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Original paper

Health behaviors in early school-aged children: The importance of a physioprophyllactic program as a strategy to support a healthy lifestyle

Mateusz Jochemczak¹, Jacek Sołtys², Regina Wysocka-Bochenek², Wiktoria Żaba²,
Grzegorz Marsik¹, Aleksandra Mrowiec³, Armand Cholewka³, Anna Brzęk²

¹Doctoral School, Medical University of Silesia, Katowice, Poland

²Department of Physiotherapy, Faculty of Health Sciences in Katowice,
Medical University of Silesia, Katowice, Poland

³Faculty of Science and Technology, University of Silesia, Katowice, Poland

Address for correspondence:

prof. dr hab. n. o zdr. Anna Brzęk
Zakład Fizjoterapii
Wydział Nauk o Zdrowiu w Katowicach
ul. Medyków 12, 40-752 Katowice
tel. +48 32 208 87 21
e-mail: abrzek@sum.edu.pl

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ABSTRACT

INTRODUCTION: Conscious shaping of pro-health habits begins in early school age, playing an important role in exemplifying patterns that may affect health status in later years of life. Reduction of spontaneous physical activity, prolonged sitting time, and increased screen time are significant risk factors influencing children's health. The aim of the study was to assess the significance of an original physioprophyllactic program as a strategy to support a healthy lifestyle among early school-age children.

MATERIAL AND METHODS: The study involved 242 children aged 7–9 years, including 145 children in the intervention group participating in the physioprophyllactic program and 97 children in the control group. The program included educational activities directed at children, parents, and teachers. The study was conducted twice with intervals of 12–13 months. Anthropometric parameters, children's physical activity, sitting and screen time, sleep duration, and selected parental behaviors were analyzed.

RESULTS: An improvement in physical activity was observed in 43.45% of children in the intervention group, and WHO recommendations were met by 37.93%. Sitting and screen time were reduced ($p < 0.001$). Improvement in joint child-parent physical activity was noted approximately one-third of cases. In the intervention group, BMI and BMI percentile decreased ($p < 0.032$).

CONCLUSIONS: The one-year physioprophyllactic program positively influenced selected health behaviors of early school-age children, particularly increasing physical activity and reducing sedentary behaviors. The results indicate that physioprophyllactic programs implemented in the school environment, in cooperation with parents and teachers, can be an important component of promoting a healthy lifestyle among children.

KEYWORDS

early school-age children, physical activity, sedentary behavior, screen time, physioprophyllaxis, health promotion

INTRODUCTION

The early school-age period is characterized by intensive psychophysical and social development, as well as being a critical time for the formation of habits that can influence health status in subsequent life stages [1], correlating with the development of chronic

diseases, including obesity, metabolic disorders, and cardiovascular diseases [2,3,4].

Fundamental health behaviors include regular physical activity, quality nutrition, adequate sleep duration, and the limitation of sedentary behaviors, including excessive screen time [5,6]. Physical activity plays a particularly important role in the psychomotor development of children [5,6,7,8]. Despite well-documented health benefits and widely available knowledge through mass media, children's lifestyles are increasingly characterized by reduced spontaneous physical activity and prolonged periods spent sitting, with far-reaching consequences. Sedentary behaviors (defined by low energy expenditure, not exceeding 1.5 METs, such as lying down, sitting, using electronic devices, etc.) are key factors associated with poorer sleep quality, diminished cognitive function, increased risk of overweight and obesity, as well as negative effects on the mental health of children and adolescents [9,10,11,12]. Prolonged sitting during leisure time, often in incorrect postures, may contribute to the development of postural disorders [13,14].

When analyzing health behaviors in children, it is essential to link them with the family and school environments, which significantly influence the child's daily time management, including choices of physical activity types, frequency, and limitations on screen time [15,16,17,18,19,20,21,22,23,24]. The school setting, in particular, serves as the best educator in terms of broadly understood health [14].

In light of the above, and considering the significant role of physioprophyllaxis, whose primary aim is to promote a healthy lifestyle by advocating educational activities related to physical activity, highlighting the benefits of movement, and reducing the negative effects of a sedentary lifestyle, including screen time, it becomes justified to emphasize these interventions. Research conducted by Brzęk et al. [14,15] demonstrates that physical inactivity can adversely affect children's posture, including the development of trunk asymmetries, whereas physioprophyllactic activities implemented in the school environment can support functional development and the shaping of pro-health behaviors among students.

The objective of this article is to explore health behaviors in early school-aged children and to present the significance of a proprietary physioprophyllactic program as an effective strategy to support a healthy lifestyle, with particular emphasis on levels of physical activity, sedentary time, use of electronic devices, sleep duration, and selected parental behaviors and their association with children's behaviors.

MATERIAL AND METHODS

Bioethics committee

The research was approved by the Bioethics Committee of the Medical University of Silesia in Katowice – Resolution No. PCN/CBN/0052/KB/1/26/I/22 dated May 10, 2022, and BNW/NWN/0052/KB1/26/II/22/24 dated February 20, 2024 as well as Resolution No. PCN/CBN/0052/KB1/13/II/22. Parents/legal guardians and participants were informed about the confidentiality of the study, its objectives, and the assumptions of the research project. Each child's legal guardian provided written consent for the child's voluntary participation in the study and was informed of the possibility to withdraw at any stage of the research.

