OBESITY IN ADOLESCENTS: FACTORS, CONSEQUENCES, AND PREVENTION STRATEGIES THROUGH HEALTH EDUCATION AND AWARENESS

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ЗАТЛЪСТЯВАНЕ ПРИ ЮНОШИТЕ: ФАКТОРИ, ПОСЛЕДИЦИ И СТРАТЕГИИ ЗА ПРЕВЕНЦИЯ ЧРЕЗ ЗДРАВНО ОБРАЗОВАНИЕ И ПОВИШАВАНЕ НА ОСВЕДОМЕНОСТТА

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Abstract. Introduction: *Reduced physical activity among children is a significant public health issue linked to a higher risk of obesity, metabolic disorders, and poor mental well-being. The increasing amount of time children spend in front of screens calls for innovative strategies to engage them in physical activity. Recent technological advancements could help adolescents increase physical activity through gamification, social challenges, and interactive missions. In this way physical activity can increase within family environments. This study aims to assess the level of physical activity among children in Bulgaria, based on their parents' perceptions, and to evaluate their willingness to use innovative digital solutions for physical activity.* ***Materials and methods:*** *A pilot online survey was conducted via Google Forms among parents of children aged 5-16. The survey included questions related to activity levels, barriers to physical activity, and attitudes toward digital interventions. The results were analyzed and described in Microsoft Excel. MedCalc was used for statistical analysis. There is a notable correlation between age-appropriate physical activities and the time children spend in front of screens, including the use of mobile games that promote movement through enjoyable games and challenges.* ***Results:*** *In terms of physical activity, 57% of parents believe that their child is sufficiently active, while 43% report insufficient activity. The main barriers to activity include limited time, the temptation of electronic devices, and low motivation. 62% of respondents are willing to use an app to encourage exercise, while only 4% are not. The most preferred digital features are games, challenges, and sharing results with peers.* ***Conclusion:*** *Parents are willing to use digital tools to increase their children's physical activity. By incorporating game elements, exercise becomes fun, and social aspects foster community spirit, motivating kids to stay active together. Family involvement strengthens bonds and provides role models, thus promoting physical and emotional well-being.*

Key words: *obesity, health awareness, physical activity, digital technologies*

Резюме. Въведение: *Намалената физическа активност сред децата представлява значим обществоздравен проблем, свързан с по-висок риск от затлъстяване, метаболитни нарушения и влошено психично благополучие. Нарастващото време, което децата прекарват пред екрани, налага разработването на иновативни стратегии за насърчаване на физическата активност. Съвременните дигитални технологии могат да подпомогнат увеличаването на физическата активност сред подрастващите чрез геймификация, социални предизвикателства и интерактивни мисии, като по този начин стимулират активността и в семейна среда. Настоящото проучване има за цел да оцени нивото на физическа активност сред децата в България въз основа на възприятията на техните родители, както и готовността им да използват иновативни дигитални решения за насърчаване на физическата активност.* ***Материал и методи:*** *Проведено е пилотно онлайн анкетно проучване чрез Google Forms сред родители на деца на възраст 5-16 години. Анкетата включва въпроси, свързани с нивото на физическа активност, бариерите пред активния начин на живот и нагласите към дигитални интервенции. Резултатите са обработени и описани в Excel, а за статистически анализ е използван софтуерът MedCalc. Установена е съществена връзка между възрастово подходящите физически дейности и времето, което децата прекарват пред екрани, включително използването на мобилни игри, които насърчават движението чрез забавни игри и предизвикателства.* ***Резултати:*** *По отношение на физическата активност 57% от родителите смятат, че тяхното дете е достатъчно активно, докато 43% съобщават за недостатъчна активност. Основните бариери включват ограничено време, конкуренция с дигиталните устройства и ниска мотивация. 62% от респондентите биха използвали мобилно приложение за насърчаване на физическата активност, докато едва 4% заявяват, че не биха го използвали. Най-предпочитаните функционалности са игри, предизвикателства и споделяне на резултати с връстници.* ***Заключение:*** *Родителите биха използвали дигитални инструменти за увеличаване на физическата активност на своите деца. Чрез включване на игрови елементи физическата активност става по-забавна, а социалните аспекти създават чувство за общност и мотивират децата да бъдат активни заедно. Участието на семейството допринася за укрепване на връзките между членовете му и осигурява положителни ролеви модели, които насърчават физическата активност и емоционалното благополучие.*

Ключови думи: *залтъстяване, здравна осведоменост, физическа активност, дигитални приложения*

Introduction and Purpose

Decreased physical activity in children is a major public health concern associated with an increased risk of obesity, metabolic disorders, and poor mental health, with the decline in energy expenditure being a key factor contributing to excessive body weight [1].

