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The effects of a combined physical activity and health education program on health knowledge and well-being of socially vulnerable children

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Abstract

The purpose of the present study was to evaluate the effects of the football-based health education program "11 for Health" on health knowledge and well-being in the setting of a 10-week residential stay in a Danish charity home for socially vulnerable children. Six hundred and fourteen children participated in the study, of which 305 took part in the standard program plus "11 for Health" (SG+: 12.4 ± 1.4 (mean ± SD) years) and 309 took part in the standard program (SG: 12.4 ± 1.6 years). We used a crossover design over two full years. The study examined changes in health knowledge and well-being through questionnaires. Overall health knowledge increased more in SG+ than SG over 10 weeks (6.6 vs. 3.4%, $p < 0.05$). The overall well-being scores were markedly improved ($p < 0.05$) by 4.54 ± 7.17 AU in SG+ and 4.51 ± 7.16 AU in SG, with no between-group differences. Specific improvements ($p < 0.05$) were seen in all well-being subcategories, raising the well-being scores to the national average. In conclusion, a 10-week stay at a Danish charity home, the Christmas Seal Home, markedly affected health knowledge and well-being of socially vulnerable children. When the football-based health education program—11 for Health—was added, there were additional positive effects on health knowledge.

KEYWORDS

11 for Health, football, learning, mental well-being, physical well-being, social well-being

1 | INTRODUCTION

Regular physical activity is well known to be associated with positive physical and mental health effects, and physical activity can prevent diseases threatening modern society.[1] The positive effect of physical activity on mental health outcomes includes psychological well-being. A systematic review[2] found associations between a greater amount of sedentary behavior, increased psychological ill-being, and decreased psychological well-being in children

and adolescents. This review also found that participants who met the recommended amount of daily physical activity improved their overall mental health compared to peers who engaged in physical activity for less than 60 min daily.[2]

Studies have found a strong association between sedentary behavior and depressive symptoms in adolescents[3] and children.[4] In terms of clinically meaningful changes in depressive symptoms in adolescents, moderately increasing activity in inactive adolescents could result in a meaningful improvement in well-being.[5]

If physical activity is practiced as participation in team sports, there is a consistent positive correlation of mental health in children and adolescents[2]; team sports may confer particular well-being benefits for girls and the least active adolescents.[5] Additionally, it has been shown that organized leisure-time sports participation was associated with higher odds of meeting children's recommended daily physical activity level.[6] Especially for soccer and team handball compared to other team and individual sports.[7] Moreover, high-intensity exercise training using team sports in schools has increased cardiovascular and musculoskeletal health in 8- to 12-year-old school children.[8,9]

It has been shown that a well-developed health literacy is associated with participation in health-enhancing activities such as regular physical activity.[10] For instance, adolescents in sports clubs exhibited greater health literacy levels than those who were not members, irrespective of age or gender.[11] Higher health literacy also motivates individuals to take more control over their health and health-related decisions.[12] Buja and colleagues showed that higher levels of health literacy improve one's ability and motivation to act on provided and learned health knowledge and education. Moreover, this review underlines that effective health education interventions could affect health knowledge and, thereby, related behaviors such as physical activity, regardless of the initial level of health literacy.[12]

The 11 for Health program, "11fH in Europe" (11fH), is a health education program that aims to improve physical activity, nutrition, health knowledge, positive thinking and psychological well-being, using recreational football as the setting. Ten health messages are delivered over 10 weeks, primarily related to non-communicable diseases and linked to a football skill. The program was tested in 2015–2016 in a pilot project involving 600 Danish children. The study showed positive effects on well-being and health knowledge,[13] cognitive skills, including reaction time and learning memory,[14] as well as physical fitness and health profile in Danish school children aged 10–13.[15] In 2017, the program was further developed into "11fH in Denmark" and was implemented in a large-scale study of 30 000 children from over 400 schools in 92 Danish municipalities. Results using a subsample of 6000 children who participated in a cluster RCT showed positive effects on health profile, well-being, and health knowledge.[9,16] It is noteworthy that the 11fH intervention is popular with girls, that girls have more profound well-being effects from 11fH, and that girls have equally significant health, fitness, and learning effects as boys.[16] To our knowledge, no health-promoting program for children combines specific health knowledge themes with practical, physical exercises like the 11fH program.

In this study, we evaluate the effects of the 11fH program in the setting of a 10-week residential stay at the Danish Christmas Seal Homes (DSCH) for socially vulnerable children aged 7–14. In the DCSHs, the children and adolescents experience a restructuring of their exercise and diet plans. They will be supported to improve their self-confidence and well-being. During the stay, the children are presented with a structured everyday life, engagement in school assignments and digital behavior. Common to the children and adolescents offered a stay at the DCSH are challenges such as bullying, social isolation, and, in many cases, being overweight. Studies have shown that the gender distribution in the DCSHs was typically 50/50, with a slight overweight of girls, and 95% of the children and adolescents had a Danish ethnic background.[17] Furthermore, children and adolescents with a residential stay at the DCSH had a higher degree of physical or mental difficulties compared to other children of the same gender and age; a larger percentage live in homes with only one parent;[18] 97% of children at the DCSHs have either overweight or obesity problems;[17] and 73% of the children report having a low quality of life prior to their residential stay.[17] For children from low-income settings to attain social benefits from sports participation, the setting must provide social support and psychological safety,[19] and sports participation is recommended to enhance psychosocial health outcomes.[20] Especially, team-sport activities positively impact everyday social health outcomes.[20]

The present study evaluated whether 11fH can have additional positive effects compared to the effects of the standard program at the DCSHs, which primarily include non-team-based physical activity. Multicomponent programs are most likely to be successful,[1] and the health-promoting 11fH program using recreational football as a team sport setting has shown impressive results for school children regarding health knowledge and well-being. However, the effects of the 11fH program for vulnerable children and adolescents in the DCSH setting are unknown.

