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Well-being, physical fitness and health profile of 10-12-year-old boys in relation to leisure-time sports club activities – a cross sectional study.

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ABSTRACT:

OBJECTIVES: Physical activity is associated with health benefits for children. This study investigated the correlation between sports club activities and well-being and physical health parameters in 10-12-yr-old Danish boys. DESIGN: Cross-sectional SETTING: Danish schools. PARTICIPANTS: 2,293 boys took part in the study. PRIMARY AND SECONDARY OUTCOME MEASURES: Questionnaires on participation in sports clubs and well-being and testing of physical health profile with measurements of body composition, resting heart rate (RHR), blood pressure and postural balance, jump and Yo-Yo IR1C performance was conducted. Data were analysed by participation in sport and according to the five most frequently reported sports. RESULTS: Boys enrolled in sports clubs had higher physical well-being (51.7±9.7 vs 45.9±8.7), psychological well-being (53.3±9.6 vs 51.4±10.0), experienced more peer and social support (50.9±9.9 vs 48.0±11.6) and perceived a more positive school environment (48.6±7.5 vs 45.9±8.1), than boys not involved in sports clubs. In addition, they showed better Yo-Yo IR1C (+46%), long-jump (9%) and balance test performance (+20%). The sports club active boys had higher relative muscle mass (+6%) and lower fat-% (-3%), BMI (-6%) and RHR (-5%) compared to boys not involved in sports clubs ($p<0.05$). Boys enrolled in football clubs had higher aerobic fitness compared to boys not active in clubs (+11%), handballers (+5%), swimmers (+8%) and badminton players (+7%). Moreover, the boys enrolled in football clubs had lower fat-% (-17%) and higher relative muscle mass (+4%) than swimmers. CONCLUSION: Boys participating in club-based sports showed markedly higher levels of well-being and better Physical health profiles than boys not involved in sports club activities did. Footballers had superior aerobic fitness and body composition compared to those active in other sports. Results suggest that sports club activities seem to be beneficial for young boys' well-being, fitness and physical health profile, with highest benefits being achieved by boys involved in football.

ARTICLE SUMMARY

Strengths and limitations

- The large number of participants which makes it possible to evaluate the differences in well-being and physical health profile from the five most popular sport activities among boys.
- Even though the number of participants in each sports group was different, the groups were still large with a minimum of 79 participants.

- Most areas of the country are represented, with schools from both larger and smaller cities, as well the countryside.
- The cross-sectional design is not able to detect causal relations but gives a snapshot of the results. Furthermore, we did not collect data on the boys' everyday activities, such as active transport, or other social or physical activities, which have a bearing on the daily level of activity and might therefore affect both well-being and physical health.
- Neither do we have any data on how long the boys have participated in sports club activities. More years in a sports club are probably more beneficial to well-being and physical health.

BACKGROUND:

Physical activity (PA) is strongly associated with physiological and mental health benefits for children and adolescents[1 2], and sports clubs are important arenas for children to be physically active. PA significantly contributes to children's health status which is defined by the WHO as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."*[3] The literature shows that being overweight in childhood and adolescence is associated with reduced quality of life, especially with regard to physical and psychological well-being, social support and school related well-being. The risks of reduced quality of life due to poor well-being is comparable to that of diseases such as diabetes and other chronic conditions[4], so it is of great relevance to prevent overweight e.g. by being active in sports[5] as well as looking at other aspects of physical health status and well-being since health status is strongly related to quality of life[6]. Sports club participation in popular sports is associated with physical and mental health in Danish 10-12 year old girls[7]. However, comparable studies focusing on boys and their most popular sports are lacking. It is therefore of great relevance to investigate whether well-being is associated with sports participation among 10-12-year-old boys. The age group is of interest, since physical activity in general decreases during the preteen age, and health status is related to the risk of different lifestyle diseases in adulthood[2].

Participating in a leisure-time sport increases PA in general but also increases PA in settings outside of the particular leisure time sport. A study by Nielsen et al. (2016) compared the daily activity level of children participating in different leisure-time sports activities and children with no leisure-time sports club participation. They found that children who played football in a sports club (even those who trained only once a week) had a higher daily level of moderate and vigorous PA and that half of the difference could be explained by higher activity levels during school time[8]. Children active in other leisure time sports than football also showed increased PA levels during school breaks and spare time, but only when the children had at least two training sessions per week outside of school. Higher overall PA during school time, however, was not registered among children from other sports than football.

There are a few studies investigating the association between sports participation and heath profile in boys. A cross-sectional study by Wold et al.[9] compared a population of football players with an age-representative reference population. The results of the study show that the football population in general shows better self-assessed health. This is also found in a pilot study of the present study which shows that boys participating in sports in general and football in particular have a better overall health profile compared to the boys not active in sports clubs[10].

One way in which sports participation can impact well-being is via the motivational climate that is created by the coach, often seen in team sports[11 12]. If a motivational sporting climate satisfies players' basic psychological needs for autonomy, competence and social relatedness as outlined in Deci and Ryan's Self Determination Theory[13] (SDT) then well-being can be ensured. A study by Alvarez et al., for example, showed how football training which emphasized the process rather than the result could positively impact player's psychological well-being and the participants' motivation[14]. A process-oriented environment focusses on individual effort and development rather than on the result. It also lays importance on community and cooperation between participants[14] and thereby satisfies participants' basic psychological needs.

The aim of the present study is to investigate the association between participation in leisure-time sports club activities and well-being and physical health parameters in 10-12-year-old Danish boys.

METHODS:

We investigated the association between various leisure-time sport activities and broad-spectrum physiological health, performance and well-being parameters in 10-12-year-old boys, by conducting a cross-sectional study using a multicomponent testing battery. The testing included measurements of cardiovascular fitness, body composition and functional capacity, and questionnaires including biographical information, leisure-time sports activity and well-being. The testers were blinded to whether the boys were active in a sports club or not. The tests were performed in early autumn (August/September) or early spring (February, March or April). The present study was conducted from August 2016 to September 2018 as an integrated part of the nationwide "11 for Health in Denmark" project, with a specific focus on the baseline results of all participating boys. The study was conducted in collaboration with the Danish FA, who invited all danish schools by email and phone to participate in 11 for Health. The pupils on the participating schools were invited to take part in the scientific measurements in the project and the parents received detailed written and oral information about the study, any possible hazards, discomfort, and the option to withdraw at any time. Written informed parental consent was obtained for all participants. The study was approved by the Regional Committees on Health Research Ethics for Copenhagen and Southern Denmark (J.no H-16026885).

Patient and Public Involvement

as an integrated part of the nationwide "11 for Health in Denmark" project, the public was involved in the development of the testing protocol through a sparing group led by the danish FA. All results will be distributed by e-mail to the participating schools, and disseminated through seminars for the relevant professionals and press releases targeting the relevant part of the public e.g. the parents.

Sample

Boys from the 157 participating schools geographically spread all over Denmark, were included in the study if they had written consent from their parents and filled out the questionnaire regarding sport participation. 2,293 subjects took part in the study, of which 1,854 boys were active in sports clubs and pooled into the all sport active group (ASA) while 439 were not active in sports clubs and were pooled into the non-sport active group (NSA). The ASA boys were on average active 2.2±0.9 times a week with the following weekly attendance for each of the individual sports: Football (n=897) 2.5±0.8 times per week, team handball (n=131) 2.3±0.7 times per week, gymnastics (n=85) 1.6±0.8 per week, swimming (n=121) 1.8±1.1 per week and badminton (n=126) 1.4±0.7 per week. All data were collected at the participating schools during regular class hours from 157 schools geographically spread all over Denmark.

Insert Figure 1: Participants flow chart.

Questionnaires on leisure time sports activity and quality of life

The participants' well-being was evaluated using a shortened version of the Danish KIDSCREEN-27 survey [15]. KIDSCREEN-27 has 27 items within five dimensions of "physical wellbeing" (5 items), "psychological well-being" (7 items), "autonomy and parent relation" (7 items), "peers and social support" (4 items) and "school environment" (4 items). The "autonomy and parent relation" scale was considered irrelevant to the aim of the present investigation and therefore left out to minimize the number of items. The items are rated on a 5-point Likert scale ranging from "never" to "always" or "not at all" to "extremely". Higher KIDSCREEN-27 scores designate better well-being. The KIDSCREEN-27 survey has shown very good reliability (Cronbach's alphas: 0.80–0.84) and high test-retest reliability[15].

Leisure time sports activity, age and gender was asked in the questionnaires. The participants answered if they were enrolled in any leisure-time sport (yes/no). If yes, they were asked to report which sport they were involved in and the number of weekly training sessions. If they were active in more than one leisure-time sport, they were instructed to state the sport they did most often. This part of the questionnaire was a self-developed section, but based on a comparable questionnaire that has been used in previous studies in similar age groups[10 16].

Resting blood pressure and HR

In a supine position, three blood pressure measurements were taken at approximately one-minute intervals after 8 minutes of initial rest. The measurements were taken in a quiet room on the left upper arm with an automatic blood pressure monitor (M6 HEM-7223-E, Omron, Illinois, USA) with adjusted cuff size. If the first three systolic or diastolic blood pressure varied by more than 10 mmHg, an extra measurement was taken. Resting HR was measured at the same time by the automatic blood pressure monitor.