A report by the World Health Organization (WHO) shows that less than 20% of adolescents worldwide are physically active, with a higher prevalence of inactivity among girls [2, 3].

The increasing amount of time children spend in front of screens is related to alarming issues of well-being, mental health and social engagement, calls for increased awareness in society to the importance of sports, and also requires the implementation of innovative strategies to engage children in physical activity [4].

Due to the increasing number of children who are overweight or obese and the rising economic costs, we need to dedicate more resources to effective obesity prevention and treatment programs. Early prevention is the best way to reduce the long-term healthcare costs and productivity losses linked to childhood obesity. It is more effective than waiting for treatment later [5].

There is a growing body of research demonstrating the benefits of team sports and working with professional trainers and coaches to enhance adolescents' attitudes toward physical activity [6, 7].

Recent technological advancements could also be considered as possible approaches to help adolescents increase physical activity through gamification, virtual reality, social challenges, and interactive missions to encourage physical activity within family environments [8, 9, 10].

This study aims to assess the level of physical activity among children in Bulgaria by examining their parents' perceptions. It seeks to evaluate parents' awareness to the associated risks and challenges, explore the potential motivations that could encourage their children to engage in sports, and assess their willingness to utilize innovative digital solutions to promote physical activity.

Materials and methods

A pilot online survey was conducted via Google Forms among parents of children aged 5-16. The survey was divided into three sections. The first section collected demographic information, including the age and gender of the children. The second section focused on activity levels, types of sports practiced, awareness of the risks associated with a lack of physical activity, as well as the challenges and motivations related to physical activity. The third section examined attitudes toward digital interventions.

The questionnaire consisted of two open-ended and eleven close-ended questions and was distributed randomly among parents' school groups.

Statistical analysis was performed in MedCalc to compare differences among variables and to examine the statistical dependencies between them. For each variable with individual values, a frequency analysis was conducted. Additionally, for every pair of single variables, a correlation analysis was carried out using the Chi-square test. The study presents the following parameters: degrees of freedom (DF) and significance level.

Results

We received a total of 85 distinct responses to the questionnaire, which reflects a diverse range of insights and opinions. Most of the respondents have children aged 8-12 years, with an almost equal number of girls (n = 41) and boys (n = 44) – Table 1.

Table 1. Demographic characteristics

Input parameter	Value	
Age group	**Male**	**Female**
• 5-7	8	12
• 8-12	21	21
• 13-16	15	8

According to 48 parents (56.5%), their children are actively engaged in sports, with the majority aged between 8 and 12. This active group consists of 27 children playing team sports (basketball, volleyball, football, etc.) and 21 practising individual sports. Excessive screen time (more than 3 hours daily) was reported in only 6 children (22.2%) from the team sports group and in 4 (19%) children from the individual sports group.

Among the children with insufficient engagement in physical activities according to their parents, 37 (43.5%), (n = 19, 51.4%) have screen time of more than 3 hours per day, 11 (29.7%) are not engaged in any sports activities. 6 of them (54.5%) have more than 3 hours of screen time. 19 (51.4%) report physical activity mostly in individual sports like swimming, cycling, running, martial arts, tennis, dancing, etc. – Figure 1.

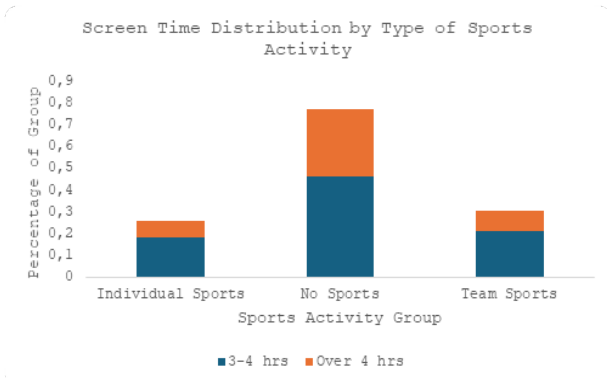

Fig. 1. Screen time distribution by type of sports activities

Our results show that prolonged daily screen time (more than 3 hours) is substantially more prevalent among children with insufficient physical activity. Children involved in team sports have the lowest proportions of prolonged screen time, which aligns with evidence that team-based and structured sporting environments may reduce sedentary behaviours compared to participation in individual or no sports.