Therefore, in this project (pre-registered at ClinicalTrials.gov ID: NCT03647007), we aimed to study whether the 11fH program has additional effects compared to the

standard care program at the DSCH. In the present study, we examined outcomes related to health knowledge, well-being, and enjoyment of the 11fH program in the DCSH setting.

2 | METHODS

2.1 | Study design

The present study was a pragmatic quasi-experimental study with a randomized crossover design over 2 years. There were two groups: a standard plus group, SG+, which included 11fH activities of 2 × 45 min per week, and a standard group (SG). Two DCSHs participated in the study. A research assistant not otherwise involved in the study selected one of two sealed envelopes with the DCSH names. The selected DCSH (DSCH-S) started with year 1 as SG+ and shifted in year 2 to SG after a wash-out period of 1 month. The other DCSH (DSCH-K) started year 1 in SG and shifted to SG+ in year 2 after a wash-out period of 1 month. All tests were carried out at both DCSHs for SG+ and SG. The DCSH had a continuous enrollment of children. At any time, 48 children could have a residential stay at DCSH-S and 24 at DCSH-K. To participate in the study, the participants had to be enrolled on a residential stay at a DCSH, be 7–14 years old, have written informed parental consent and be willing to participate in tests and SG+ or SG.

Outcomes other than those reported in the present study are measured in this project. The DCSH residential stay improved the participants' physical activity and sleep patterns, body composition, fitness, physical performance, sleep difficulties, and emotional behavior challenges.[21,22]

2.2 | Participants

In Denmark, a general physician can refer a child or adolescent to a residential stay at the DCSH based on a request from the parents/schoolteacher/school nurse and on concerns for the physical health, mental well-being, or social vulnerability of the child or adolescent. The families then converse with DCSH staff to determine if a DCSH residential stay can positively affect the child or adolescent. Recruitment for participants in the present study occurred at information meetings for parents at the DCSHs. There were no other inclusion criteria besides a residential stay at a DCSH.

In total, 614 children were recruited for the study, with 305 children involved in SG+ (12.4 ± 1.4 yrs, 159.4 ± 9.7 cm, 65.8 ± 15.7 kg, 1.45 ± 0.82 BMIz), and 309 children involved in SG (12.4 ± 1.6 yrs, 160.4 ± 9.4 cm, 68.3 ± 16.3 kg, 1.50 ± 0.84 BMIz) (see flow chart, Figure 1). With baseline questionnaire data, 290 and 291 participants in SG+ and SG were included in the intention-to-treat analysis regarding the well-being results. An available-case analysis was used to assess the complete dissemination of health knowledge in the 11fH program (SG+: $N = 243$, SG: $N = 235$). The participants in the present study completed the questionnaires at baseline and follow-up, except those who ended the residential stay before 10 weeks, were ill or were not present at the DCSH for the specific measurement sessions. No participant was excluded because of a lack of ability or motivation to answer the questionnaires (see Figure 1). According to the DSCH staff, the primary reason for ending a residential stay and decreasing overall well-being was an increasing feeling of being homesick (no data on reasons for ending the residential stay).

2.3 | Procedure

2.3.1 | The DCSH setting

For all children and adolescents at the DSCHs, there is a strong focus on experiences with learning, personal development, progress, and positive peer relationships rather than a competitive environment and externally referenced criteria for success. These factors are essential in environments that seek to enhance children's and adolescents' well-being and motivation.[23] During the two measurement years, the standard program was observed to collect information about the typical daily content at the DCSH. The standard residential stay is a 24-h stay on weekdays. The children spent three weekends at the DCSH in the first measurement year and only stayed at the DCSHs on weekdays in the second year. A 10-week residential stay at the DCSH generally promoted healthy food habits, daily physical activity, and social engagement. The children and adolescents were expected to participate in all DCSH activities in the broadest possible range.

In SG+, the 11fH sessions replaced two weekly physical activity sessions from the standard program. The 11fH program consists of 11 weeks of health training on the football pitches with two weekly 45-min sessions, where technical, tactical, and physical elements of football are used to deliver 10 health messages related to (1) physical activity; (2) healthy and varied diets; (3) unhealthy temptations such as alcohol, tobacco, and drugs; (4) hygiene; (5) respect, cooperation, and psychosocial well-being. Every week, there is a "Play Football" and a "Play Fair" session, with a different combination of exercises, small-sided games, and health learning. The "Play Football" sessions included, for example, warm-up exercises, assigning