Body composition

Body mass, muscle mass (kg) and body fat (%) were measured using an InBody 270 multifrequency body composition analyzer (Biospace, California, USA). The subjects were weighed barefoot and in light clothing. The validity and reliability of the InBody 270 compared to DXA-scanning in 127 10-12-yr old girls and boys, has shown interclass correlation of 0.99 for fat percentage and 0.97 for muscle mass–[7]. Height was measured with 0.1 cm precision using a Tanita Leicester portable altimeter (Tanita, Amsterdam, Netherlands).

Muscle Strength

Standing long jump performance was measured after a reduced version of the FIFA 11+ warm-up programme, including jumps, as described by Ørntoft et al. (2018). The participants performed two jumps separated by a 5-10-minute rest. The jumps were performed wearing sports shoes or with bare feet. The participants were standing still with their feet parallel and shoulder-width apart placing the toes just behind a line. The children were instructed to bend their knees to a 90-degree squat position with their hands placed on the hips and hold this position for 2 seconds before jumping as long as possible, still with their hands on their hips. The distance from the start line to the backheel was measured in centimeters. Each child had two tries 5-10 minutes apart: the longest jump was reported as the result. The standing long jump is valid test for children aged 6–17 years and is strongly associated with upper (r =0.82-0.86) and lower body (r=0.69-0.85) maximal muscle strength, and showed moderate-to high reliability [17 18].

Cardiovascular fitness

Running performance was evaluated by the YYIR1C. The test was performed indoors in a gymnasium. The test consisted of two 16-metre shuttle runs back and forth at progressively increasing speeds, separated by 10 seconds of jogging after each session of running, around a cone placed 4 meters behind the start line. Each run was separated by a sound from an audio played through loudspeakers. The frequency of the beep sounds was increased throughout the test. The first time the participant failed to make the finish line in time, a warning was given; the second time, the test ended for the participant. Total running distance was recorded. Before the real test, the children got used to protocol with the test procedure by running the three initial shuttles (also worked as re-warm-up session before the test). Aerobic fitness was estimated from the running distance in the YYIR1C test by the equation: $VO_2max = 0.0116x+42.3$ ml/min/kg, as described by Ahler et al. (2012). The test has been validated in 6 to 11-year-old children (CV for 9–11-year-old girls: untrained CV=10.1%, football playing girls CV=11.5%) [19 20].

Balance test

Postural balance was evaluated using the Stork Balance Stand test [21]. The children stood barefooted and positioned their hands on their hips, then placed the non-supporting foot at the inside knee of the supporting leg. Then they raised their heel to balance on the forefoot.

The time started as the heel was raised from the floor. The timer was stopped if: a) the hands left the hips, b) the supporting foot rotated or moved in any direction, c) the non-supporting foot lost connection with the knee, d) the heel of the supporting foot touched the floor. The Stork balance test has a high test-retest reliability in an fit adolescent population and is valid for evaluating postural balance in young adults [21 22].

The above described phycological measurements were always performed in the same order, beginning with resting blood pressure, resting HR and InBody measurements followed by a uniform warm-up, a standing long jump length test and the YYIR1C. The testing was conducted by trained test personnel from the university, blinded to the children's sports club participation. They were assisted by educated teachers and/or pedagogues.

Statistical analysis

Cronbach's alpha scores calculated with SPSS Statistic 25 (IBM SPSS Statistics, Chicago, IL, USA) were used to determine internal consistency of the four well-being scales. Mean and SD were calculated for all the test results, age and weekly frequency of participation in sports. Multiple linear regression in which age was adjusted for were used to analyze differences between boys active in sports clubs and inactive boys. The same statistical analysis was used to investigate differences between the five most popular sports, and here adjusted for both age and frequency of weekly participation[23].

Data were analysed according to whether the boys participated in leisure-time sport and according to the five most frequently reported sports.

RESULTS: Boys enrolled in leisure-time sports clubs had higher physical well-being (51.7±9.7 vs 45.9±8.7), psychological well-being (53.3±9.6 vs 51.4±10.0), experienced more peer and social support (50.9±9.9 vs 48.0±11.6) and perceived a more positive school environment (48.6±7.5 vs 45.9±8.1). The sports club active boys also had better Yo-Yo IR1C (+46%), long-jump (9%) and balance test performance (+20%) than boys not involved in leisure time sports clubs. The boys active in leisure-time sports clubs had higher relative muscle mass (+6%), lower fat percentage (-3%), BMI (-6%), RHR (-5%), compared to boys not involved in leisure-time sport ($p<0.05$). Boys enrolled in football clubs had higher aerobic fitness compared to boys not active in leisure-time sports clubs (+11%), handball players (+5%), swimmers (+8%) and badminton players (+7%). Moreover, the boys enrolled in football clubs had lower fat percentage (-17%) and higher relative muscle mass (+4%) than swimmers. All results can be found in table 1 and 2.

INSERT TABLE 1 AND 2

DISCUSSION

The main finding in the present study was that boys participating in club-based leisure-time sports showed markedly higher levels of well-being and better fitness and health profiles than boys not involved in any sports club activities did. These findings are in line with previous findings from the 11 for health in Europe pilot study, as well as findings among younger boys in Denmark[10 24]. Boys involved in football had better aerobic fitness and better body composition compared to those active in other sports, which also was seen previously[10]. Although this cross-sectional study doesn´t describe any causal effects of sports participation, it is interesting that those participating in football have a superior health and performance profile, as well as better well-being scores related to social support and positive school environment compared to other sports with similar training frequency.

Since the study is cross-sectional, we cannot conclude what causes the differences, but the following section will suggest some possible explanations.

Well-being

The boys who engaged in leisure time sports club activity had better physical and psychological well-being and reported higher peer and social support and a more positive school environment compared to the boys who were not active in leisure time sport activities. The better well-being for the active boys might be caused by a greater amount of MVPA, social activities connected to sports club participation, higher self-perception and self-worth as well as positive perception of the school environment. Parameters, and due to more and better social relations/connections (social capital). We have already discussed in a recent paper from the same study found the exact same differences in girls[7].

For boys playing football, the relation to peers and social support was superior when compared to the non-sports group, which also confirms findings in girls. The benefits of team vs individual sports have been studied with different outcomes, but the overall psychological outcomes of team sports seem to be more advantageous compared to individual sports[25]. The feeling of a more positive school environment might be caused by the experiences that skilled players have in physical education class but especially also in school breaks, where sports/football is often played. This consequently also leads to more physical activity during school time for football players[26].And, in addition, boys can experience satisfaction of the basic needs for autonomy, competence and social relatedness which could explain the higher well-being scores.

In general the findings support the general assumption that participation in leisure time sports clubs is associated with higher well-being scores in children[27 28].

Performance measurements

Performance in the YYIR1C is highly correlated with maximal oxygen uptake measured in the laboratory setting[19]. As cardiovascular fitness in children and adolescents affects risk factors for future BMI, body fat and metabolic syndrome, a good cardiovascular fitness is important for future health [29]. Boys doing leisure-time sport ran 58% further in the YYIR1C test, corresponding to 4.1 ml/kg/min, than NSA boys, while boys playing football ran 85, 24, 51 and 64% further, corresponding to 6.1, 2.6, 4.4 and 4.1 ml/kg/min respectively, compared to NSA subjects, handball players, swimmers and badminton players. That boys participating in leisure-time sports have greater cardiovascular fitness than non-active boys was also found in previous small-scale studies in 8 to 12-year-old boys[10 16]. Furthermore, the analysis of the five sports in this study reveals that boys playing football had higher cardiovascular fitness compared to team handball, swimming and badminton players, but not gymnastics. The difference in cardiovascular fitness might be due to differences in training intensity between the sports[30]. We know from previous studies that the intensity in football is high in terms of heart rate but we lack measurements for the other sports[30]. Another reason for the difference in the distance run may be the design of the test, which is favorable to intermittent sports like football, as it was originally designed for intermittent sports, or the high training frequency among football players.

Boys active in sports clubs jumped further and had better balance than non-active boys. The jump length is well correlated with muscle strength and shows, together with the higher muscle percentage, a better muscular fitness for the ASA boys[17]. In relation to balance, it is an important parameter in many physical activities, and since competences in activities helps to keep motivation[13], this might lead to enhanced physical activity.

Cardiovascular health profile

Resting heart rate (RHR) was lower for boys active in all sports clubs, as well as in gymnasts, football and handball players compared to non-active boys. Previous studies have found comparable differences in RHR and an association between cardiovascular fitness profile and RHR[10 16].

Blood pressure was normotensive for all groups, but diastolic blood pressure (DBP) was significantly lower for footballers than non-active boys were, while systolic pressure was higher in the football players. Both differences are very small (0.2 mmHG) and should be interpreted carefully. The clinical relevance of the difference in blood pressure can be discussed, but blood pressure paths are recognisable in childhood and a healthy blood pressure in childhood will follow into adulthood and avert development of hypertension[31].

Previous cross-sectional studies have not shown any differences in blood pressure or MAP when comparing different sport groups with inactive school children[10 16], so the findings in the present study are preferred to be confirmed by studies with similar sample size.