Characteristics of the study group

A total of 242 children were included in the final analysis, comprising 133 girls (54.96%) and 109 boys (45.04%), aged 7 to 9 years (mean age: 7.05 ± 0.21 years). Participants were divided into two groups: the study group (A), which included 145 children: 78 girls (53.79%) and 67 boys (46.21%) and the control group (B), consisting of 97 children: 55 girls (56.70%) and 42 boys (43.30%) (Table I).

Table I. Characteristics of the study groups

Variable	Study Group (mean $\pm$ SD / n [%])	Study Group Median (Q1–Q3)	Control Group (mean $\pm$ SD / n [%])	Control Group Median (Q1–Q3)	p-value
Sex [girls/boys]	78 (53.79%) / 67 (46.21%)	–	55 (56.70%) / 42 (43.30%)	–	–
Height [cm]	126.16 ± 5.58	127 (122–130.5)	126.30 ± 6.08	125.5 (121–132)	0.847
Body weight [kg]	26.82 ± 4.50	26.4 (23.6–29.4)	25.24 ± 5.19	24.5 (22.2–26.4)	0.012
BMI	16.88 ± 2.82	16.73 (14.86–18.63)	15.80 ± 2.76	15.32 (14.44–16.59)	0.413
BMI percentile	58.78 ± 32.17	68 (31–88)	44.17 ± 28.51	40 (22–69)	<0.001

Number of participants (percentage); mean $\pm$ standard deviation; Median (first quartile–third quartile); *Mann–Whitney U test

Study group participation and anthropometric differences

The study group participated in a physioprophylactic program lasting one academic year. Both groups were homogeneous in terms of anthropometric parameters, differing significantly in body weight ($p = 0.012$) and BMI percentile ($p < 0.001$).

Inclusion and exclusion criteria

Children were eligible for the study if they met the following criteria: age 7 to 8 years;

enrollment in early school education; written informed consent from a parent or legal guardian for participation; no diagnosed postural disorders requiring specialized treatment. Children were excluded if they presented with: spinal deformities; lower limb length discrepancy greater than 0.5 cm; previous injuries affecting musculoskeletal function; growth spurts occurring between baseline and follow-up assessments.

Physioprophylactic programme

The proprietary physioprophylactic program was developed as a multi-level educational intervention implemented simultaneously among children, parents, and teachers. The primary goal of the program was to raise health awareness and promote behaviors conducive to a healthy lifestyle, as well as to support proper functioning of the musculoskeletal system.

Although five intervention sessions had initially been planned, the programme coincided with the COVID-19 pandemic, which disrupted its implementation. Consequently, the intervention was reduced to three main stages conducted at the beginning, middle, and end of the school year. Each educational session for children lasted approximately 90 minutes (two class periods). The programme was intentionally designed as a low-intensity intervention based on simple educational activities that required limited additional time from children and their parents and could be implemented with relatively low organisational and financial demands.

Activities for children included education on physical activity, its forms, physical inactivity and its consequences, the use of electronic devices and the reduction of screen time, as well as the consequences of excessive use of electronic devices. Additionally, the program promoted the use of safe and interactive physical games that encourage regular physical activity.

Activities directed at parents participating in the educational project included principles of ergonomic sitting, correct use of school backpacks (not analyzed in this paper), the importance of physical activity for child development, limiting screen time, and promoting active leisure. Moreover, parents were provided access to educational materials prepared as part of the project and had the opportunity to participate in training sessions and workshops focused on children's health prevention. They were also provided with access to educational materials available through the "Stairs of Health" project platform. In addition, parents were

offered the opportunity to participate in one educational conference combined with practical training workshops focused on child health prevention.

Activities aimed at teachers were designed to engage them in monitoring students' posture during lessons and implementing short intra-class breaks intended to reduce the effects of prolonged sitting. They were also asked to introduce short, approximately three-minute movement breaks during lessons to relax antigravity muscles and reduce the adverse effects of prolonged sitting.

Research procedure

The study was conducted twice: the first assessment was carried out at the beginning of the school year, and the second after 12–13 months.

At both time points, anthropometric parameters were measured. Parents completed a proprietary questionnaire regarding their child's physical activity, time spent sitting, use of electronic devices, sleep duration, and selected parental behaviors. These parental behaviors included the parent's own physical activity, joint physical activities with the child, time the parent spent sitting, and parental control over the child's screen time.

The following areas were analyzed:

Health behaviors: children's physical activity levels and adherence to WHO physical activity recommendations.

Unhealthy behaviors: time spent sitting, electronic device usage, and sleep duration.

Parental behaviors and family environment: parental physical activity, joint physical activities involving both child and parent, parental sitting time, and parental control over the child's screen time.

Health outcomes: body mass index (BMI) and BMI percentile.