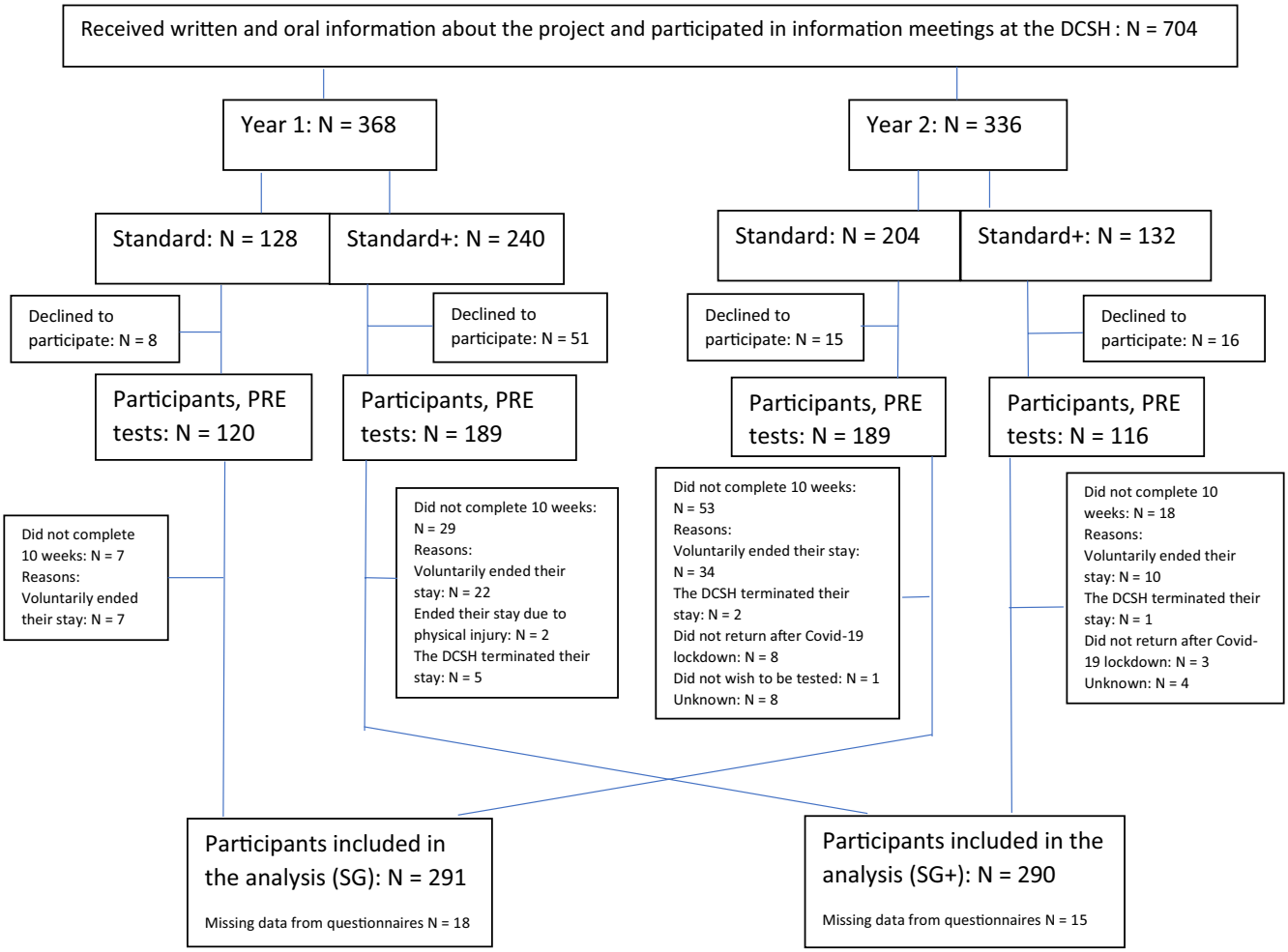

FIGURE 1 Study flowchart.

a praise partner for each participant, and training in football skills. The "Play Fair" sessions included, for example, presenting facts about the session's health message, an interactive, football-based activity linked to the session's health message, and praising partners' comments on positive actions and attitudes exhibited by the children during the session.[24] An example of the combination of physical activity, football skill and health messages was the practice of passes to each other during play related to respect for others (pass the ball so the teammate can handle it), helping each other (move on the pitch so you are available to receive the ball) and avoiding bullying (small-sided games, that include all participants).[15]

The DCSH staff handle all teaching and are trained in a 2-day course organized by the University of Southern Denmark (SDU). The course outlines the research underpinning the project, the tests used, the detailed project manual, and relevant health knowledge. For this purpose, theoretical and practical training is implemented so that DCSH staff can use football as a motivating and effective tool for health learning. The program includes exercises designed to be engaging and socially inclusive and small games each week related to one central health message, each targeting a key health theme for children and adolescents in the Western world.[13] The length of the program is defined by the standard DCSH stay, which is 10 weeks, and therefore, the usual 11-week 11fH program has been adapted to fit within this format. A 10-week format is similar to many effective physical activity interventions, often 12 weeks long.

In SG, the standard program for children and adolescents at the DCSH includes 2–4 h of school in small groups of approximately 5–6 children, daily physical activity (typically individual activities like walking, running, cycling, swimming, strength exercises, circuit training, games, and some team-ball activities), social activities, healthy food education, a midday-rest hour, and household chores. The daily physical activity sessions are designed to develop success experiences, personal development, and a strong sense of community. In addition, the DCSH staff regularly conducted joint meetings with the children to ensure a healthy social environment and teach communication with peers. The DCSH staff all have pedagogical education and specialize in supporting and teaching children so

they can join communities because this is the prerequisite for their well-being, learning, and development.[25]

On all test days, a DCSH staff member participated in the fulfillment of the different measurements. The participating DSCH staff members were the same throughout the study and were all trained in the relevant standard operating procedures by the first author (TKM). The measurements were always performed in the same order in both DCSHs. Before breakfast on one of the first (baseline) and last (follow-up) mornings, the participants were measured by DCSH staff for their height and weight. After breakfast, the participants individually filled out the questionnaires, with the opportunity for adults to help them read or understand them.

2.3.2 | Health knowledge

A 36-item health knowledge survey examined the development of the participants according to the health themes incorporated in the 11fH: physical activity, nutrition, well-being, alcohol and tobacco, and hygiene (Figure 3). In Table 1, the overall topics are presented as 10 health messages. Figure 3 presents the 10 health messages as five health knowledge themes. The survey has been described in detail in several other studies.[9,16] The pilot study observed some ceiling effects in the responses from the health knowledge survey. Therefore, the survey was upgraded from the pilot version (32-item survey)[15] before the nationwide "11 for Health – Denmark" study (36-item survey).[9,16] In the present study, the 36-item survey was used in year two. To maintain the design with two DCSH in SG+ and SG, years 1 and 2 were analyzed combined.

2.3.3 | Well-being

A shortened version of the Danish KIDSCREEN-27 survey was used to measure well-being. KIDSCREEN-27 has 27 items covering five dimensions of "physical well-being" (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 items are rated on a 5-point Likert scale ranging from "never" to "always" or "not at all" to "extremely." In the follow-up, the participants were instructed to relate their answers to the 7 days before the test day. The participants did not see their parents in the last 14 days before the post-test. Therefore, the "autonomy and parent relation" scale was excluded. The KIDSCREEN-27 questionnaire generally has good reliability (Cronbach's alphas: 0.80–0.84) and high test–retest reliability.[26] Higher KIDSCREEN-27 scores indicate better well-being.