Body composition

Boys participating in leisure-time sports had lower body mass, BMI and fat percentage and higher relative muscle percentage than non-active boys. These differences were also seen among girls[7] and as stated there "the differences might be explained by the higher level of PA that children enrolled in leisure time sport have, which is also higher than for children participating in self-organised sports and children who do not participate in sports at all" [32 33]. Gymnasts had the lowest body mass, BMI and fat percentage compared to the other sports, with a few exceptions. The differences could be caused by a gymnast's exercises bearing own weight, where low weight is important. On the other hand, swimmers had higher fat and lower muscle percentage compared to boys active in football, badminton and gymnastics, which may be related to a poorer health status, or a selection bias, since that type of body composition might be an advantage in (long distance) swimming, and swimming training may not have a positive effect on body composition[34].

Practical implications

This article revealed that boys participating in leisure time sports club activities have better health profile, physical capacity and well-being. The results provide specific information regarding sports club activities in Danish boys as a whole as well as for five popular sporting activities, with football and gymnastics as prominent examples. The results suggest that higher levels of sport participation possibly increase fitness profiles and well-being and should be considered by parents, politician and sports organizations. They should ensure that children participate in leisure time sports and thereby could positively impact the health and well-being of future generations.

CONCLUSIONS:

Boys participating in club-based leisure-time sports showed markedly higher levels of well-being and better fitness and health profiles than boys not involved in any sports club activities. Boys involved in football had better aerobic fitness and better body composition compared to those active in other sports. Therefore, leisure-time sports club activities seem to be both beneficial and important for childhood well-being, fitness and physical health profile, with a team sport like football as a prominent example.

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Competing interests: No competing interests.

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REFERENCES:

1. Andersen LB, Harro M, Sardinha LB, et al. Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). *The Lancet* 2006;368(9532):299-304. doi: 10.1016/s0140-6736(06)69075-2
2. Bangsbo J, Krustrup P, Duda J, et al. The Copenhagen Consensus Conference 2016: children, youth and physical activity in schools and during leisure time. *Br J Sports Med* 2016;50(19):1177-78
3. Organization WH. Global status report on noncommunicable diseases 2014: World Health Organization 2014.
4. Buttitta M, Iliescu C, Rousseau A, et al. Quality of life in overweight and obese children and adolescents: a literature review. *Quality of life research* 2014;23(4):1117-39.
5. Zahner L, Muehlbauer T, Schmid M, et al. Association of sports club participation with fitness and fatness in children. *Med Sci Sports Exerc* 2009;41(2):344.
6. Ngamaba KH, Panagioti M, Armitage CJ. How strongly related are health status and subjective well-being? Systematic review and meta-analysis. *Euro J of Pub Health* 2017;27(5):879-85.
7. Madsen M. Team sports activity in school and in leisure-time sports clubs for 8–12-year-olds – Exercise intensity and importance for cardiovascular health, fitness, body composition and well-being [PhD]. University of Southern Denmark, 2020.
8. Nielsen G, Bugge A, Andersen LB. The influence of club football on children's daily physical activity. *Soccer & Society* 2015;17(2):246-58. doi: 10.1080/14660970.2015.1082754
9. Wold B, Duda JL, Balaguer I, et al. Comparing self-reported leisure-time physical activity, subjective health, and life satisfaction among youth soccer players and adolescents in a reference sample. *Int J Sport and Exerc Psych* 2013;11(4):328-40.
10. Ørntoft C, Larsen MN, Madsen M, et al. Physical Fitness and Body Composition in 10–12-Year-Old Danish Children in Relation to Leisure-Time Club-Based Sporting Activities. *BioMed Res Int* 2018;2018:1-8. doi: 10.1155/2018/9807569
11. Eime RM, Young JA, Harvey JT, et al. A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *Int J Beha Nut Phys Act* 2013;10(1):1-21.
12. Reinboth M, Duda JL. Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psych Sport and Exer* 2006;7(3):269-86.
13. Deci EL, Ryan RM. Self-determination theory: A macrotheory of human motivation, development, and health. *Can Psych* 2008;49(3):182.

14. Alvarez MS, Balaguer I, Castillo I, et al. The coach-created motivational climate, young athletes' well-being, and intentions to continue participation. *J Clin Sport Psych* 2012;6(2):166-79.
15. Ravens-Sieberer U, Herdman M, Devine J, et al. The European KIDSCREEN approach to measure quality of life and well-being in children: development, current application, and future advances. *Qual Life Res* 2014;23(3):791-803. doi: 10.1007/s11136-013-0428-3 [published Online First: 2013/05/18]
16. Larsen MN, Nielsen CM, Orntoft CO, et al. Physical Fitness and Body Composition in 8-10-Year-Old Danish Children Are Associated With Sports Club Participation. *J Strengt Con Res.* 2017;31(12):3425-34. doi: 10.1519/jsc.0000000000001952
17. Castro-Pinero J, Ortega FB, Artero EG, et al. Assessing muscular strength in youth: usefulness of standing long jump as a general index of muscular fitness. *J Strength Con Res.* 2010;24(7):1810-7. doi: 10.1519/JSC.0b013e3181ddb03d
18. Ortega FB, Artero EG, Ruiz JR, et al. Reliability of health-related physical fitness tests in European adolescents. The HELENA Study. *Int J Obes (Lond)* 2008;32 Suppl 5:S49-57. doi: 10.1038/ijo.2008.183
19. Ahler T, Bendiksen M, Krustrup P, et al. Aerobic fitness testing in 6- to 9-year-old children: reliability and validity of a modified Yo-Yo IR1 test and the Andersen test. Eur. J. Appl. Physiol. 2012;112(3):871-6. doi: 10.1007/s00421-011-2039-4
20. Povoas SCA, Castagna C, da Costa Soares JM, et al. Reliability and Construct Validity of Yo-Yo Tests in Untrained and Soccer-Trained Schoolgirls Aged 9-16. *Pediatr Exerc Sci* 2016;28(2):321-30. doi: 10.1123/pes.2015-0212
21. Panta K, Arulsingh W, Raj J, et al. A study to associate the Flamingo Test and the Stork Test in measuring static balance on healthy adults. *The Foot and Ankle Online Journal* 2015;8 doi: 10.3827/faoj.2015.0803.0004
22. Hammami R, Chaouachi A, Makhlouf I, et al. Associations Between Balance and Muscle Strength, Power Performance in Male Youth Athletes of Different Maturity Status. *Pediatr Exerc Sci* 2016;28 doi: 10.1123/pes.2015-0231
23. Montgomery DC, Peck EA, Vining GG. Introduction to linear regression analysis: John Wiley & Sons 2012.
24. Larsen MN, Nielsen CM, Ørntoft C, et al. Physical fitness and body composition in 8–10-year-old Danish children are associated with sports club participation. *BioMed Res Int* 2017;31(12)
25. Wikman JM, Elsborg P, Ryom K. Psychological benefits of team sport. In: Parnell D, Krustrup P, eds. Sport and Health: Exploring the Current State of Play, Routledge 2017.
26. Nielsen G, Bugge A, Andersen LB. The influence of club football on children's daily physical activity. *Soccer Soc.* 2015:1-13. doi: 10.1080/14660970.2015.1082754
27. Bangsbo J, Krustrup P, Duda J, et al. The Copenhagen Consensus Conference 2016: children, youth, and physical activity in schools and during leisure time. *Br J Sports Med* 2016;50(19):1177-78.
28. Spengler S, Woll A. The more physically active, the healthier? The relationship between physical activity and health-related quality of life in adolescents: the MoMo study. *J Phys Act Health* 2013;10(5):708-15.
29. Mintjens S, Menting MD, Daams JG, et al. Cardiorespiratory Fitness in Childhood and Adolescence Affects Future Cardiovascular Risk Factors: A Systematic Review of Longitudinal Studies. *Sports Med* 2018;48(11):2577-605. doi: 10.1007/s40279-018-0974-5
30. Bendiksen M, Williams CA, Hornstrup T, et al. Heart rate response and fitness effects of various types of physical education for 8- to 9-year-old schoolchildren. *Eur J Sport Sci* 2014;14(8):861-9. doi: 10.1080/17461391.2014.884168

31. Theodore RF, Broadbent J, Nagin D, et al. Childhood to Early-Midlife Systolic Blood Pressure Trajectories: Early-Life Predictors, Effect Modifiers, and Adult Cardiovascular Outcomes. *Hypertension (Dallas, Tex : 1979)* 2015;66(6):1108-15. doi: 10.1161/
32. Mooses K, Kull M. The participation in organised sport doubles the odds of meeting physical activity recommendations in 7–12-year-old children. *Eur J Sport Sci* 2019:1-7. doi: 10.1080/17461391.2019.1645887

	Soccer		Team Handball		Gymnastics		Swimming		Badminton		All sports (ASA)		No Sports (NSA)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Yo-Yo IR1 C test (m)	ahsb 1139	567	af919	510	absf897	514	g756	457	agf782	452	a973	543	616	403
Height (cm)	hb 151.4	6.9	afg153.1	6.1	h149.8	5.8	152.0	7.1	af152.0	7.1	151.5	6.9	151.1	7.4
Weight (kg)	ahs 41.3	7.6	fg43.7	8.6	abs40.8	7.7	43.7	9.7	41.85	9.84	41.89	8.5	43.79	9.6
SLJ (cm)	a 115.4	38.9	a114.6	37.3	as118.6	37.0	a111.7	39.1	a121.8	30.1	a115.1	38.6	104.9	40.0
Balance (s)	a 4.38	3.38	ab3.81	2.44	4.13	3.05	b3.68	2.41	as4.80	3.53	a4.33	3.33	3.49	3.20
Fat percentage (%)	as 18.56	6.75	a19.72	7.39	as 19.02	6.65	bgf21.62	8.45	as19.49	7.57	a19.41	7.38	23.22	8.55
Muscle mass (%)	as 43.20	4.02	a42.86	3.95	as42.83	3.80	fg41.63	4.46	a42.58	4.29	a42.77	4.26	40.72	4.71

33. Lagestad P, Mikalsen H, Ingulfsvann LS, et al. Associations of Participation in Organized Sport and Self-Organized Physical Activity in Relation to Physical Activity Level Among Adolescents. *Front Public Health* 2019;7(129):129. doi: 10.3389/fpubh.2019.00129
34. Clarke DH, Vaccaro P. The effect of swimming training on muscular performance and body composition in children. *Res Q Am. Ass Health* 1979;50(1):9-17.