The temporal stability of the proprietary questionnaire was assessed using a test–retest procedure. The questionnaire was completed twice by 30 participants, with a 7-day interval between assessments and under comparable conditions. Test–retest reliability of the total questionnaire score was evaluated using the intraclass correlation coefficient (ICC).

Agreement for individual questionnaire items was assessed using Cohen's kappa coefficient.

The questionnaire demonstrated good temporal stability, with an ICC of 0.86. Cohen's kappa values ranged from 0.64 to 0.85, indicating substantial to very good agreement between the two assessments.

Statistical methods

The collected data were integrated into a single database and subsequently analyzed using Microsoft Excel and Statistica v.13.3 (StatSoft). The normality of the distribution was verified using the Shapiro-Wilk test. Statistical analysis included measures of central tendency and variability, such as the median (Me), first quartile (Q1), third quartile (Q3), arithmetic mean ($\bar{x}$), and standard deviation (SD). To compare two independent variables, the non-parametric Mann-Whitney U test was applied, while dependent variables were analyzed using the Wilcoxon test and McNemar test. Relationships between variables were calculated using Pearson's chi-square test (χ^2) and Spearman's rank correlation coefficient (R). For paired comparisons performed with the Wilcoxon signed-rank test, the magnitude of change was additionally expressed using the Hodges–Lehmann estimator with a 95% confidence interval (95% CI). Effect size was calculated, with values of approximately 0.10, 0.30, and 0.50 interpreted as small, moderate, and large, respectively. A significance level of $\alpha = 0.05$ was assumed for all tests.

RESULTS

Anthropometric parameter results in the respective assessments

The overall analysis showed an increase in both height and body weight between the baseline and follow-up measurements. Simultaneously, a decrease in BMI percentile was observed across the entire study population (Table II).

In the study group, a statistically significant decrease in BMI and BMI percentile was noted between the first and second assessments ($p < 0.05$ and $p < 0.001$, respectively).

In contrast, the control group showed significant increase in BMI with no significant changes in BMI percentile ($p = 0.457$). Detailed results are presented in the table below.

Table II. Anthropometric results in both study groups and overall in both assessments – assessment I and assessment II

Group	Variable	n	Assessment I mean $\pm$ SD; Median (Q1–Q3)	Assessment II mean $\pm$ SD; Median (Q1–Q3)	95%CI	Z*	Effect size r
Overall (n=242)	Height [cm]	242	126.22 $\pm$ 5.77; 126 (122–130.5)	133.39 $\pm$ 5.47; 134 (129–137)	7.17 (6.61 to 7.73)	13.49 ^b	0.87
	Body weight [kg]	242	26.19 $\pm$ 4.84; 25.5 (22.9–28.9)	28.76 $\pm$ 4.60; 28.2 (26.1–30.7)	2.57 (2.04 to 3.10)	8.72 ^b	0.56
	BMI	242	16.45 $\pm$ 2.84; 15.93 (14.72–17.65)	16.15 $\pm$ 2.26; 15.81 (14.84–17.21)	-0.30 (-0.63 to 0.03)	0.09	0.01
	BMI percentile	242	52.92 $\pm$ 31.53; 52 (27–82)	45.51 $\pm$ 27.19; 43 (25–68)	-7.41 (-11.63 to -3.19)	3.20 ^b	0.2
Study group (n=145)	Height [cm]	145	126.16 $\pm$ 5.58; 127 (122–130.5)	134.10 $\pm$ 4.79; 134.4 (130.9–137.2)	7.98 (7.07 to 8.88)	10.45 ^b	0.87
	Body weight [kg]	145	26.82 $\pm$ 4.50; 26.4 (23.6–29.4)	29.11 $\pm$ 4.14; 28.9 (26.9–31.2)	2.29 (1.41 to 3.16)	4.87 ^b	0.4
	BMI	145	16.88 $\pm$ 2.82; 16.73 (14.86–18.63)	16.17 $\pm$ 2.09; 15.91 (14.84–17.52)	-0.71 (-1.25 to -0.17)	2.14 ^a	0.18
	BMI percentile	145	58.78 $\pm$ 32.17; 68 (31–88)	46.60 $\pm$ 28.00; 46 (25–72)	-12.17 (-19.02 to -5.33)	3.30 ^b	0.27
Control group (n=97)	Height [cm]	97	126.30 $\pm$ 6.08; 125.5 (121–132)	132.27 $\pm$ 6.30; 132 (127–137)	5.96 (5.79 to 6.14)	8.55 ^b	0.87
	Body weight [kg]	97	25.24 $\pm$ 5.19; 24.5 (22.2–26.4)	28.24 $\pm$ 5.19; 27.5 (25.5–29.9)	2.99 (2.80 to 3.18)	8.56 ^b	0.87
	BMI	97	15.80 $\pm$ 2.76; 15.32 (14.44–16.59)	16.11 $\pm$ 2.51; 15.77 (14.87–16.81)	0.31 (0.19 to 0.43)	4.28 ^b	0.44
	BMI percentile	97	44.17 $\pm$ 28.51; 40 (22–69)	43.88 $\pm$ 25.97; 42 (25–61)	-0.29 (-2.27 to 1.69)	0.74	0.07

Abbreviations: Mean $\pm$ SD (standard deviation); median (first quartile–third quartile); *Wilcoxon signed-rank test, ^a<0,05; ^b<0,001; BMI – body mass index; CI – confidence interval; Q1 – first quartile; Q3 – third quartile.