TABLE 1 Mean percentage and change scores for correct responses to health-related assessment by instructional method and time.

	Standard ($n = 235$)			Standard +11 for Health ($n = 243$)			
Health message (Overall topic)	**Pre**	**Post**	**Δ**	**Pre**	**Post**	**Δ**	**Change score (Estimated mean difference) (95% CI), ΔSG+ v. ΔSG**
1. Play football (physical activity)	66.2 (28.6)	68.3 (26.0)	2.1 (38.7)	64.5 (25.6)	73.1 (24.7)	8.6 (34.5)[a]	4.8 (0.2; 9.4)[b]
2. Respect (well-being)	97.6 (10.2)	97.7 (10.0)	0.1 (14.6)	95.6 (13.5)	97.1 (11.2)	1.5 (15.2)	−0.4 (−2.3; 1.5)
3. Be active (physical activity)	63.2 (22.6)	73.9 (21.3)	10.7 (27.6)[a]	68.9 (23.3)	70.8 (21.5)	1.9 (26.9)	−4.5 (−8.2; −0.7)[b]
4. Avoid tobacco, alcohol and drugs	92.3 (20.3)	96.2 (14.8)	3.8 (25.0)[a]	89.7 (22.7)	93.2 (20.5)	3.5 (30.8)	−3.0 (−6.2; 0.3)
5. Control your weight (nutrition)	63.4 (31.4)	76.7 (26.7)	13.3 (42.5)[a]	60.1 (32.9)	74.2 (28.1)	14.1 (42.0)[a]	−2.5 (−7.4; 2.5)
6. Wash your hands (hygiene)	77.3 (25.5)	67.0 (19.2)	−10.4(31.9)[a]	74.8 (24.7)	73.0 (21.6)	−1.8 (31.1)	6.1 (2.5; 9.8)[b]
7. Drink water (nutrition)	72.8 (22.2)	78.2 (23.4)	5.4 (33.6)[a]	69.8 (23.7)	79.8 (22.0)	10.1 (30.8)[a]	1.7 (−2.4; 5.8)
8. Eat a balanced diet (nutrition)	64.7 (19.1)	70.2 (19.5)	5.5 (27.6)[a]	61.8 (20.5)	73.7 (22.1)	11.8 (30.4)[a]	3.4 (−0.4; 7.2)
9. Get fit (physical activity)	26.1 (27.6)	27.4 (27.1)	1.3 (38.4)	25.2 (25.6)	36.4 (32.4)	11.1 (40.8)[a]	9.0 (3.6; 14.4)[b]
10. Think positive (well-being)	80.0 (22.3)	82.4 (21.3)	2.4 (22.9)	82.4 (23.6)	87.4 (21.6)	4.9 (27.2)[a]	4.2 (0.6; 7.8)[b]
Total mean	70.4 (11.0)	73.8 (10.4)	3.4 (15.5)[a]	69.3 (12.0)	75.9 (10.7)	6.6 (15.0)[a]	2.1 (0.2; 4.0)[b]

Note: Data are presented as means (SD).

[a]Significant within-group differences ($p < 0.05$).

[b]Significantly between-group differences ($p < 0.05$).

2.3.4 | Enjoyment and attendance of the intervention

The participants were asked how well they liked the 11fH program on a 1–5 scale ranging from "not at all (1)" to "very much (5)." The staff registered attendance for the 11fH activities. During the year with SG+ activities, all 20 11fH sessions were observed to supervise the DCSH staff and provide sufficient support in their program delivery. During the year with SG activities, approximately 10 physical activity sessions in the standard program were observed to assess the type of activity. The same researcher performed all observations to ensure similar dissemination at the two DCSHs.

2.3.5 | Anthropometric measurements

Standing height was measured with 0.1 cm precision using a Tanita Leicester portable altimeter (Tanita, Amsterdam, Netherlands). Body mass was measured using an InBody 270 multifrequency body composition analyzer (Biospace, San Diego, CA). The participants were weighed barefoot and in light clothing or pajamas before breakfast.

2.4 | Data analysis

Statistical analyses were performed using IBM SPSS statistics, version 28. Mean (standard deviation) values are reported for each of the 10 health messages, based on all individual items related to the message, together with an overall "11fH" intervention mean (standard deviation) value. For health knowledge, the baseline to follow-up within-group differences was tested using a paired *t*-test on all available cases. Afterward, the between-group differences in change scores were tested with a univariate variance analysis using the change score as a dependent value, baseline values as a covariate, and the group as a factor.

The well-being scores were analyzed in four separate categories and a total mean. Within- and between-group differences were examined with an intention-to-treat analysis with missing values due to dropouts replaced by baseline observations carried forward (equivalent to assuming that dropouts experienced no effect). Baseline to follow-up within-group differences were tested using a paired *t*-test. Between-group effects were tested with a univariate variance analysis using change score as a dependent value, baseline values and age as a covariate, and group as a factor. The analysis was performed for each gender separately and both genders combined (with gender as an additional covariate). In addition, an all available-case analysis was performed that indirectly assumes that dropouts would have similar trends to participants completing the 10-week stay (similar benefits). Unless otherwise mentioned, the discussion on well-being results relates to the intention-to-treat analysis.

3 | RESULTS

3.1 | Monitoring of the 11 for health program

The children in SG+ rated the 11fH program with an enjoyment score of 3.5 ± 1.0, with no significant differences between boys (3.6 ± 0.9) and girls (3.5 ± 1.0). The attendance in the 11fH program was 90.0 ± 15.9% or 18.0 ± 3.2 sessions over 10 weeks (of 20 possible sessions), with similar attendances for boys (89.7 ± 16.2%) and girls (90.3 ± 15.6%).