TABLES AND FIGURES:

Table 1. Physical fitness profile and training frequency for all boys active in leisure-time sports**.** the five primary sports and the no-sport group.

SBP (mmHg)	a 101.4	8.6	a100.9	9.7	100.3	9.2	101.7	9.1	100.8	9.7	101.0	8.8	101.2	9.2
DBP (mmHg)	a 64.5	7.25	a63.5	5.8	63.8	7.1	64.6	8.1	64.7	6.9	64.33	7.2	64.8	7.0
MAP (mmHg)	76.8	6.72	76.0	6.3	76.0	7.0	77.0	7.8	76.7	6.9	76.6	6.8	76.9	6.8
RHR (bpm)	a 72.1	10.2	a72.1	10.2	a72.7	9.5	74.3	10.2	74.1	10.6	a72.7	10.1	75.9	10.0
BMI	ahs 17.91	2.48	a18.58	3.03	18.10	2.65	bf18.79	3.42	as17.91	2.85	a18.16	2.86	19.05	3.25
VO_2 (mL/min/kg)	ahsb 55.5	6.6	a53.0	5.9	as52.7	6.0	f51.1	5.3	af51.4	5.3	a53.6	6.3	49.4	4.7
Training/wk (n)	2.5	0.8	2.3	0.7	1.5	0.8	1.8	1.1	1.9	0.9	2.2	0.9	0	0

Raw means ± SD. NSA. non-sports-club active; ASA. all-sports-club active; a = sign. different from "No-sport". f = sign. different from Soccer. h = sign. different from Team handball. g = sign. different from Gymnastics. s = sign. different from Swimming. d = sign. different from Dance. P≤0.05.

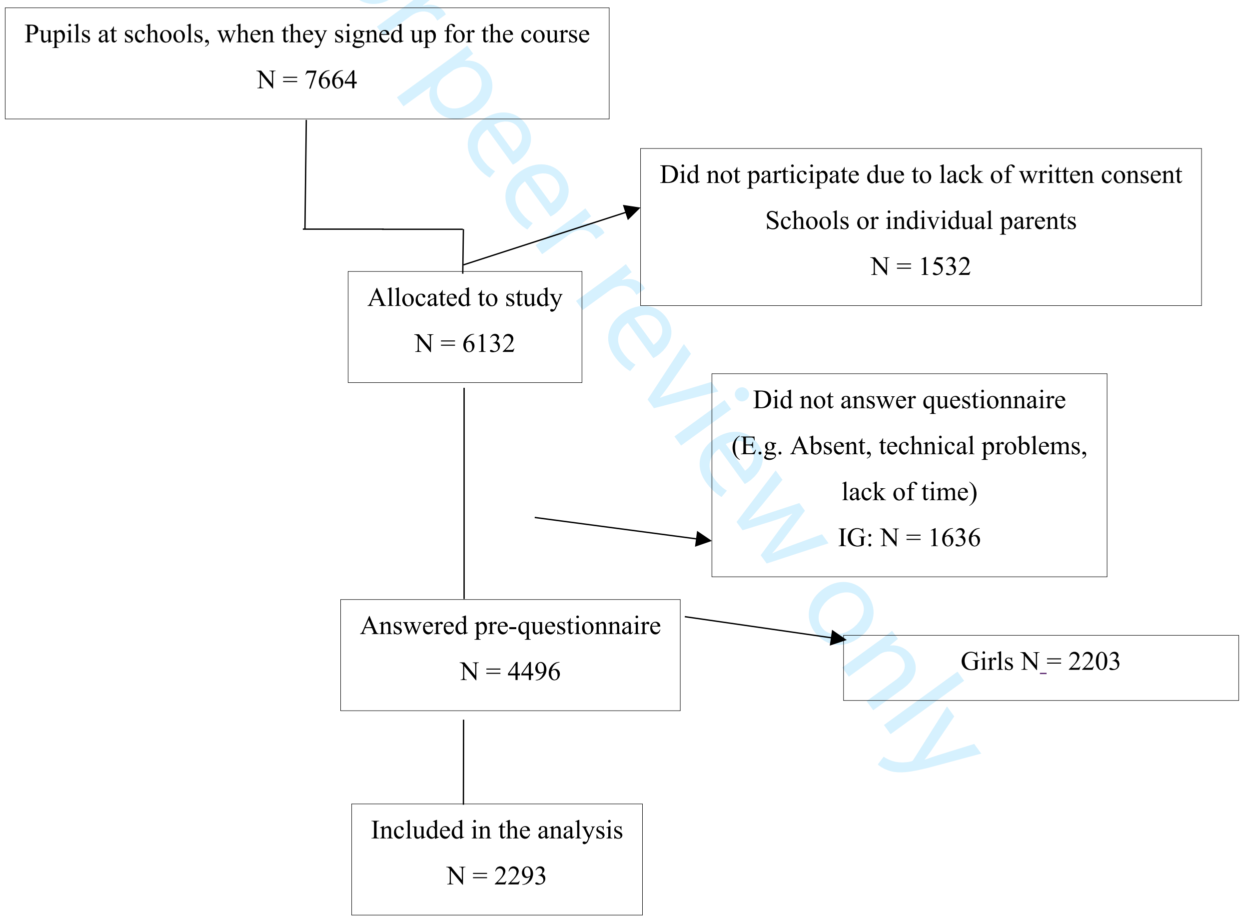
Table 2. KIDSCREEN-27 well-being score for all boys active in leisure-time sports. the five primary sports and the no-sport group.

	Well-being measurements						
	No Sports (NSA)	**All sports (ASA)**	**Soccer**	**Team handball**	**Gymnastics**	**Swimming**	**Badminton**
Physical well-being							
Mean	45.9± 8.7	51.7 ± 9.7a	53.3 ± 9.6as	51.7±10.6as	51.1±7.7a	48.7±10.2afg	50.7±8.6a
Psychological well-being							
Mean	51.4±10.0	53.3± 9.6a	51.4 ± 9.2ah	52.4±10.1f	53.1± 9.4fd	52.3±9.3	52.8±9.6
Peers and social support							

Mean	48.0±11.6	50.9±9.9a	51.8± 9.8ah	49.6±9.6	49.6±8.5	50.0±9.7	50.6±10.4a
School environment							
Mean	45.9±8.1	48.6±7.5a	48.8±7.2a	47.8±8.1a	48.0±7.5a	48.2±7.0a	49.0±7.8a

Raw means ± SD. NSA. non-sports-club active; ASA. all-sports-club active; a = sign. different from "No-sport". f = sign. different from Soccer. h = sign. different from Team handball. g = sign. different from Gymnastics. s = sign. different from Swimming. d = sign. different from Dance. P≤0.05.

Figure 1: Participants flow chart.



Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study’s design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of	5

		recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5
Bias	#9	Describe any efforts to address potential sources of bias	8
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	8
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	8
Statistical methods	#12c	Explain how missing data were addressed	8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	8
Statistical methods	#12e	Describe any sensitivity analyses	8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	5
Participants	#13b	Give reasons for non-participation at each stage	5
Participants	#13c	Consider use of a flow diagram	5

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	8
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	5
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
Main results	#16b	Report category boundaries when continuous variables were categorized	8
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	11
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	11
Generalisability	#21	Discuss the generalisability (external validity) of the study results	12
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

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BMJ Open

Well-being, physical fitness and health profile of 10-12-year-old boys in relation to leisure-time sports club activities – a cross sectional study.

