2011, 28/626/2016] and The Finnish Cultural Foundation. We would like to thank all of the adolescents, sports clubs, and schools that participated in this study.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTIONS

SK and JP coordinated and managed all parts of the study. LH carried out the literature search. SK and JV conducted data collection and performed preliminary data preparations. LH conducted data analyses, and all of the authors contributed to the interpretation of data. LH, MV, and RK wrote the first draft of the paper, and all authors provided substantive feedback on the paper and contributed to the final manuscript. All authors read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

1. Dumith SC, Gigante DP, Domingues MR, et al. Physical activity change during adolescence: a systematic review and a pooled analysis. *Int J Epidemiol*. 2011;40(3):685-698.
2. Hiza HAB, Casavale KO, Guenther PM, et al. Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. *J Acad Nutr Diet*. 2013;113(2):297-306.
3. World Health Organization. *Guideline: Implementing Effective Actions for Improving Adolescent Nutrition*. Geneva: World Health Organization; 2018.
4. Inchley J, Currie D, Young T, et al. Growing up unequal: gender and socioeconomic differences in young people's health and well-being. Health Behaviour in School-aged children (HBSC) study: International Report from the 2013/2014 Survey. Copenhagen: WHO Regional Office for Europe; 2016.
5. Mikkilä V, Räsänen L, Raitakari OT, et al. Consistent dietary patterns identified from childhood to adulthood: the cardiovascular risk in Young Finns Study. *Br J Nutr*. 2005;93(6):923-931.