Results from the area of children's physical activity

In the study group, a statistically significant difference was observed in children's physical activity outside of physical education lessons between the initial and final assessments ($p < 0.001$). Following the completion of the program, children participated more frequently in additional physical activities and reported a greater number of minutes dedicated daily and weekly to physical activity ($p < 0.001$). A significant increase was also noted in the total weekly time spent exercising ($p < 0.001$), indicating an overall increase in physical activity levels after program implementation. In the control group, a statistically significant difference was found between the initial and final assessments in terms of weekly physical activity outside of physical education classes ($p = 0.002$). After the second measurement, a

slight increase in the reported frequency of activity was recorded. A significant increase was also observed in the time spent daily and weekly on physical activity (Table III).

Table III. Comparison of child physical activity between assessment I and assessment II in the study group

Group	Variable	Assessment I Median (Q1–Q3)	Assessment II Median (Q1–Q3)	95%CI	Z*	Effect size r
Study n=145	Frequency per week (times/week)	1 (0–2)	2 (2–3)	1.50 (1.00–1.50)	7.31 ^b	0.62
	Minutes per day	10 (0–30)	50 (45–60)	32.50 (30.0–37.50)	8.40 ^b	0.70
	Minutes per week	0 (0–60)	120 (60–180)	90.00 (75.0–110.0)	8.68 ^b	0.72
Control n=97	Frequency per week (times/week)	2 (0–2)	2 (1–2)	0.00 (0.00–0.00)	3.08 ^a	0.31
	Minutes per day	30 (0–60)	45 (30–60)	0.00 (0.00–0.00)	3.06 ^a	0.31
	Minutes per week	60 (0–120)	60 (30–120)	0.00 (0.00–0.00)	3.52 ^b	0.36

Abbreviations: Median (Q1-first quartile–Q3 -third quartile); *Wilcoxon signed-rank test

^a <0,01; ^b <0,001; CI – confidence interval.

A statistically significant association was found between the child's level of physical activity and the stage of assessment ($p < 0.001$). Compared to the initial assessment, there was an increase in the number of children who reported engaging in physical activity after completing the program (Table IV). Significant differences were also observed regarding adherence to the World Health Organization (WHO) physical activity recommendations ($p < 0.001$). Among children who did not meet the recommended standards at baseline, 39.57% reached the required activity level by the final assessment. A statistically significant association was demonstrated between the child's physical activity level and the assessment stage ($p = 0.041$). In the control group in 20.00% of children who were inactive at baseline had begun physical exercise by the final assessment. Furthermore, nearly 10% of children who failed to meet WHO physical activity guidelines at baseline achieved the recommended activity level by the end of the study ($p = 0.013$) (Table IV).

Table IV. Comparison of child physical activity between assessment I and assessment II

Group	Variable	Assessment II	Assessment I YES N (%)	Assessment I NO N (%)	McNemar's Test	p- value
Study n=145	Child physical activity	yes	76 (97.44%)	63 (94.03%)	55.38	<0,001
		no	2 (2.56%)	4 (5.97%)		
	Adherence to WHO recommendations	yes	4 (66.67%)	55 (39.57%)	47.44	<0,001
		no	2 (33.33%)	84 (60.43%)		
Control n=97	Child physical activity	yes	67 (100.00%)	6 (20.00%)	4.17	0,041
		no	0 (0.00%)	24 (80.00%)		
	Adherence to WHO recommendations	yes	7 (100.00%)	8 (8.89%)	6.13	0,013
		no	0 (0.00%)	82 (91.11%)		

N (%) – Numbers of participants (percentages)

Comparison between the study and control groups regarding changes from the baseline to the follow-up assessment revealed statistically significant differences in children's physical activity outside of physical education classes ($p < 0.001$). The study group demonstrated a greater increase in the number of additional weekly physical activity sessions and a more pronounced improvement in the time dedicated to physical activity, both on a daily and weekly basis, compared to the control group ($p < 0.001$).