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Well-being, physical fitness and health profile of 10–12-year-old boys in relation to leisure-time sports club activities – a cross-sectional study

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Short title: Well-being and health profile in boys active in sports clubs

Key words: physical activity, football, team handball, gymnastics, swimming

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ABSTRACT:

OBJECTIVES: This study investigated the correlation between sports club activities and well-being and physical health parameters in 10–12-yr-old boys. DESIGN: Cross-sectional. SETTING: Danish schools. PARTICIPANTS: 2,293 boys took part in the study. PRIMARY AND SECONDARY OUTCOME MEASURES: Questionnaires on participation in sports clubs and well-being and testing of physical health profile through measurement of body composition, resting heart rate (RHR), blood pressure and postural balance, jump and Yo-Yo IR1C performance. Data were analysed by participation in sport and according to the five most frequently reported sports. RESULTS: Boys enrolled in sports clubs had higher physical well-being (51.7±9.7 vs 45.9±8.7) and psychological well-being (53.3±9.6 vs 51.4±10.0), experienced more peer and social support (50.9±9.9 vs 48.0±11.6), and had a more positive perception of the school environment (48.6±7.5 vs 45.9±8.1) than boys not involved in sports clubs. In addition, they showed better Yo-Yo IR1C (+46%), long-jump (9%) and balance test performance (+20%). The boys active in sports clubs had higher relative muscle mass (+6%) and lower fat percentage (-3%), BMI (-6%) and RHR (-5%) compared to boys not involved in sports clubs ($p<0.05$). Boys enrolled in football clubs had higher aerobic fitness compared to boys not active in clubs (+11%), handball players (+5%), swimmers (+8%) and badminton players (+7%). Moreover, the boys enrolled in football clubs had lower fat percentage (-17%) and higher relative muscle mass (+4%) than swimmers. CONCLUSION: Boys participating in club-based sports showed markedly higher levels of well-being and better physical health profiles than boys not involved in sports club activities. Footballers had superior aerobic fitness and body composition compared to those active in other sports. Results suggest that sports club activities seem to be beneficial for young boys' well-being, fitness and physical health profile, with the greatest benefits achieved by boys involved in football.

ARTICLE SUMMARY

Strengths and limitations

- A strength is the large number of participants, making it possible to evaluate the differences in well-being and physical health profile from the five most popular sporting activities among boys, whereas earlier studies have lacked statistical power to detect differences when dividing the sample into more than three groups.

- Even though the participant numbers in the various sporting groups differ, the groups are all large, with a minimum of 79 participants.
- Most areas of the country are represented, with schools from both larger and smaller cities as well as the countryside.
- The cross-sectional design is not able to detect causal relations but gives a snapshot of the results. Furthermore, we did not collect data on the boys' everyday activities, such as active transport, or other social or physical activities, which have a bearing on the daily level of activity and might therefore affect both well-being and physical health.
- Neither do we have any data on how long the boys have participated in sports club activities. More years in a sports club are probably more beneficial to well-being and physical health.

BACKGROUND:

Physical activity (PA) is strongly associated with physiological and mental health benefits for children and adolescents[1 2], and sports clubs are important arenas for children to be physically active.

Participating in a leisure-time sport increases PA in general, but also increases PA in settings outside the particular leisure-time sport. A study by Nielsen et al.[3] compared the daily activity level of children participating in different leisure-time sports activities and children with no leisure-time sports club participation. They found that children who played football in a sports club (even those who trained only once a week) had a higher daily level of moderate and vigorous PA, and that half of the difference could be explained by higher activity levels during school time[3]. Children active in leisure-time sports other than football also showed increased PA levels during school breaks and spare time, but only when the children had at least two training sessions per week outside of school. Higher overall PA during school time, however, was not recorded among children for sports other than football.

The literature shows that being overweight in childhood and adolescence is associated with reduced quality of life, especially with regard to physical and psychological well-being, social support and school-related well-being[4 5]. The risk of reduced quality of life due to poor well-being is comparable to that of diseases such as diabetes and other chronic conditions[6], so it is of great relevance to prevent overweight, e.g. by being active in sports[7], as well as looking at other aspects of physical health status and well-being given that health status is strongly related to quality of life[8]. Club participation in popular sports is associated with physical and mental health in Danish 10–12-year-old girls[9]. However, comparable studies focusing on boys and their most popular sports are lacking. It is therefore of great relevance to investigate whether well-being is associated with sports participation among 10–12-year-old boys. The age group is of interest, since physical activity in general decreases during the pre-teen period and health status is related to the risk of various lifestyle diseases in adulthood[2].

There are a few studies investigating the association between sports participation and heath profile in boys. A cross-sectional study by Wold et al.[10] compared a population of football players with an age-representative reference population. The results of the study show that the football population in general shows better self-assessed health. This is also found in a pilot study of the present study, which shows that boys participating in sports in general, and football in particular, have a better overall health profile compared to boys not active in sports clubs[11].

One way in which sports participation can impact on well-being is via the motivational climate that is created by the coach, often seen in team sports[12 13]. If a motivational sporting climate satisfies players' basic psychological needs for autonomy, competence and social relatedness, as outlined in Deci and Ryan's Self Determination Theory[14] (SDT), then well-being can be ensured. A study by Alvarez et al., for example, showed how football training which emphasised the process rather than the result could positively impact players' psychological well-being and motivation[15]. A process-oriented environment focuses on individual effort and development rather than on the result. It also places importance on community and cooperation between participants[15], and thereby satisfies participants' basic psychological needs.

The aim of the present study is to investigate the association between participation in leisure-time sports club activities and well-being and physical health parameters in 10–12-year-old Danish boys.

METHODS:

We investigated the association between various leisure-time sporting activities and broad-spectrum physiological health, performance and well-being parameters in 10–12-year-old boys by conducting a cross-sectional study using a multicomponent testing battery. The testing included measurements of cardiovascular fitness, body composition and functional capacity, and questionnaires including biographical information, leisure-time sports activity and well-being. The testers were blinded to whether or not the boys were active in a sports club. The tests were performed in early autumn (August/September) or early spring (February, March or April). The present study was conducted from August 2016 to September 2018 as an integrated part of the nationwide "11 for Health in Denmark" project, with a specific focus on the baseline results of all participating boys. The study was conducted in collaboration with the Danish Football Association (FA), which issued invitations, by email and phone, to all Danish schools to participate in "11 for Health". The pupils in the participating schools were invited to take part in the scientific measurements in the project and the parents received detailed written and oral information about the study, any possible hazards or discomforts, and the option to withdraw at any time. Written informed parental consent was obtained for all participants. The study was approved by the Regional Committees on Health Research Ethics for Copenhagen and Southern Denmark (J.no H-16026885).

Patient and public involvement

As an integrated part of the nationwide "11 for Health in Denmark" project, the public was involved in the development of the testing protocol through a sparring group led by the Danish FA. All results will be distributed by email to the participating schools and disseminated through seminars for the relevant professionals and press releases targeting the relevant section of the public, e.g. the parents.

Sample

Boys from the 157 participating schools, geographically spread all over Denmark, were included in the study if they had written consent from their parents and filled out the questionnaire regarding sports participation. 2,293 subjects took part in the study, of which 1,854 boys were active in sports clubs and pooled into the all-sports active group (ASA), while 439 were not active in sports clubs and were pooled into the non-sports active group (NSA), see figure 1 for the study flow chart. The ASA boys were on average active 2.2±0.9 times a week, with the following weekly attendance for each of the individual sports: football (n=897) 2.5±0.8 times per week; team handball (n=131) 2.3±0.7 times per week; gymnastics (n=85) 1.6±0.8 per week; swimming (n=121) 1.8±1.1 per week; and badminton (n=126) 1.4±0.7 per week. All data were collected at the participating schools during regular class hours.

Insert Figure 1: Participants' flow chart.

Questionnaires on leisure-time sports activity and quality of life

The participants' well-being was evaluated using a shortened version of the Danish KIDSCREEN-27 questionnaire[16]. KIDSCREEN-27 has 27 items within five dimensions: "physical wellbeing" (5 items); "psychological well-being" (7 items); "autonomy and parent relations"; (7 items); "peers and social support" (4 items); and "school environment" (4 items). The "autonomy and parent relations" scale was not considered relevant to the aim of the present investigation and therefore left out to minimise the number of items. The items are rated on a five-point Likert scale ranging from "never" to "always" or "not at all" to "extremely". Higher KIDSCREEN-27 scores designate better well-being. The KIDSCREEN-27 questionnaire has shown very good reliability (Cronbach's alphas: 0.80–0.84) and high test-retest reliability[16].

Leisure-time sports activity, age and gender were identified in the questionnaires. The participants were asked whether they were enrolled in any leisure-time sport (yes/no). If yes, they were asked to say which sports they were involved in and the number of weekly training sessions. If they were active in more than one leisure-time sport, they were instructed to state the sport they did most often. This part of the questionnaire was a self-developed section but based on a comparable questionnaire that has been used in previous studies in similar age groups[11 17].

Resting blood pressure and heart rate (HR)

In a supine position, three blood pressure measurements were taken at approximately 1-minute intervals after 8 minutes of initial rest. The measurements were taken in a quiet room on the left upper arm using an automatic blood pressure monitor (M6 HEM-7223-E, Omron, Illinois, USA) with adjusted cuff size. If the first three systolic or diastolic blood pressure measurements varied by more than 10 mmHg, an additional measurement was taken. Resting HR was measured at the same time using the automatic blood pressure monitor.

Body composition

Body mass, muscle mass (kg) and body fat (%) were measured using an InBody 270 multifrequency body composition analyzer (Biospace, California, USA). The subjects were weighed barefoot and in light clothing. The validity and reliability of the InBody 270 compared to DXA scanning in 127 10–12-yr old girls and boys have shown interclass correlation of 0.99 for fat percentage and 0.97 for muscle mass[9]. Height was measured with 0.1 cm precision using a Tanita Leicester portable altimeter (Tanita, Amsterdam, Netherlands).