6. Pedersen TP, Holstein BE, Flachs EM, et al. Meal frequencies in early adolescence predict meal frequencies in late adolescence and early adulthood. *BMC Public Health*. 2013;13:445.
7. Kaikkonen JE, Mikkilä V, Magnussen CG, et al. Does childhood nutrition influence adult cardiovascular disease risk? – insights from the Young Finns Study. *Ann Med*. 2013;45(2):120-128.
8. Wennberg M, Gustafsson PE, Wennberg P, et al. Poor breakfast habits in adolescence predict the metabolic syndrome in adulthood. *Public Health Nutr*. 2015;18(1):122-129.
9. Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet*. 2012;380(9838):247-257.
10. Tremblay MS, Barnes JD, González SA, et al. Global Matrix 2.0: report card grades on the physical activity of children and youth comparing 38 countries. *J Phys Act Health*. 2016;13(11 Suppl 2):S343-S366.
11. Kokko S, Martin L, eds. *Lasten ja nuorten liikuntakäyttäytyminen Suomessa. LIITU-tutkimuksen tuloksia vuodelta 2018* (in Finnish). Publications of the National Sports Council. 2019:1.
12. Nelson TF, Stovitz SD, Thomas M, et al. Do youth sports prevent pediatric obesity? A systematic review and commentary. *Curr Sports Med Rep*. 2011;10(6):360-370.
13. Coutinho LA, Porto CP, Pierucci AP. Critical evaluation of food intake and energy balance in young modern pentathlon athletes: a cross-sectional study. *J Int Soc Sports Nutr*. 2016;13(1):15.
14. Diehl K, Thiel A, Zipfel S, et al. Substance use among elite adolescent athletes: findings from the GOAL Study. *Scand J Med Sci Sports*. 2014;24(1):250-258.
15. Kokko S. Sports clubs as settings for health promotion: fundamentals and an overview to research. *Scand J Public Health*. 2014;42(15 Suppl):60-65.
16. Torstveit MK, Johansen BT, Haugland SH, et al. Participation in organized sports is associated with decreased likelihood of unhealthy lifestyle habits in adolescents. *Scand J Med Sci Sports*. 2018;28(11):2384-2396.
17. von Rosen P, Olofsson O, Väsborn S, et al. Correlates of health in adolescent elite athletes and adolescents: a cross-sectional study of 1016 adolescents. *Eur J Sport Sci*. 2019;19(5):707-716.
18. Taliaferro LA, Rienzo BA, Donovan KA. Relationships between youth sport participation and selected health risk behaviors from 1999 to 2007. *J Sch Health*. 2010;80(8):399-410.
19. Vella SA, Cliff DP, Okely AD, et al. Associations between sports participation, adiposity and obesity-related health behaviors in Australian adolescents. *Int J Behav Nutr Phys Act*. 2013;10:113.
20. Voráčová J, Badura P, Hamrik Z, et al. Unhealthy eating habits and participation in organized leisure-time activities in Czech adolescents. *Eur J Pediatr*. 2018;177(10):1505-1513.
21. Kokko S, Selänne H, Alanko L, et al. Health promotion activities of sports clubs and coaches, and health and health behaviours in youth participating in sports clubs: the Health Promoting Sports Club study. *BMJ Open Sport Exerc Med*. 2015;1(1):e000034.
22. Vereecken CA, Maes L. A Belgian study on the reliability and relative validity of the health behaviour in school-aged children food-frequency questionnaire. *Public Health Nutr*. 2003;6(6):581-588.
23. Finnish institute for health and welfare. School Health Promotion study. <https://thl.fi/en/web/thlfi-en/research-and-expertwork/population-studies/school-health-promotion-study>. Accessed August 21, 2019.
24. Vereecken CA, Rossi S, Giacchi MV, et al. Comparison of a short food-frequency questionnaire and derived indices with a seven-day diet record in Belgian and Italian children. *Int J Public Health*. 2008;53(6):297-305.
25. Pate RR, Trost SG, Levin S, et al. Sports participation and health-related behaviors among US youth. *Arch Pediatr Adolesc Med*. 2000;154(9):904-911.
26. Cavadini C, Decarli B, Grin J, et al. Food habits and sport activity during adolescence: differences between athletic and non-athletic teenagers in Switzerland. *Eur J Clin Nutr*. 2000;54(Suppl 1):16.
27. Aerenhouts D, Deriemaeker P, Hebbelink M, et al. Energy and macronutrient intake in adolescent sprint athletes: a follow-up study. *J Sports Sci*. 2011;29(1):73-82.
28. Diehl K, Yarmoliuk T, Mayer J, et al. Eating patterns of elite adolescent athletes: results of a cross-sectional study of 51 Olympic sports. *Dtsch Z Sportmed*. 2013;64(05):126-131.
29. Galanti G, Stefani L, Scacciati I, et al. Eating and nutrition habits in young competitive athletes: a comparison between soccer players and cyclists. *Transl Med UniSa*. 2014;11:44-47.
30. Hoppu U, Lehtisalo J, Tapanainen H, et al. Dietary habits and nutrient intake of Finnish adolescents. *Public Health Nutr*. 2010;13(6A):965-972.
31. Virtanen M, Kivimäki H, Ervasti J, et al. Fast-food outlets and grocery stores near school and adolescents' eating habits and overweight in Finland. *Eur J Public Health*. 2015;25(4):650-655.
32. Bauer KW, Larson NI, Nelson MC, et al. Socio-environmental, personal and behavioural predictors of fast-food intake among adolescents. *Public Health Nutr*. 2009;12(10):1767-1774.
33. French SA, Story M, Neumark-Sztainer D, et al. Fast food restaurant use among adolescents: associations with nutrient intake, food choices and behavioral and psychosocial variables. *Int J Obes Relat Metab Disord*. 2001;25(12):1823-1833.
34. Goodwin DK, Knol LL, Eddy JM, et al. The relationship between self-rated health status and the overall quality of dietary intake of US adolescents. *J Am Diet Assoc*. 2006;106(9):1450-1453.
35. Stea TH, Torstveit MK. Association of lifestyle habits and academic achievement in Norwegian adolescents: a cross-sectional study. *BMC Public Health*. 2014;14:829.
36. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc*. 2000;32(5):963-975.
37. Birkenhead KL, Slater G. A review of factors influencing athletes' food choices. *Sports Med*. 2015;45(11):1511-1522.
38. Eime RM, Harvey JT, Craike MJ, et al. Family support and ease of access link socio-economic status and sports club membership in adolescent girls: a mediation study. *Int J Behav Nutr Phys Act*. 2013;10:50.
39. Kokko S, Kannas L, Villberg J. Health promotion profile of youth sports clubs in Finland: club officials' and coaches' perceptions. *Health Promot Int*. 2009;24(1):26-35.
40. Sprengeler O, Wirsik N, Hebestreit A, et al. Domain-specific self-reported and objectively measured physical activity in children. *Int J Environ Res Public Health*. 2017;14(3):242.

How to cite this article: Heikkilä L, Korpelainen R, Aira T, et al. The associations between adolescents' sports club participation and dietary habits. *Transl Sports Med*. 2021;4:617–626. <https://doi.org/10.1002/tsm.249>