Key reasons for the lack of physical activity include low motivation, insufficient time, and insufficient sports facilities. – Figure 2.

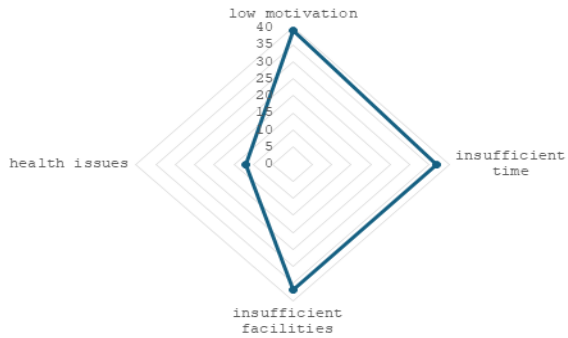

Fig. 2. Key factors affecting physical activities

According to the data, 98.8% of parents consider regular physical activity to be „extremely important“ or „important“ for their child‘s health. Despite this consensus, parents reported significant obstacles preventing their children from being sufficiently active. When asked about the barriers to physical activity, the results showed an exact split between three primary factors: lack of time, lack of motivation, and lack of suitable conditions/infrastructure, each cited by 48.2% (n = 41) of respondents as key hurdles. Health reasons were a less frequent barrier, cited by 16.5% of the sample.

An analysis of the open-ended responses regarding the risks of inactivity identified four main themes: 1) obesity and metabolic disorders – the most frequently mentioned concern; 2) musculo-skeletal issues – participants specifically noted problems such as spinal curvatures and muscle weakness; 3) mental health decline – this included issues like low self-esteem and poor concentration, and 4) social isolation – often linked to excessive screen time among the respondents – Figure 3.

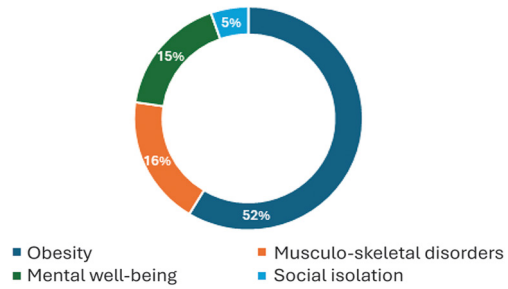

Fig. 3. Perceptions of the negative impact of reduced physical activity among respondents

When asked to describe specific methods used to stimulate their children's physical activity (open-ended question), the responses gravitated around three primary strategies: personal example and shared family activities – respondents frequently stated that they "lead by example," "play together outside," or "train with the child," highlighting that active parents tend to raise active children. Outdoor recreation is an effective way to increase physical activity, as many parents depend on non-competitive outdoor activities, such as walking in parks, hiking in the mountains, and cycling, to help combat sedentary behaviour. Additionally, enrollment in organized sports, including structured training sessions for swimming, football, and martial arts, is seen as a necessary measure to promote regular physical activity and instil discipline.

Our findings suggest that children’s existing play preferences create a strong foundation for the successful integration of gamified digital tools to promote physical activity. In our sample, 80% of parents reported that their children enjoy playing outdoors, indicating that most children are already motivated by exploration, movement, and unstructured physical play. At the same time, 48.2% reported that their children regularly engage in playing or video games, and 31.8% indicated that their children enjoy playing board games. These results demonstrate that children are not only physically playful, but also highly receptive to game-based reward systems, strategic thinking, storytelling, and competition – all core components of gamification.

Importantly, 64.7% of parents in our study expressed interest in a mobile game that encourages movement through fun challenges and playful interactions. This finding indicates a high level of parental acceptance and readiness for digital health solutions grounded in gamification.

Statistical analysis

The results from the frequency analysis of single-valued variables show that an equal number of participants responded that children have enough physical activity. The result regarding the amount of time children spend in front of the screen is alarming. The 45.99% of all children are in front of a screen for 2-3 hours daily – Table 2.

The correlation analysis conducted to assess the statistical significance of the values indicates a significant correlation among a child‘s age, level of physical activity, and the time spent in front of a computer (see Table 3).