3.2 | Baseline values and intervention effects on health knowledge

Baseline health knowledge and delta values for SG+ and SG about the 10 subtopics are presented in Table 1. We observed a significant between-group difference in favor of SG+ for overall health knowledge, which increased by 6.6% and 3.4% in SG+ and SG, respectively (available-case analysis, Table 1). For SG+, small effect sizes were observed for Play Football, Control your weight, Drink Water, Eat a balanced diet, Get Fit, Think Positive and Total health knowledge. Small effect sizes were observed in the categories Be Active, Avoid alcohol and tobacco, Control your weight, Wash your hands, Drink Water, Eat a balanced diet and Total health knowledge for SG (Table 1). After the 10-week residential stay, increases in health knowledge were observed for 73.7% of the participants in SG+ and 67.2% of the participants in SG (Figure 2, available-case analysis). The baseline values for health knowledge related to physical activity (Get Fit, Table 1) were below the national average.[9]

Concerning the five subthemes in health knowledge, there were increases of 7.2 ± 20.5% and 4.7 ± 21.7% in knowledge of physical activity for SG+ and SG, respectively (Figure 3). For nutrition knowledge, we observed 12.0 ± 24.5% and 8.1 ± 25.1% increases in SG+ and SG, respectively. For well-being, there was a 3.2 ± 17.0% and 1.3 ± 15.2% (NS) in SG+ and SG, respectively. Knowledge about avoiding alcohol and tobacco increased by 3.5 ± 30.8% (NS: $p = 0.078$) and 3.8 ± 25.0% in SG+ and SG, respectively. The Hygiene theme decreased nonsignificantly in SG+ by 1.8 ± 31.1% and 10.4 ± 31.9% in SG. We observed a between-group difference of 6.1% (95% CI: 2.5; 9.8, $p = 0.001$) between the nonsignificant change in knowledge of Hygiene in SG+ and the 10.4% decrease in SG. For the Physical Activity Theme, there was a 3.4% between-group difference in favor of SG+ (95% CI: 0.6;

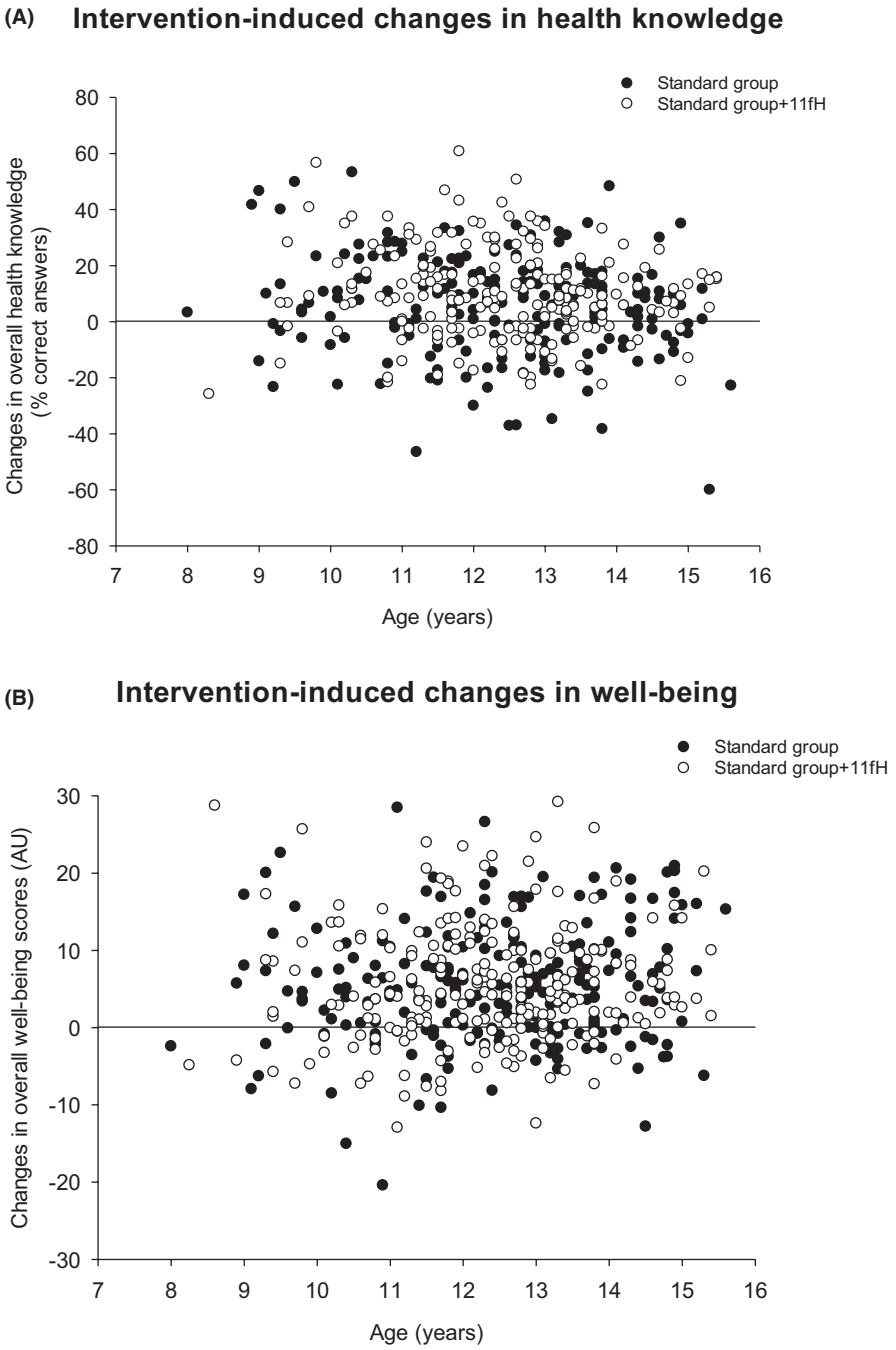

FIGURE 2 (A) Intervention-induced changes in health knowledge according to age—available-case analysis. (B) Intervention-induced changes in well-being according to age—available-case analysis.