Muscle strength

Standing long jump performance was measured following a reduced version of the FIFA 11+ warm-up programme, including jumps, as described by Ørntoft et al.[11] The participants performed two jumps separated by a 5–10-minute rest. The jumps were performed wearing sports shoes or barefoot. The participants stood still with their feet parallel and shoulder-width apart, their toes just behind a line. The children were instructed to bend their knees to a 90-degree squat position with their hands placed on their hips and to hold this position for 2 seconds before jumping as far as possible, still with their hands on their hips. The distance from the start line to the back heel was measured in centimetres. Each child had two tries 5–10 minutes apart: the longest jump was reported as the result. The standing long jump is a valid test for children aged 6–17 years, is strongly associated with upper- (r =0.82–0.86) and lower-body (r=0.69–0.85) maximal muscle strength, and shows moderate to high reliability [18 19].

Cardiovascular fitness

Running performance was evaluated by YYIR1C. The test was performed indoors in a gymnasium. The test consisted of two 16-metre shuttle runs at progressively increasing speeds, separated by 10 seconds of jogging after each session of running around a cone placed 4 metres behind the start line. Each run was separated by a beep from an audio device played through loudspeakers. The frequency of the beeps increased throughout the test. The first time the participant failed to make the finish line in time, a warning was given; the second time, the test ended for the participant. Total running distance was recorded. Before the real test, the children were familiarised with the protocol for the test procedure by running the three initial shuttles (also used as a re-warm-up session before the test). Aerobic fitness was estimated from the running distance in the YYIR1C test by the equation: $VO_2max = 0.0116x+42.3$ ml/min/kg, as described by Ahler et al.[20]. The test has been validated in 6–11-year-old children (CV for 9–11-year-old girls: untrained girls CV=10.1%, football-playing girls CV=11.5%) [20 21].

Balance test

Postural balance was evaluated using the stork balance stand test [22]. The children stood barefoot and positioned their hands on their hips, then placed their non-supporting foot on the inside knee of the supporting leg. They then raised their heel to balance on the forefoot.

The time started as the heel was raised from the floor. The timer was stopped if: a) the hands left the hips; b) the supporting foot rotated or moved in any direction; c) the non-supporting foot lost contact with the knee; d) the heel of the supporting foot touched the floor. The stork balance test has a high test-retest reliability in a fit adolescent population and is valid for evaluating postural balance in young adults [22 23].

The physiological measurements described above were always performed in the same order, beginning with resting blood pressure, resting HR and InBody measurements, followed by a uniform warm-up, a standing long jump test and the YYIR1C. The testing was conducted by trained test personnel from the university blinded to the children's sports club participation. They were assisted by qualified teachers and/or pedagogues.

Statistical analysis

Cronbach's alpha scores calculated with SPSS Statistic 25 (IBM SPSS Statistics, Chicago, IL, USA) were used to determine the internal consistency of the four well-being scales. Mean and SD were calculated for all test results, age and weekly frequency of participation in sports. Multiple linear regression, in which age was adjusted for, was used to analyse differences between boys active in sports clubs and boys not active in sport clubs. The same statistical analysis was used to investigate differences between the five most popular sports, and here adjusted for both age and frequency of weekly participation[24].

Data were analysed according to whether the boys participated in leisure-time sport and according to the five most frequently reported sports.

RESULTS: Boys enrolled in leisure-time sports clubs had higher physical well-being (51.7±9.7 vs 45.9±8.7) and psychological well-being (53.3±9.6 vs 51.4±10.0), experienced more peer and social support (50.9±9.9 vs 48.0±11.6), and had a more positive perception of the school environment (48.6±7.5 vs 45.9±8.1). The boys active in sports clubs also had better Yo-Yo IR1C (+46%), long jump (9%) and balance test performance (+20%) than boys not involved in leisure-time sports clubs. The boys active in leisure-time sports clubs had higher relative muscle mass (+6%) and lower fat percentage (-3%), BMI (-6%) and RHR (-5%) compared to boys not involved in leisure-time sport ($p<0.05$). Boys enrolled in football clubs had higher aerobic fitness compared to boys not active in leisure-time sports clubs (+11%), handball players (+5%), swimmers (+8%) and badminton players (+7%). Moreover, the boys enrolled in football clubs had lower fat percentage (-17%) and higher relative muscle mass (+4%) than swimmers. All results can be found in Tables 1 and 2.

INSERT TABLE 1 AND 2

DISCUSSION

The main finding in the present study was that boys participating in club-based leisure-time sports showed markedly higher levels of well-being and fitness, and better health profiles than boys not involved in any sports club activities. These findings are in line with previous findings from the "11 for Health in Europe" pilot study, as well as findings among younger boys in Denmark[11 25]. Boys involved in football had better aerobic fitness and better body composition compared to those active in other sports, which was also seen previously[11]. Although this cross-sectional study does not describe any causal effects of sports participation, it is interesting that those participating in football have a superior health and performance profile, as well as better well-being scores related to social support and positive school environment, compared to other sports with similar training frequency. Since the study is cross-sectional, we cannot conclude what causes the differences, but the following section will suggest some possible explanations based on the assumptions that there could be different intensity and quality[26] during training in the clubs and that participation in different sports can lead to different behaviour, including around the training sessions[3].

Well-being

The boys who engaged in leisure-time sports club activity had better physical and psychological well-being and reported higher peer and social support and a more positive school environment compared to the boys who were not active in leisure-time sporting activities. The better well-being for the active boys might be caused by a greater amount of MVPA, social activities connected to sports club participation, higher self-perception and self-worth, as well as positive perception of the school environmentand due to more and better social relations/connections (social capital), as discussed in a recent paper from the same study found the exact same differences in girls[9].

For boys playing football, the relationship with peers and social support was superior when compared to the non-sports group, which also confirms findings in girls. The benefits of team vs individual sports have been studied with different outcomes, but overall the psychological outcomes of team sports seem to be more advantageous compared to individual sports[27]. The feeling of a more positive school environment might be caused by the experiences that skilled players have in physical education classes, but especially also in school breaks, when football and other sports are often played. This also leads to more physical activity during school time for football players[28]. And, in addition, boys can experience satisfaction of the basic needs for autonomy, competence and social relatedness, which could explain the higher well-being scores[14].

In general, the findings support the general assumption that participation in leisure-time sports clubs is associated with higher well-being scores in children[29 30].

Performance measurements

Performance in YYIR1C is highly correlated with maximal oxygen uptake measured in the laboratory setting[20]. As cardiovascular fitness in children and adolescents affects risk factors for future BMI, body fat and metabolic syndrome, good cardiovascular fitness is important for future health[31]. Boys doing leisure-time sport ran 58% further in the YYIR1C test, corresponding to 4.1 ml/kg/min, than NSA boys, while boys playing football ran 85, 24, 51 and 64% further, corresponding to 6.1, 2.6, 4.4 and 4.1 ml/kg/min respectively, compared to NSA subjects, handball players, swimmers and badminton players. That boys participating in leisure-time sports have greater cardiovascular fitness than non-active boys were also found in previous small-scale studies in 8–12-year-old boys[11 17]. Furthermore, the analysis of the five sports in this study reveals that boys playing football had higher cardiovascular fitness compared to team handball players, swimmers and badminton players, but not gymnasts. The difference in cardiovascular fitness might be due to differences between the sports in training intensity[26]. We know from previous studies that the intensity in football is high in terms of heart rate, but we lack measurements for the other sports[26]. Another reason for the difference in the distance run may be the design of the test, which is favourable to intermittent sports such as football, as it was originally designed for intermittent sports, or the high training frequency among football players.

Boys active in sports clubs jumped further and had better balance than non-active boys. The jump length is well correlated with muscle strength and shows, together with the higher muscle percentage, a better muscular fitness for the ASA boys[18]. In relation to balance, it is an important parameter in many physical activities, and since competence in activities helps with maintaining motivation[14], this might lead to enhanced physical activity.

Cardiovascular health profile

Resting heart rate (RHR) was lower for boys active in all sports clubs, as well as in gymnasts, footballers and handball players compared to non-active boys. Previous studies have found comparable differences in RHR and an association between cardiovascular fitness profile and RHR[11 17].

Blood pressure was normotensive for all groups, but diastolic blood pressure (DBP) was significantly lower for footballers than for non-active boys, while systolic blood pressure was higher in the football players. Both differences are very small (0.2 mmHG) and should be interpreted carefully. The clinical relevance of the difference in blood pressure can be discussed, but blood pressure paths are detectible in childhood and a healthy blood pressure in childhood will follow into adulthood and avert development of hypertension[32].

Previous cross-sectional studies have not shown any differences in blood pressure or MAP when comparing different sporting groups with inactive school children[11 17], so the findings of the present study should ideally be confirmed by studies with similar sample size.

Body composition

Boys participating in leisure-time sports had lower body mass, BMI and fat percentage, and higher relative muscle percentage, than non-active boys. These differences were also seen in girls[9] and, as stated there, "the differences might be explained by the higher level of PA that children enrolled in leisure-time sport have, which is also higher than for children participating in self-organised sports and children who do not participate in sports at all" [33 34]. Gymnasts had the lowest body mass, BMI and fat percentage compared to the other sports, with a few exceptions. The differences could be caused by a gymnast's exercises bearing own weight, where low weight is important. On the other hand, swimmers had higher fat and lower muscle percentage compared to boys active in football, badminton and gymnastics, which may be related to a poorer health status, or to a selection bias, since that type of body composition might be an advantage in (long-distance) swimming and swimming training may not have a positive effect on body composition[35].