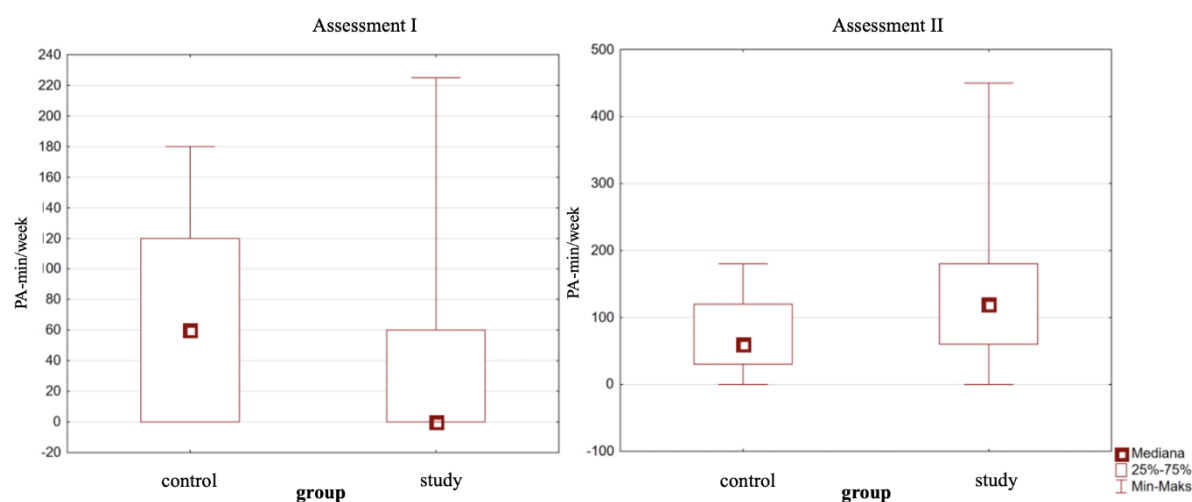


Fig. 1. Weekly physical activity (minutes/week) of both children at baseline (Assessment I) and follow-up (Assessment II)

Results regarding passive behaviors of children and parents

In the second assessment, a statistically significant reduction was observed in the time children spent sitting outside of school after completing the program ($p < 0.001$). Significant differences were also found concerning the use of electronic devices, both in the number of

days per week ($p < 0.001$) and in daily and weekly usage time ($p < 0.001$). Following the final assessment, children spent less time in front of screens. A small but statistically significant difference in children's sleep duration was noted between the assessment stages ($p = 0.019$).

In the control group, an increase was observed in the frequency of electronic device use weekly, along with prolonged daily and weekly usage times; these differences were statistically significant ($p < 0.05$). However, no significant differences were found between the first and second assessments regarding the time children spent sitting outside school ($p = 0.625$), parental limiting of screen time ($p = 0.917$), children's sleep duration ($p = 0.301$), or the time parents spent sitting (Table V).

Table V. Sitting and screen time of children and sitting time of parents between assessment I and assessment II

Group	Variable	Assessment I Median (Q1–Q3)	Assessment II Median (Q1–Q3)	95%CI	Z*	Effect size r
Study n=145	Child's sitting time (hours/day)	4 (3–4)	3 (2–3)	-1.00 (-1.00 to -1.00)	6.38 ^b	0.53
	Electronic device use (days per week)	2 (1–4)	3 (0–3)	-0.50 (-0.50 to 0.00)	4.14 ^b	0.34
	Electronic device use (minutes/day)	60 (0–60)	30 (0–60)	-7.50 (-15.00 to 0.00)	3.53 ^b	0.29
	Electronic device use (minutes/week)	150 (0–240)	90 (0–180)	-30.00 (-45.00 to -15.00)	4.87 ^b	0.40
	Sleep duration (hours/day)	9 (9–10)	9 (8–10)	0.00 (-0.50 to 0.00)	2.35 ^a	0.20
	Parent's sitting time (hours/day)	9 (7–9)	8 (7–9)	0.00 (0.00 to 0.00)	4.62 ^b	0.38
Control n=97	Child's sitting time (hours/day)	4 (4–5)	4 (4–5)	0.00 (0.00 to 0.00)	0.49	0.05
	Electronic device use (days per week)	1 (0–3)	2 (0–3)	0.00 (0.00 to 0.00)	2.20 ^a	0.22
	Electronic device use (minutes/day)	20 (0–45)	30 (0–60)	0.00 (0.00 to 7.50)	4.37 ^b	0.45
	Electronic device use (minutes/week)	50 (0–120)	60 (0–150)	0.00 (0.00 to 22.50)	4.15 ^b	0.42
	Sleep duration (hours/day)	10 (9–10)	10 (9–10)	0.00 (0.00 to 0.00)	1.03	0.10
	Parent's sitting time (hours/day)	8 (6–8)	8 (6–8)	0.00 (0.00 to 0.00)	–	–

Abbreviations: Median (Q1-first quartile–Q3 -third quartile); *Wilcoxon signed-rank test

^a <0,05; ^b <0,001; CI – confidence interval.

Comparison of the differences between the final and baseline assessments revealed a significant reduction in time spent sitting outside of school in the study group compared to the control group ($p < 0.001$) (Figure 2).