6.2, $p=0.016$). Borderline between-group differences were observed in the theme of alcohol and tobacco in favor of SG (3.0%, 95% CI: −0.3; 6.2, $p=0.071$) and the well-being theme in favor of SG+ (2.1%, 95% CI: −0.2; 4.4, $p=0.072$). No significant gender differences were observed in SG+ or SG.

3.3 | Baseline values and intervention effects for well-being

Baseline well-being scores and delta values for SG+ and SG in the four subcategories of well-being are presented in Table 2. The baseline values for the four subcategories, physical well-being, psychological well-being, peer and social support, and school environment, were all lower than the national average, with physical well-being being the lowest.

Overall well-being, the mean of the four subcategories, increased by 4.54 ± 7.17 AU in SG+ and 4.51 ± 7.16 AU in SG, with no between-group differences (intention-to-treat analysis). The baseline values for well-being were lower for girls than for boys, but change scores were similar for girls and boys, with overall increases in well-being (Table 2).

Specific improvements were seen for SG+ and SG, respectively, in physical well-being (5.5±10.1 and

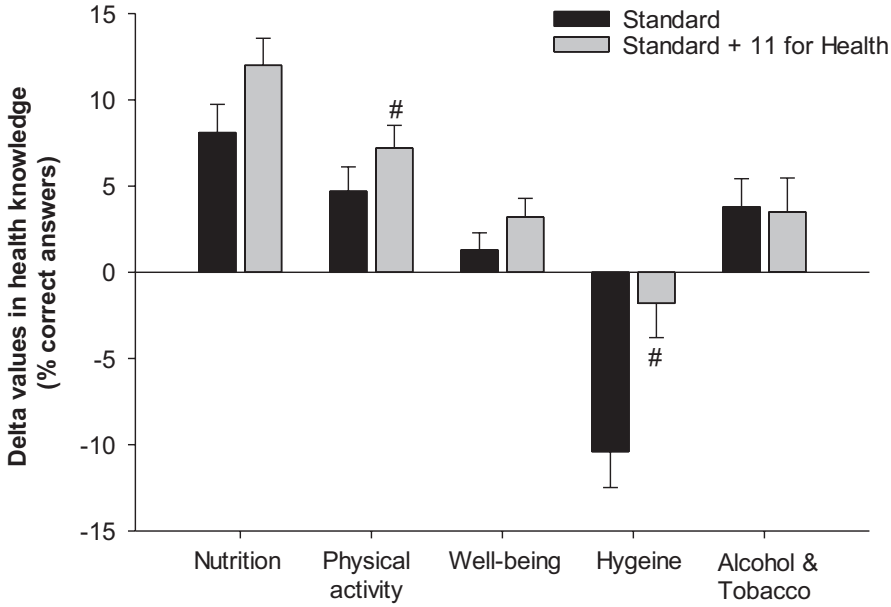

FIGURE 3 Delta values in health knowledge subthemes, SG (black) and SG+ (gray), available-case analysis. Means±SEM. #: Denotes significant between-group difference, $p < 0.05$.

6.7±9.7 AU), psychological well-being (3.4±9.3 and 3.4±9.4 AU), peers and social support (5.2±11.6 and 5.1±12.2 AU), and school environment (4.0±10.1 and 2.8±10.0 AU) (available-case values can be found in Figure 4).

After the 10-week residential stay, the available-case analysis (*N*: SG+: 243 (128 girls/115 boys); SG: 237 (123 girls/114 boys)) showed increases in overall well-being for 80.1% of the participants in SG+ and 76.1% of the participants in SG (Figure 2B), with follow-up levels reaching average national levels (Table 2). Within group results, differences between the intention-to-treat and all available-case analyses are shown in Table 2. The available case analysis showed no between-group differences (data not shown).

4 | DISCUSSION

The present study examined the enjoyment, attendance, and potential effects of adding a football-based health education program, for 2×45 min per week, to the standard DCSH program. Furthermore, we investigated the health knowledge and well-being, before and after a 10-week residential stay at the DCSHs, of a large group of 7-to 14-year-old socially vulnerable children.

A significant finding of the present study was that the 11fH group achieved an additional positive effect concerning overall health knowledge and specific knowledge about physical activity with borderline effects for well-being (all available-case analysis), compared to the positive effects on health knowledge achieved during the 10-week standard residential stay at the DCSHs. In the 10 health knowledge topics, there was an additional positive effect of 11fH concerning specific knowledge about the topics "Play Football," "Wash your Hands," "Get Fit," and "Think Positive". The standard group had an additional effect on "Be Active" (all available case analyses).

We also observed substantial positive effects on well-being during the 10-week residential stay, with no between-group differences. Thus, for the 11fH group and the standard group, significant increases were seen in physical well-being, psychological well-being, peer and social support and school environment, which elevated well-being scores to national average scores during the intervention period.[16] The effects on health knowledge and well-being were similar for boys and girls and similar across the investigated age span.

At baseline, the investigated group of socially vulnerable 7- to 14-year-old children had well-being scores significantly lower than the average national levels. Especially regarding physical and psychological well-being, with average scores of 40–42 for the girls and 44–47 for the boys compared to average national values of around 50.[9,16] With regard to the baseline values for health knowledge for the investigated group, it was interesting to see that the average values were similar to, or even higher than, the national average for health knowledge on nutrition (65% correct answers) and well-being and unhealthy habits (90%–95%). In contrast, the health knowledge scores on physical activity were just above the national average (55%).

After the 10-week residential stay, overall health knowledge increased by 6.6% in the standard +11fH and 3.4% in the standard group. Altogether, 74% and 67% of the 11fH and standard group participants increased their health knowledge during the 10-week residential stay (Figure 2). The observed increase of 6.6%-point in the 11fH group is

TABLE 2 Baseline scores and change scores for well-being, in total and for the four subscales, in the standard group and the standard +11 for health group.