Practical implications

This study revealed that boys participating in leisure-time sports club activities have better health profile, physical capacity and well-being. The results provide specific information regarding sports club activities in Danish boys as a whole, as well as for five popular sporting activities, with football and gymnastics as prominent examples. The results suggest that higher levels of participation in sport possibly improve fitness profiles and well-being and should be considered by parents, politicians and sports organisations. They should ensure that children participate in leisure-time sports, thereby potentially having a positive impact on the health and well-being of future generations. This could be done by introducing sports in schools and by helping challenged families with financing and guidance.

CONCLUSIONS:

Boys participating in club-based leisure-time sports showed markedly higher levels of well-being, and better fitness and health profiles, than boys not involved in any sports club activities. Boys involved in football had better aerobic fitness and better body composition compared to those active in other sports. Therefore, leisure-time sports club activities seem to be both beneficial and important for childhood well-being, fitness and physical health profile, with a team sport like football as a prominent example.

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Author contributions: MNL conducted testing, analysed the data, prepared the first draft of the paper, revised the manuscript and approved the final version of the paper. A-ME contributed to the design of the study, revised the manuscript and approved the final submission. MM, EEM, RC, RRL and KR implemented the intervention, conducted testing, analysed the data, revised the manuscript and approved the final submission. SRC performed the statistical analysis. PK designed the study, applied for funding, implemented the intervention, analysed the data, prepared the first draft of the paper, revised the manuscript and approved the final version of the paper.

Ethics approval: The study was approved by the Regional Committees on Health Research Ethics for Copenhagen and Southern Denmark (J.no. H-16026885).

Competing interests: No competing interests.

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Data availability statement: Data are available upon reasonable request. Deidentified participant data can be shared in respect of data protection and ethical approval. Please contact 11forhealth@sdu.dk.

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REFERENCES:

1. Andersen LB, Harro M, Sardinha LB, et al. Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). *The Lancet* 2006;368(9532):299-304. doi: 10.1016/s0140-6736(06)69075-2
2. Bangsbo J, Krustrup P, Duda J, et al. The Copenhagen Consensus Conference 2016: children, youth and physical activity in schools and during leisure time. *Br J Sports Med* 2016;50(19):1177-78
3. Nielsen G, Bugge A, Andersen LB. The influence of club football on children's daily physical activity. *Soccer & Society* 2015;17(2):246-58. doi: 10.1080/14660970.2015.1082754
4. Wallander J, Kerbawy S, Toomey S, et al. Is obesity associated with reduced health-related quality of life in Latino, black and white children in the community? *International Journal of Obesity* 2013;37(7):920-25.
5. Meixner L, Cohrdes C, Schienkiewitz A, et al. Health-related quality of life in children and adolescents with overweight and obesity: results from the German KIGGS survey. *BMC public health* 2020;20(1):1-11.
6. Buttitta M, Iliescu C, Rousseau A, et al. Quality of life in overweight and obese children and adolescents: a literature review. *Quality of life research* 2014;23(4):1117-39.
7. Zahner L, Muehlbauer T, Schmid M, et al. Association of sports club participation with fitness and fatness in children. *Medicine+ Science in Sports+ Exercise* 2009;41(2):344.
8. Ngamaba KH, Panagioti M, Armitage CJ. How strongly related are health status and subjective well-being? Systematic review and meta-analysis. *The European Journal of Public Health* 2017;27(5):879-85.
9. Madsen M. Team sports activity in school and in leisure-time sports clubs for 8–12-year-olds – Exercise intensity and importance for cardiovascular health, fitness, body composition and well-being [PhD]. University of Southern Denmark, 2020.
10. Wold B, Duda JL, Balaguer I, et al. Comparing self-reported leisure-time physical activity, subjective health, and life satisfaction among youth soccer players and adolescents in a reference sample. *International Journal of Sport and Exercise Psychology* 2013;11(4):328-40.
11. Ørntoft C, Larsen MN, Madsen M, et al. Physical Fitness and Body Composition in 10–12-Year-Old Danish Children in Relation to Leisure-Time Club-Based Sporting Activities. *BioMed Research International* 2018;2018:1-8. doi: 10.1155/2018/9807569
12. Eime RM, Young JA, Harvey JT, et al. A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *International journal of behavioral nutrition and physical activity* 2013;10(1):1-21.

13. Reinboth M, Duda JL. Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psychology of sport and exercise* 2006;7(3):269-86.
14. Deci EL, Ryan RM. Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian psychology/Psychologie canadienne* 2008;49(3):182.
15. Alvarez MS, Balaguer I, Castillo I, et al. The coach-created motivational climate, young athletes' well-being, and intentions to continue participation. *Journal of clinical sport psychology* 2012;6(2):166-79.
16. Ravens-Sieberer U, Herdman M, Devine J, et al. The European KIDSCREEN approach to measure quality of life and well-being in children: development, current application, and future advances. *Qual Life Res* 2014;23(3):791-803. doi: 10.1007/s11136-013-0428-3 [published Online First: 2013/05/18]
17. Larsen MN, Nielsen CM, Orntoft CO, et al. Physical Fitness and Body Composition in 8-10-Year-Old Danish Children Are Associated With Sports Club Participation. *Journal of strength and conditioning research* 2017;31(12):3425-34. doi: 10.1519/jsc.0000000000001952 [published Online First: 2017/04/27]
18. Castro-Pinero J, Ortega FB, Artero EG, et al. Assessing muscular strength in youth: usefulness of standing long jump as a general index of muscular fitness. *Journal of strength and conditioning research* 2010;24(7):1810-7. doi: 10.1519/JSC.0b013e3181ddb03d [published Online First: 2010/06/18]
19. Ortega FB, Artero EG, Ruiz JR, et al. Reliability of health-related physical fitness tests in European adolescents. The HELENA Study. *Int J Obes (Lond)* 2008;32 Suppl 5:S49-57. doi: 10.1038/ijo.2008.183 [published Online First: 2008/11/26]
20. Ahler T, Bendiksen M, Krustrup P, et al. Aerobic fitness testing in 6- to 9-year-old children: reliability and validity of a modified Yo-Yo IR1 test and the Andersen test. *European journal of applied physiology* 2012;112(3):871-6. doi: 10.1007/s00421-011-2039-4 [published Online First: 2011/06/21]
21. Povoas SCA, Castagna C, da Costa Soares JM, et al. Reliability and Construct Validity of Yo-Yo Tests in Untrained and Soccer-Trained Schoolgirls Aged 9-16. *Pediatr Exerc Sci* 2016;28(2):321-30. doi: 10.1123/pes.2015-0212 [published Online First: 2015/12/24]
22. Panta K, Arulsingh W, Raj J, et al. A study to associate the Flamingo Test and the Stork Test in measuring static balance on healthy adults. *The Foot and Ankle Online Journal* 2015;8 doi: 10.3827/faoj.2015.0803.0004
23. Hammami R, Chaouachi A, Makhlouf I, et al. Associations Between Balance and Muscle Strength, Power Performance in Male Youth Athletes of Different Maturity Status. *Pediatric exercise science* 2016;28 doi: 10.1123/pes.2015-0231
24. Montgomery DC, Peck EA, Vining GG. Introduction to linear regression analysis: John Wiley & Sons 2012.
25. Larsen MN, Nielsen CM, Ørntoft C, et al. Physical fitness and body composition in 8–10-year-old Danish children are associated with sports club participation. *BioMed Research International* 2017;31(12)
26. Bendiksen M, Williams CA, Hornstrup T, et al. Heart rate response and fitness effects of various types of physical education for 8- to 9-year-old schoolchildren. *European journal of sport science* 2014;14(8):861-9. doi: 10.1080/17461391.2014.884168 [published Online First: 2014/02/19]
27. Wikman JM, Elsborg P, Ryom K. Psychological benefits of team sport. In: Parnell D, Krustrup P, eds. Sport and Health: Exploring the Current State of Play 2017.

28. Nielsen G, Bugge A, Andersen LB. The influence of club football on children's daily physical activity. *Soccer & Society* 2015:1-13. doi: 10.1080/14660970.2015.1082754
29. Bangsbo J, Krustrup P, Duda J, et al. The Copenhagen Consensus Conference 2016: children, youth, and physical activity in schools and during leisure time. *British Journal of Sports Medicine* 2016;50(19):1177-78.
30. Spengler S, Woll A. The more physically active, the healthier? The relationship between physical activity and health-related quality of life in adolescents: the MoMo study. *Journal of Physical Activity and Health* 2013;10(5):708-15.
31. Mintjens S, Menting MD, Daams JG, et al. Cardiorespiratory Fitness in Childhood and Adolescence Affects Future Cardiovascular Risk Factors: A Systematic Review of Longitudinal Studies. *Sports Med* 2018;48(11):2577-605. doi: 10.1007/s40279-018-0974-5 [published Online First: 2018/08/26]
32. Theodore RF, Broadbent J, Nagin D, et al. Childhood to Early-Midlife Systolic Blood Pressure Trajectories: Early-Life Predictors, Effect Modifiers, and Adult Cardiovascular Outcomes. *Hypertension (Dallas, Tex : 1979)* 2015;66(6):1108-15. doi: 10.1161/HYPERTENSIONAHA.115.05831 [published Online First: 2015/11/13]
33. Mooses K, Kull M. The participation in organised sport doubles the odds of meeting physical activity recommendations in 7–12-year-old children. *European journal of sport science* 2019:1-7. doi: 10.1080/17461391.2019.1645887
34. Lagestad P, Mikalsen H, Ingulfsvann LS, et al. Associations of Participation in Organized Sport and Self-Organized Physical Activity in Relation to Physical Activity Level Among Adolescents. *Front Public Health* 2019;7(129):129. doi: 10.3389/fpubh.2019.00129 [published Online First: 2019/06/11]
35. Clarke DH, Vaccaro P. The effect of swimming training on muscular performance and body composition in children. *Research Quarterly American Alliance for Health, Physical Education, Recreation and Dance* 1979;50(1):9-17.