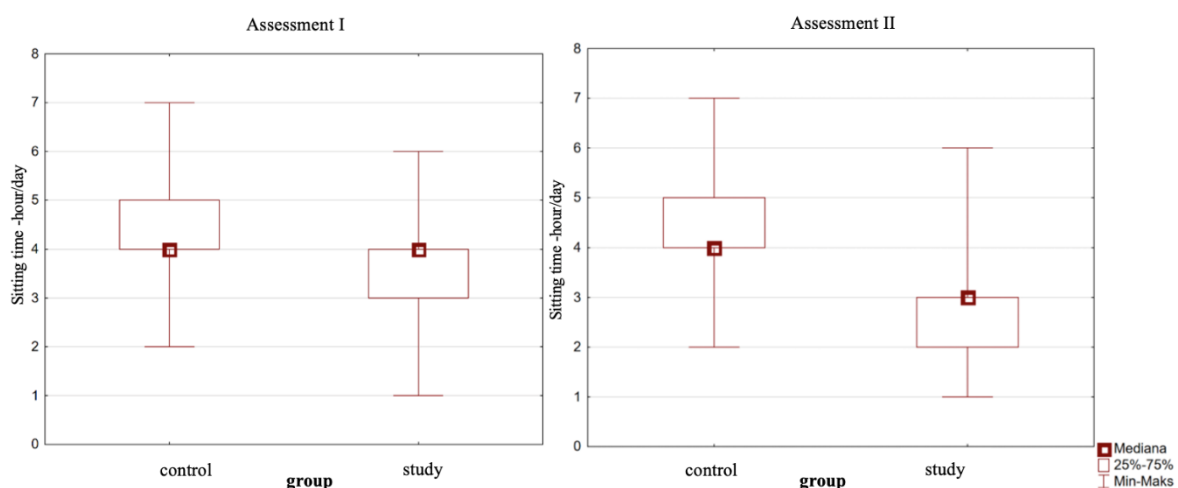


Fig. 2. Daily sitting children's time (hours) at baseline (Assessment I) and follow-up (Assessment II)

Significant differences were observed between groups regarding electronic device usage. In the study group, there was a reduction in the frequency of device use per week and a decrease in daily and weekly usage time, whereas no beneficial changes were noted in the control group ($p <$

0.001). Additionally, parents in the study group significantly more often reported controlling their children's screen time ($p < 0.001$).

Moreover, a significant reduction in the time parents spent sitting was observed in the study group ($p < 0.001$). No significant differences were found between the study and control groups in terms of children's sleep duration ($p = 0.339$) (Table VI).

Table VI. Comparison of differences between final and baseline assessments of passive behaviors in children and parents in the study and control groups

Variable	Study Group M(Q1–Q3)	Control Group M(Q1–Q3)	95%CI	Z*	Effect size r
Time spent sitting (hours/day)	-1 (-1 to -1)	0 (0–0)	-1.00 (-1.00 to -1.00)	-9.24 ^a	0.59
Electronic device use (days per week)	0 (-1–0)	0 (0–0)	0.00 (0.00 to 0.00)	-3.95	0.25
Electronic device use (minutes/day)	0 (-30–0)	0 (0–7.5)	-10.00 (-15.00 to 0.00)	-5.95 ^a	0.38
Electronic device use (minutes/week)	0 (-90–0)	0 (0–30)	-45.00 (-60.00 to -30.00)	-6.16 ^a	0.40
Sleep duration (hours/day)	0 (-1–0)	0 (0–0)	0.00 (0.00 to 0.00)	-0.96	0.06
Parent's sitting time (hours/day)	0 (0–0)	0 (0–0)	0.00 (0.00 to 0.00)	-4.58 ^a	0.29

Abbreviations: Median (Q1 -first quartile–Q3 -third quartile); *Mann–Whitney U test; ^a<0,001; CI – confidence interval.

The reduction in electronic device usage was relatively small but statistically significant - improvement was observed in 7.59% of children in the study group compared to 2.06% in the control group ($p = 0.009$) (Figure 3).

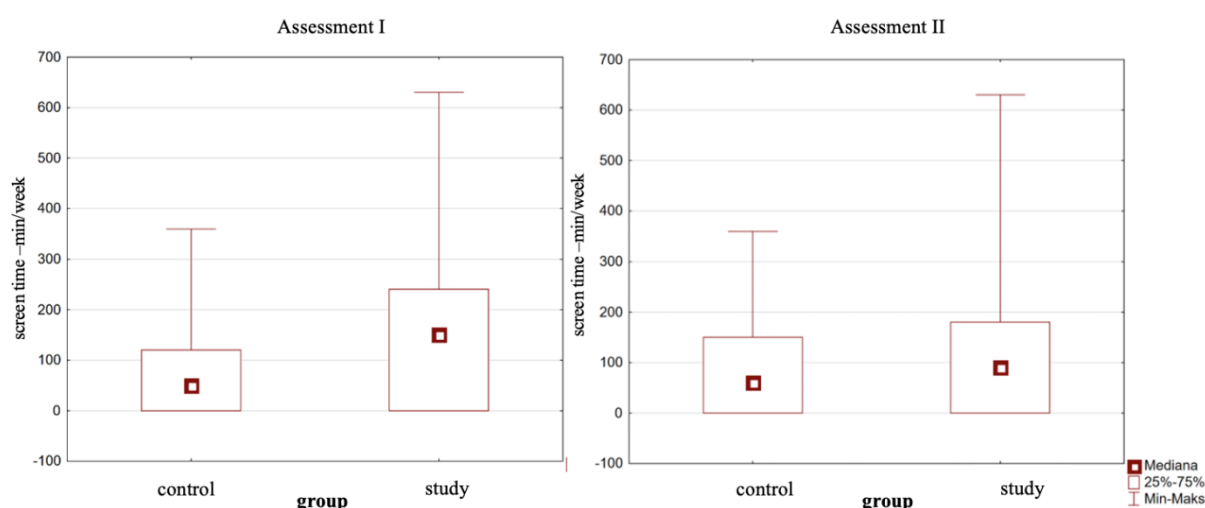


Fig. 3. Weekly electronic device use/ screen time (minutes/week) among children in the study and control groups at baseline (Assessment I) and follow-up (Assessment II)