	SG (291 (147 girls/144 boys)			SG+ (290 (152 girls/138 boys))			Change score (estimated mean difference)
	Baseline	Change score (ITT)	Change score (A-C)	Baseline	Change score (ITT)	Change score (A-C)	Between-group (95% CI) (ITT, SG+ vs SG)
Physical well-being (AU)							
All	43.0 (8.8)	6.7 (9.7)[a]	8.3 (10.2)[a]	42.9 (9.2)	5.5 (10.1)[a]	6.6 (10.7)[a]	−1.2 (−2.7; 0.3)
Girls	41.9 (8.1)	6.3 (9.3)[a]	7.5 (9.7)[a]	41.4 (8.0)	5.1 (8.9)[a]	6.1 (9.4)[a]	−1.4 (−3.3; 0.5)
Boys	44.1 (9.4)	7.2 (10.2)[a]	9.1 (10.6)[a]	44.5 (10.1)	6.0 (11.2)[a]	7.1 (11.9)[a]	−1.0 (−3.3; 1.3)
Psychological well-being (AU)							
All	44.1 (9.3)	3.4 (9.4)[a]	4.2 (10.3)[a]	43.3 (10.2)	3.4 (9.3)[a]	4.1 (10.0)[a]	−0.3 (−1.7; 1.0)
Girls	42.0 (8.6)	3.7 (9.2)[a]	4.4 (9.9)[a]	39.8 (9.0)	3.4 (9.5)[a]	4.0 (10.2)[a]	−1.5 (−3.3; 0.4)
Boys	46.2 (9.6)	3.2 (9.6)[a]	4.0 (10.6)[a]	47.1 (10.1)	3.5 (9.1)[a]	4.2 (9.8)[a]	0.7 (−1.3; 2.6)
Peers and social support (AU)							
All	46.5 (12.7)	5.1 (12.2)[a]	6.2 (13.2)[a]	46.0 (12.2)	5.2 (11.6)[a]	6.3 (12.4)[a]	−0.1 (−1.8; 1.5)
Girls	45.6 (13.1)	6.2 (12.6)[a]	7.4 (13.5)[a]	45.2 (11.8)	6.1 (12.3)[a]	7.2 (13.1)[a]	−0.4 (−2.7; 2.0)
Boys	47.5 (12.2)	3.9 (11.6)[a]	4.9 (12.9)[a]	46.9 (12.5)	4.3 (10.8)[a]	5.2 (11.6)	0.2 (−2.1; 2.5)
School environment (AU)							
All	46.3 (10.0)	2.8 (10.0)[a]	3.4 (11.0)[a]	45.0 (10.0)	4.0 (10.1)[a]	4.7 (10.9)[a]	0.6 (−0.9; 2.1)
Girls	45.8 (9.6)	3.3 (11.0)[a]	3.9 (11.9)[a]	43.4 (9.0)	3.8 (9.1)[a]	4.5 (9.7)[a]	−0.5 (−2.6; 1.7)
Boys	46.9 (10.4)	2.4 (8.9)[a]	3.0 (10.0)	46.9 (10.8)	4.1 (11.2)[a]	5.0 (12.1)[a]	1.8 (−0.4; 4.0)
Mean (AU)							
All	45.0 (7.8)	4.5 (7.2)[a]	5.5 (7.6)[a]	44.3 (7.8)	4.5 (7.2)[a]	5.4 (7.5)[a]	−0.2 (−1.3; 0.9)
Girls	43.8 (7.5)	4.9 (7.5)[a]	5.8 (7.8)[a]	42.4 (7.1)	4.6 (7.2)[a]	5.5 (7.5)[a]	−0.8 (−2.3; 0.8)
Boys	46.2 (7.9)	4.2 (6.8)[a]	5.2 (7.3)[a]	46.3 (8.1)	4.5 (7.2)[a]	5.4 (7.6)[a]	0.4 (−1.1; 1.9)

Note: Data are presented as means (SD) with intention-to-treat analysis (ITT) and available-case analysis (A–C).

Abbreviations: AU, Arbitrary Units; SG, Standard Group; SG+, Standard +11fH group.

[a]Significant within-group differences ($p < 0.05$).

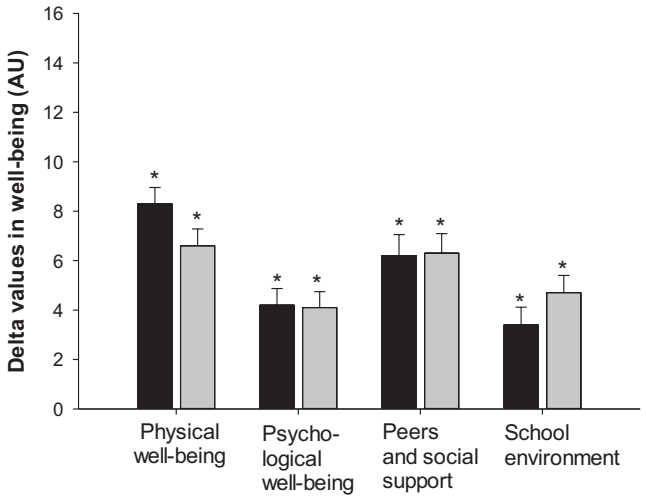

FIGURE 4 Delta values in well-being subthemes, SG (black) and SG+ (gray), available-case analysis. Means±SEM. *Denotes significant within-group difference; $p < 0.05$.

similar to several recent studies investigating the effects of the 11fH education program over 11 weeks in more than 3500 Danish schoolchildren and 500 Faroese schoolchildren aged 10–12 years.[9,13,27,28] The previous studies also observed that the effects on health knowledge were similar for girls and boys. This gender-equal effect on improvement in health knowledge from 11fH contrasts with other studies that show gender differences in areas related to health knowledge, such as self-rated health,[29] identifying psychological problems[30] and general health information behavior.[31]