Additionally, there is a notable correlation between age-appropriate physical activities, and the time children spend in front of screens, including the use of mobile games that promote movement through enjoyable games and challenges. There-

fore, physical activities are significantly related to both the use of mobile games and screen time. Furthermore, a child's age is directly associated with both their level of physical activity and the amount of time they spend in front of screens.

Table 2. Results from frequency analysis of single-valued variables

Variables	Explored parameters	Results	
		Number	%
The children's gender	Girl	41	48.2%
	Boy	44	51.8%
	Total	85	100.0%
Do you think your child gets enough physical activity for his/ her age?	Yes	48	56.5%
	No	37	43.5%
	Total	85	100.0%
How much time does the child spend in front of screens (phone, tablet, TV, computer)?	up to 1 hour	16	18.8%
	2-3 hours	39	45.9%
	3-4 hours	20	23.5%
	More than 4 hours	10	11.8%
	Total	85	100.0%

Table 3. Results from correlation analysis

Explored parameters	Degrees of freedom (DF)	Significance level, p value
Child's age vs enough physical activity for their age	2	0.0494*
Child's gender vs enough physical activity	1	0.9469
Child's age vs the time the child spends in front of screens	6	0.0005*
Child's gender vs the time the child spends in front of screens	3	0.4622
Child's age vs use of a mobile game that encourages movement through fun games and challenges	6	0.5008
Child's gender vs use a mobile game that encourages movement through fun games and challenges	3	0.7388
Physical activity relevant for the age vs time spent in front of screens (phone, tablet, TV, computer)	3	0.0083*
Physical activity relevant for the age vs use a mobile game that encourages movement through fun games and challenges	3	0.0238*
The time spent in front of screens vs use a mobile game that encourages movement through fun games and challenges	9	0.5312

**Statistically significant differences are found*

Discussion

To our knowledge, this study is the first one in Bulgaria analyzing parents' perceptions on the importance of physical activity for their children. It examines the risks associated with insufficient physical engagement and parents' attitudes toward the potential use of digital tools to enhance their children's motivation and participation in physical activities. Our results outline several important insights.

A key finding is the clear connection between insufficient physical activity and excessive daily screen time. Almost half of the children classified as not sufficiently active had over three hours of daily screen time, while children engaged in organized sports – particularly team sports – showed the lowest rates of prolonged screen use. This supports the widely recognised view that structured sport participation can act as a protective factor against sedentary behavior by providing routine, social accountability, and an enjoyable alternative to screen-based leisure [11].

Parents are perfectly well-informed about the negative effects of physical inactivity, but at the same time, almost half of those surveyed (43.5%) noted that their children do not get enough physical activity, and at the same time have excessive screen time. These findings suggest a serious contradiction between parents' attitudes toward this problem and their actions. At the same time, parents identified modifiable barriers to regular activity, such as lack of time, limited motivation, and insufficient facilities. Children's play preferences – with 80% enjoying outdoor games, 48.2% electronic or video games, and 31.8% board games – together with the finding that 64.7% of parents are interested in a mobile game that promotes movement, highlight the high potential for gamification. Health reasons appear to be a less significant factor, which means that all barriers for parents can be easily overcome. Everything here depends on the motivation of the parents, not the children. These findings may lead to the conclusion that among the surveyed group, physical activity in children is closely related to the behaviour and habits of their parents.

"Lead by example" is another important finding in our study, showing that parents' roles and models can influence children's attitudes toward the importance of sports for physical and mental well-being. These results are consistent with other studies showing the importance of parents' perceptions of physical activity on children's physical literacy [12, 13].

Our study findings, more specifically the alarming values and statistically significant differences between physical activities and use of mobile phones, support the development of policies that expand access to organised and school-based sports, improve safe recreational environments, and

provide guidance on healthy screen-time habits. Integrating evidence-based gamified digital tools into health-promotion programs may further enhance children's motivation and long-term engagement in physical activity. Movement-based digital tools may transform passive screen time into active, engaging play that aligns with children's existing interests [8].

Conclusions

Parents are willing to consider utilizing digital tools to enhance their children's physical activity. By incorporating game elements, exercise becomes fun, and social aspects foster community spirit, motivating kids to stay active together and for longer. Family involvement strengthens bonds and provides role models, thus promoting fitness and emotional well-being.

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