Parental behaviors and concurrent changes in child and parent behaviors

To complement the analysis with a family component, selected parental behaviors and joint

physical activity undertaken by the child and parent were also assessed. The comparison of differences between the initial and final assessments revealed significantly more favorable changes in the study group not only regarding children's physical activity but also in parental behaviors and family shared physical activity (Table VII).

Table VII. Comparison of differences between final and baseline assessments of child and parent physical activity in the study and control groups

Variable	Change Category	Study Group n (%)	Control Group n (%)	Statistic χ^2	p-value
Child PA	Deterioration	2 (1.38%)	0 (0.00%)	41.92	<0.001
	No change	80 (55.17%)	91 (93.81%)		
	Improvement	63 (43.45%)	6 (6.19%)		
Child PA – WHO Recommendations	Deterioration	2 (1.38%)	0 (0.00%)	28.68	<0.001
	No change	88 (60.69%)	89 (91.75%)		
	Improvement	55 (37.93%)	8 (8.25%)		
Joint Child and Parent PA	Deterioration	3 (2.07%)	0 (0.00%)	44.31	<0.001
	No change	93 (64.14%)	97 (100.00%)		
	Improvement	49 (33.79%)	0 (0.00%)		
Parent PA	Deterioration	–	–	14.58	<0.001
	No change	125 (86.21%)	97 (100.00%)		
	Improvement	20 (13.79%)	0 (0.00%)		
Parent PA – WHO Recommendations	Deterioration	1 (0.69%)	1 (1.03%)	16.41	<0.001
	No change	110 (75.86%)	92 (94.85%)		
	Improvement	34 (23.45%)	4 (4.12%)		

Abbreviations: PA – physical activity; WHO – World Health Organization; Note: Statistical significance determined by appropriate tests (e.g., chi-square or similar).

Improvement in joint physical activity of child and parent

Improvement in joint physical activity undertaken by the child and parent was observed in 49 participants of the study group (33.79%), while no such improvement was noted in the control group ($p < 0.001$). Improvement in parental physical activity was identified in 20 individuals from the study group (13.79%), with no changes observed in the control group ($p < 0.001$).

Furthermore, adherence to WHO physical activity recommendations by parents improved in 34 participants from the study group (23.45%) compared to 4 participants in the control group (4.12%; $p < 0.001$).

DISCUSSION

Physioprophylaxis represents a crucial component of contemporary health prevention for children and adolescents. The early school period is a vital stage for shaping health behaviors, as it is when patterns related to physical activity, leisure time organization, and healthy lifestyle habits become established, influencing health status in later life stages. Numerous studies indicate that modern

children increasingly exhibit insufficient physical activity levels and high prevalence of sedentary behaviors despite growing awareness of related risks [2,3,4,5,11].

Given these concerns, the authors considered it essential to evaluate the effectiveness of a one-year physioprophylactic program in modifying selected health and unhealthy behaviors among early school-aged children. Drawing on prior experience, the program was designed as a simultaneous educational intervention for children, parents, and teachers, aimed at improving daily habits related to physical activity and reducing sedentary behaviors.

Participation in the program significantly increased engagement in additional physical activities during leisure time, both in terms of frequency and duration. Although the achievement of WHO physical activity guidelines before and after the study was not entirely satisfactory, an upward trend was evident, reflecting a complex, multifactorial process. The reduction in sitting and screen time further suggests positive effects of the program on health behaviors, especially as the control group either maintained or increased these times over one year.

Parental involvement in shared physical activity and their own physical activity levels were notable, correlating with program effectiveness, which was also reflected in the decreased BMI percentile among children. Sleep duration did not change significantly.

The increased proportion of children meeting WHO physical activity recommendations aligns with other studies demonstrating the effectiveness of school-based programs targeting increased physical activity [5,6,25].

Kingston et al. [26] emphasize that well-designed physical activity programs in schools positively impact activity levels and overall child development. Similar findings by Dullien et al. [27] and Kozinoga et al. [28] indicate that consistent preventive actions in school settings contribute to improved health behaviors and postural parameters. These observations are particularly important in early education, a critical period for establishing lasting health behaviors. Habits formed in childhood tend to persist into adulthood, affecting long-term health [2,3,4]. Thus, the observed increased physical activity in the study group may have both immediate and long-term benefits.