TABLES:

Table 1. Physical fitness profile and training frequency for all boys active in leisure-time sports. The five primary sports and the no-sports group.

	Football		Team Handball		Gymnastics		Swimming		Badminton		All Sports (ASA)		No Sports (NSA)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Yo-Yo IR1 C test (m)	ahsb 1139	567	af919	510	absf897	514	g756	457	agf782	452	a973	543	616	403
Height (cm)	hb 151.4	6.9	afg153.1	6.1	h149.8	5.8	152.0	7.1	af152.0	7.1	151.5	6.9	151.1	7.4
Weight (kg)	ahs 41.3	7.6	fg43.7	8.6	abs40.8	7.7	43.7	9.7	41.85	9.84	41.89	8.5	43.79	9.6
SLJ (cm)	a 115.4	38.9	a114.6	37.3	as118.6	37.0	a111.7	39.1	a121.8	30.1	a115.1	38.6	104.9	40.0
Balance (s)	a 4.38	3.38	ab3.81	2.44	4.13	3.05	b3.68	2.41	as4.80	3.53	a4.33	3.33	3.49	3.20
Fat percentage (%)	as 18.56	6.75	a19.72	7.39	as 19.02	6.65	bgf21.62	8.45	as19.49	7.57	a19.41	7.38	23.22	8.55
Muscle mass (%)	as 43.20	4.02	a42.86	3.95	as42.83	3.80	fg41.63	4.46	a42.58	4.29	a42.77	4.26	40.72	4.71
SBP (mmHg)	a 101.4	8.6	a100.9	9.7	100.3	9.2	101.7	9.1	100.8	9.7	101.0	8.8	101.2	9.2
DBP (mmHg)	a 64.5	7.25	a63.5	5.8	63.8	7.1	64.6	8.1	64.7	6.9	64.33	7.2	64.8	7.0
MAP (mmHg)	76.8	6.72	76.0	6.3	76.0	7.0	77.0	7.8	76.7	6.9	76.6	6.8	76.9	6.8
RHR (bpm)	a 72.1	10.2	a72.1	10.2	a72.7	9.5	74.3	10.2	74.1	10.6	a72.7	10.1	75.9	10.0
BMI	ahs 17.91	2.48	a18.58	3.03	18.10	2.65	bf18.79	3.42	as17.91	2.85	a18.16	2.86	19.05	3.25
VO_2 (mL/min/kg)	ahsb 55.5	6.6	a53.0	5.9	as52.7	6.0	f51.1	5.3	af51.4	5.3	a53.6	6.3	49.4	4.7
Training/wk (n)	2.5	0.8	2.3	0.7	1.5	0.8	1.8	1.1	1.9	0.9	2.2	0.9	0	0

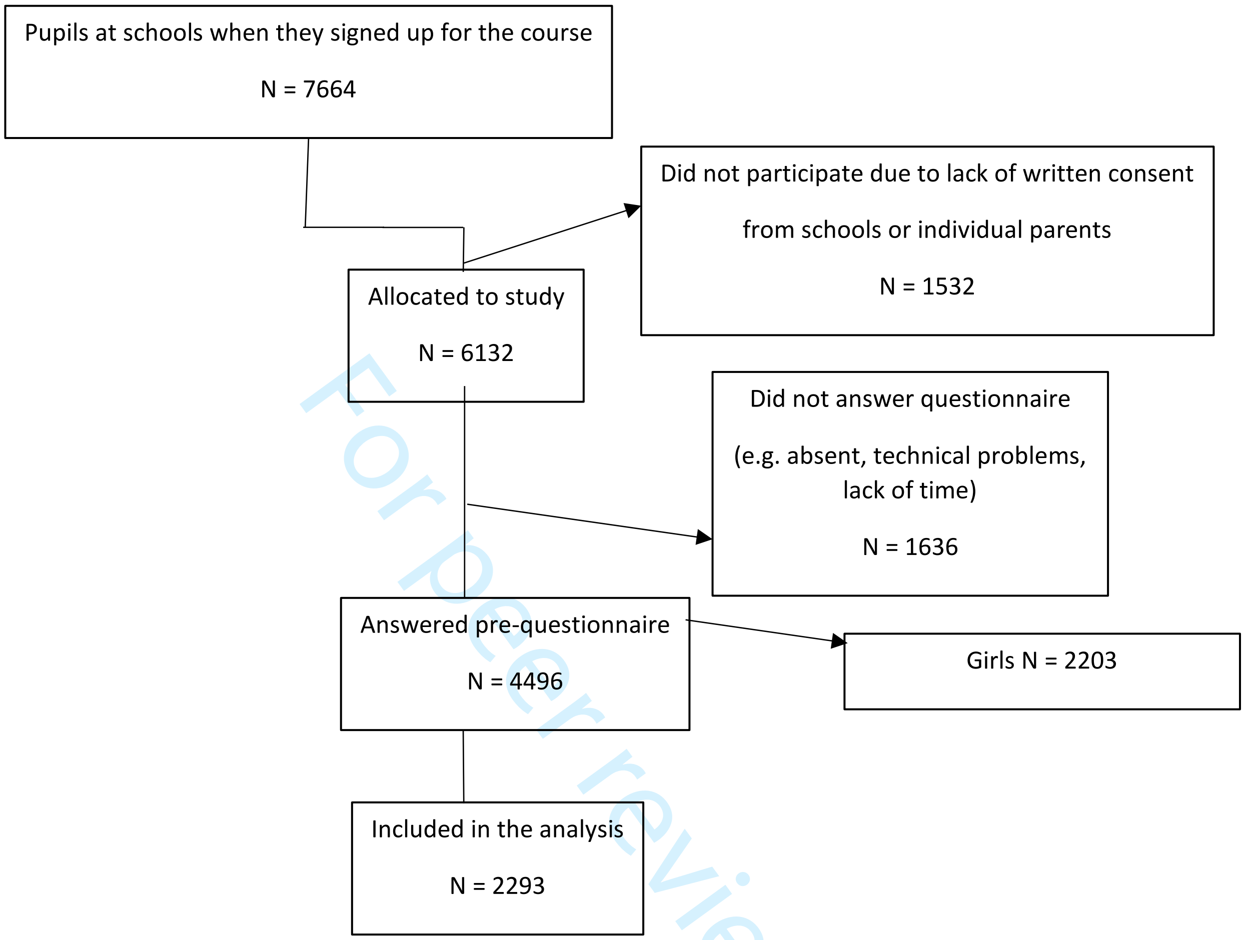
Raw means ± SD. NSA = non-sports-club active; ASA = all-sports-club active; a = sign. difference from "no-sports". f = sign. difference from football. h = sign. difference from team handball. g = sign. difference from gymnastics. s = sign. difference from swimming. d = sign. difference from badminton. P≤0.05.

Table 2. KIDSCREEN-27 well-being score for all boys active in leisure-time sports. The five primary sports and the no-sports group.

	Well-being measurements						
	No Sports (NSA)	All Sports (ASA)	Football	Team Handball	Gymnastics	Swimming	Badminton
Physical well-being							
Mean	45.9± 8.7	51.7 ± 9.7a	53.3 ± 9.6as	51.7±10.6as	51.1±7.7a	48.7±10.2afg	50.7±8.6a
Psychological well-being							
Mean	51.4±10.0	53.3± 9.6a	51.4 ± 9.2ah	52.4±10.1f	53.1± 9.4fd	52.3±9.3	52.8±9.6
Peers and social support							
Mean	48.0±11.6	50.9±9.9a	51.8± 9.8ah	49.6±9.6	49.6±8.5	50.0±9.7	50.6±10.4a
School environment							
Mean	45.9±8.1	48.6±7.5a	48.8±7.2a	47.8±8.1a	48.0±7.5a	48.2±7.0a	49.0±7.8a

Raw means ± SD. NSA = non-sports-club active; ASA = all-sports-club active; a = sign. difference from "no-sports". f = sign. difference from football. h = sign. difference from team handball. g = sign. difference from gymnastics. s = sign. difference from swimming. d = sign. different from badminton. P≤0.05.

Figure 1: Participants' flow chart.



Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of	5

		recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5
Bias	#9	Describe any efforts to address potential sources of bias	8
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	8
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	8
Statistical methods	#12c	Explain how missing data were addressed	8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	8
Statistical methods	#12e	Describe any sensitivity analyses	8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	5
Participants	#13b	Give reasons for non-participation at each stage	5
Participants	#13c	Consider use of a flow diagram	5

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	8
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	5
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
Main results	#16b	Report category boundaries when continuous variables were categorized	8
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	11
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	11
Generalisability	#21	Discuss the generalisability (external validity) of the study results	12
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13