The high attendance, averaging 90% with equal participation for girls and boys, indicated a successful implementation of the 11fH program and gave exceptional data to evaluate the effect of health knowledge dissemination in SG+. Although the children and adolescents had no options to choose another physical activity instead of 11fH (except for occasional subjective assessment by DCSH staff), the DCSH staff successfully motivated the children to participate actively, and the program enjoyment scores of 3.5 support a successful delivery of the health education program. The enjoyment scores are similar to the values obtained in previous studies, which showed that 11fH is as popular for girls as for boys (3.6 and 3.7 on a scale of 1–5, with higher scores indicating greater program satisfaction).[16] As indicated by the average baseline values in health knowledge on physical activity (Figure 3), the experience with physical activity in general and specifically ball games (football) was low among the participants in the present study. Despite this, the enjoyment values for the 11fH program in the present study, as well as in previous studies,[9,28] were observed to be similar for girls and boys, which provides evidence that prior experience with football is not necessary for the participants to become engaged. The present study provided evidence that the addition of the health education program can result in elevated health knowledge in critical areas related to physical activity for children and adolescents. Therefore, the combination of pair-based exercises, small-sided football drills, and health education in the 11fH program appears to be a motivating model for increasing health knowledge related to physical activity for vulnerable children and adolescents.

Increasing health knowledge has been chosen as a component of the intervention as evidence suggests that increasing health knowledge can lead to a change in health behaviors.[12] Improved health literacy can also lead to a better ability to manage and apply lifestyle, and it has been found that health literacy can lead to increased physical activity and improved diet quality.[10]

There are several behavior change strategies utilized in the program, some of those being a demonstration of the behavior (the teachers demonstrating the behavior to the children), behavioral practice (the children practicing the behavior in between sessions or in sessions), arranging social support in particular in the form of praise partners. Mapping the behavior change techniques in the 11fH program is part of an ongoing study on the 11fH program, and some preliminary findings from that study are reported here.

Having an intervention where the participants live at the facility is a unique feature of this program. It can be argued that the behaviors may be challenging to maintain once they are in a home environment, but this is accounted for by the fact that the children go home on some weekends where they have practice in managing the behaviors at home, and this is followed up by discussions when they return to the DCSH. Behavioral practice is also encouraged in the 11fH program both within and between sessions and in particular, the behavioral practice between sessions will increase the likelihood of the participants being able to adopt the behavior permanently once in a different setting. At the end of the DCSH stay, meetings are arranged where a physical activity plan for when the children are at home is created, and goals are set. Follow-up days are also part of the program's aftercare, where progress is analyzed.

After the 10-week residential stay, we found no differences between groups in well-being. However, we observed increases of 3–7 units, corresponding to 6%–16% after the 10-week residential stay, and the effects were similar for the girls and the boys and similar for various age groups. This impressive increase was seen in all subcategories of well-being, physical well-being, psychological well-being, peer and social support and school environment, raising the well-being scores to around the

average national level of 50, except for girls' psychological well-being reaching 44-46—both for the intention-to-treat and available-case analysis. These improvements are substantial compared to previous studies looking into the effects of short-term physical activity interventions for 10- to 13-year-old children from average and low socioeconomic backgrounds with increases in well-being scores of 1–3 arbitrary units.[16,28] Nevertheless, the results showed a considerable individual variation in overall well-being effects, with improved well-being for 80% and 76% and worsened well-being for 20% and 24% in SG+ and SG, respectively (Figure 2). Through increased participation in group-based physical activity and sports, the DCSH residential stay may promote a positive attitude toward sporting activities for children with less experience with leisure-time physical activity than the national average levels. The improvements in well-being in the present study are in accordance with the findings by Seabra et al., where a similar increase was observed in well-being scores after a 5-month after-school football training study in a comparable group of overweight boys.[32] Together, this indicates that physical activity conducted in an inclusive and non-competitive setting may enhance the well-being of vulnerable children. This finding aligns with a review stating that physical activity interventions help improve psychological well-being.[33]

4.1 | Strengths and limitations

One study strength is using a crossover design where two DCSHs were participating as hosts for both groups, minimizing the effects of staying at one DCSH compared to the other. A potential problem in this design is that the standard group in year 2 could be contaminated since the staff at the DSCH was a part of the SG+ group in year 1. However, a wash-out period was introduced, and there was frequent contact with the researchers and the DCSH to ensure that SG did not use the 11fH program or principles in year 2. A limitation of the study was that there was no control group; however, this was impossible from a practical and ethical perspective. As soon as it is decided to enroll the vulnerable children in the DCSH program, they are offered a spot. Therefore, including information about the control group results from parallel large-scale studies in Denmark is relevant. These show no changes in health knowledge or well-being over a relatively short period of 10 and 11 weeks for girls and boys with regular and low fitness scores, well-being scores, and socioeconomic background.[9,16,28]

In the second intervention year, the 11fH activities in SG+ were temporarily affected by COVID-19 restrictions. DSCH-K canceled 11fH activities for a short period, but this only affected a small number of participating children, and only 7.1% of the SG+ participants at DSCH-K had an attendance <65% due to COVID-19-related cancellations, and the results from these participants were still included in the analysis.

5 | CONCLUSION

In conclusion, the present study provides evidence for an adequate standard residential stay to impact the well-being of socially vulnerable children and adolescents positively. The elements of the residential stay counteracted the challenges of being away from home. Furthermore, the addition of the 11fH program was perceived as enjoyable and seemed to boost health knowledge, even more so than the standard residential stay. Future studies are warranted to evaluate whether the rapid gains in well-being and health knowledge achieved during the 10-week residential stay can be maintained long-term and whether the experience and sports competencies achieved by participating in the football-based 11fH program can contribute to better maintenance of the gains and higher participation in sports and physical activity at home, in school and leisure-time sports clubs.

6 | PERSPECTIVES

This study's findings support the worthwhile conduct of interventions for children who are not well adjusted in their traditional settings. It emphasizes that spending time with children with similar issues in a supportive environment focusing on physical activity, a healthy diet, and well-being effectively increases health knowledge and well-being. The findings show that health education is effective as part of a physical activity (in this case, football) program. Based on the present findings it appears interesting to investigate to what extent the improvements can be maintained long-term and whether the use of the 11 for Health program will influence the long-term effects.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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