Including parental behaviors enriches the interpretation, as family environment strongly influences habit formation. Scientific evidence supports that parental support and their own regular physical activity are linked to increased child physical activity [17,18,19,20,21,22]. In this study, positive behavioral changes in children coincided with changes in parental behaviors, underscoring the importance of the family context.

Sedentary behaviors were a key focus; significant reductions in sitting time and electronic device use were observed only in the study group. These findings are especially relevant given current

research showing high physical inactivity among children and adolescents in Poland and Europe [11,29,30]. Studies by Carson et al. [31], Saunders and Vallance [10], and Brzęk et al. [32] link excessive screen time to poorer sleep quality, lower physical activity, and higher risk of overweight and obesity. A meta-analysis by Carter et al. [33] further confirms the detrimental impact of screen devices on sleep quality in youth. Prolonged electronic device use negatively affects mental health [34], cognitive functioning, and academic achievement [35].

These results suggest educational interventions can effectively reduce sedentary behaviors early in schooling. Limiting screen time is a significant public health challenge, given the pervasive presence of digital devices in children's education and leisure. Preventive efforts should target both increasing physical activity and cultivating mindful digital media habits [10,11,31].

The family environment's influence was also evident in screen behavior; children's reduced screen time was accompanied by increased parental monitoring and reduced parental sitting time, indicating that interventions may support behavioral changes in both children and family routines. This aligns with research showing that children's media use is closely linked to parental regulations, parent-child relationships, and screen time enforcement [23,24].

Although differences were noted between the study and control groups in terms of body weight ($p = 0.012$) and BMI percentile ($p < 0.001$), it should be emphasized that both groups were within the normative range for these parameters. Therefore, the initial differences had no practical impact on the evaluated outcomes. Consequently, the observed significant changes in the study group and the stabilization in the control group support the effectiveness of the program in reducing body weight.

Despite the relatively short intervention, BMI and BMI percentile decreased in the physioprophylaxis group, consistent with literature highlighting the role of regular physical activity and healthy lifestyles in preventing overweight and obesity in growth periods [15]. Excess body weight in childhood substantially increases the risk of persistent in adulthood [16] and is associated with postural abnormalities and reduced physical activity levels in children [36,37,38]. These findings should be interpreted cautiously due to multiple influencing factors, including nutrition (not studied here) and growth spurts, the latter of which were exclusion criteria. However, the observed trends suggest that improving daily health behaviors, particularly increasing physical activity and reducing sedentary time, may favor healthier body mass outcomes in children.

The study underscores the school environment's importance for preventive interventions, especially when combined with parental engagement. Literature suggests that multi-component school programs promoting health education, physical activity, ergonomics, and healthy habits

yield better outcomes than solely theoretical education [39,40,41,42]. Consistent, comprehensive interventions produce more favorable results [41,43].

Research by Brzęk et al. [13,14] emphasizes that educational programs covering ergonomics, physical activity, and posture disorder prevention assist in fostering healthy behaviors and mitigating sedentary lifestyle effects. Schools, reaching large groups during critical habit-forming years, serve as key platforms for ongoing reinforcement of desirable behaviors related to physical activity, ergonomics, and leisure time, enhancing intervention efficacy.

Limitations include a relatively short observation period, preventing assessment of long-term effects, and reliance on parental self-report, which may introduce recall or subjective bias. In addition, parent-reported outcomes may be affected by social desirability bias, as parents may unintentionally overestimate healthy behaviors or underestimate sedentary behaviors and screen time. Future studies should consider longer follow-up and objective physical activity measures, including accelerometers, pedometers, or wearable activity trackers, to provide more accurate estimates of physical activity and sedentary. Longitudinal research could clarify the durability of physioprophylactic program benefits and their impact on health behaviors across developmental stages. Reported correlations between child and parent behaviors should be seen as concurrent positive changes within the family environment, and should not be interpreted as evidence of causality.

CONCLUSIONS

The one-year physioprophylactic program positively influenced selected health behaviors among early school-aged children, particularly by increasing physical activity during leisure time both in children and their parents, who showed greater involvement in joint physical games. Children participating in the program demonstrated a reduction in sedentary behaviors, including decreased sitting and screen time, along with enhanced parental control over screen time. Physioprophylactic programs implemented within the school environment, in collaboration with parents and teachers, may constitute an important component in promoting a healthy lifestyle among children.

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Conflict of interest

The authors declare no conflicts of interest.

Authors' contribution

Study design – M. Jochemczak, A. Brzęk

Data collection – J. Sołtys, M. Jochemczak, R. Wysocka-Bochenek, W. Żaba, A. Brzęk

Data interpretation – J. Sołtys, M. Jochemczak, A. Mrowiec, A. Cholewka, A. Brzęk

Statistical analysis – M. Jochemczak, J. Sołtys, A. Brzęk

Manuscript preparation – M. Jochemczak, G. Marsik, J. Sołtys, A. Cholewka, A. Mrowiec, A. Brzęk

Literature research – M. Jochemczak, G. Marsik, J. Sołtys, W. Żaba, R. Wysocka-Bochenek, A.

Cholewka, A. Mrowiec, A. Brzęk

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