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Smartphone Screen Time and Physical Activity in a Sample of Czech and Slovak Secondary School Male Students

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Czas korzystania ze smartfonów a aktywność fizyczna na próbie uczniów czeskich i słowackich szkół średnich

Streszczenie

Nadmierne korzystanie ze smartfona może powodować spadek aktywności fizycznej. Niniejsze badanie ma na celu analizę i porównanie zależności między czasem spędzonym przed ekranem smartfona a aktywnością fizyczną na próbie uczniów czeskich i słowackich szkół średnich. Narzędziem do badania (niestandardyzowanego) czasu korzystania ze smartfonów i aktywności fizycznej

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było celowe wylosowanie 1225 uczniów czeskich i słowackich szkół średnich (w wieku $17,50 \pm 0,65$ lat), którzy uczęszczali do ostatniej klasy szkół średnich. Do analizy i porównania danych zastosowano test chi-kwadrat (χ^2) oraz statystyki opisowe. Badanie określenia zależności między czasem korzystania ze smartfona a aktywnością fizyczną prowadzono przez 9 miesięcy. Po przeanalizowaniu danych okazało się, że 42,12% ($n = 516$) ankietowanych wskazało na 1 do 3 godzin dziennie czasu spędzonego przed ekranem smartfona ($p < 0,01$). Oceniając czas przed ekranem smartfona, ankietowana grupa ($n = 1225$) uznała go za czas adekwatny (58,21%, $n = 713$) ($p < 0,01$). Jeśli chodzi o czas spędzany ze smartfonem, badana grupa ($n = 1225$) preferowała serwisy społecznościowe (53,58%, $n = 656$) ($p < 0,01$). Aplikacje na smartfony są odpowiednimi narzędziami nie tylko do poprawy jakości życia, ale także do skutecznego promowania aktywności fizycznej w czasie wolnym wśród dorastających chłopców.

Słowa kluczowe: dorastający chłopiec, aktywność fizyczna, czas spędzony ze smartfonem, uczniowie szkół średnich.

Abstract

Excessive use of smartphones can cause a decrease in physical activity. The present study aims at analysing and comparing the relationship between smartphone screen time and physical activity in a sample of Czech and Slovak secondary school male students. The survey instrument (non-standardised) for measuring smartphone screen time and physical activity was intentional sampling of 1225 Czech and Slovak secondary school male students (aged $17.50 \pm .65$ years) who attended the last year of secondary schools. Chi-square test (χ^2) and descriptive statistics were used to analyse and compare the data. Determining the relationship between smartphone screen time and physical activity was carried out for 9 months. After analysing the data, it turned out that 42.12% ($n = 516$) of the survey group pointed to 1 to 3 hours/ day of smartphone screen time ($p < 0.01$). When evaluating their smartphone screen time, the survey group ($n = 1225$) considered it as adequate (58.21%, $n = 713$) ($p < 0.01$). In terms of the smartphone screen time activity, the survey group ($n = 1225$) preferred social networking services (53.58%, $n = 656$) ($p < 0.01$). Smartphone apps are adequate tools not only to improve quality of life, but also to promote leisure-time physical activity among adolescent boys.

Keywords: adolescent boys, physical activity, smartphone screen time, secondary school male students.

Introduction

Dependency on digital screen use resulting in an ever-increasing and excessive daily screen time is associated with non-communicable diseases (NCDs), in particular, cancer, heart disease, diabetes and chronic respiratory disease, the leading cause of death worldwide and an emerging global health threat (Sultana et al., 2021). Digital screen use is prevalent among adolescent boys, most of whom use smartphones, computers, and game consoles. Smartphone screen time is very common among adolescent boys being major smartphone users, particularly in modern society, because it constitutes an important part of their life (Haghjoo et al., 2022). According to recent data, average smartphone screen

time is 3 hours and 15 minutes and 1 in 5 smartphone users makes use of their smartphone for an average of 4.5 hours/ day (Liu et al., 2022), being more than recommended time for adolescent boys and girls (≤ 2 hours/ day) (Kim et al., 2020). An excessive use of a smartphone (≥ 2 hours/ day) can affect quality of life among adolescent boys and girls and ≥ 2 hours/ day of smartphone screen time do not provide necessary energy, but result in lack of interest in doing anything else (Niklová et al., 2020).

Smartphones are emerging as a common device among adolescent boys, offering portable computer devices of a mobile phone and computing functions, namely the Internet, navigation system, camera, pedometer, gaming devices and social networking services (e.g. Meta – Facebook, Instagram) (Kim et al., 2015). Almost a quarter of adolescent boys are dependent on smartphone screen time, which becomes like an addiction. Available evidence shows that smartphone use (screen time) and abuse by an adolescent sample of Spanish secondary school male and female students (49% male and 51% female, aged 13–18 years) was excessive, i.e. 41.4% of the adolescent sample ($n = 614$) admitted to abusing smartphones sometimes, 18.3% of the adolescent boys and girls admitted to abusing smartphones more often, and 24% of the secondary school students defined themselves as smartphone addicts (de Albéniz Garrote et al., 2021). Smartphone possession increases with age, with market available data reporting 83% of adolescent boys and girls (the United Kingdom, aged 12–15 years) owning a smartphone, 30.3% of them changing their smartphone every year, and 50.7% every 2 years (Girela-Serrano et al., 2022). According to recent data, adolescent boys (aged 15 ± 2 years) who own a smartphone reached 89%, doubling over a 6-year period (Abi-Jaoude et al., 2020). Available American market data revealed that 91% of adolescent boys and girls reported having access to a smartphone, while 84% of them had their own device (Rideout & Robb, 2019). Another analysis of Australian data revealed that 86% of adolescent boys and girls owned smartphones in grade 8, increasing to 93% by grade 11 (Vernon et al., 2018).

With their multiple functions and different social networking services and technology being combined into one device, smartphones provide convenience and efficiency (Cheung et al., 2022). Smartphone overdependence among adolescent boys who use smartphones for ≥ 2 hours/ day on average leads to musculoskeletal pain, in particular, neck, shoulder, and lower back pain (Maurya et al., 2022), resulting in poor body posture and physical inactivity (Dewi et al., 2021). Longer use of smartphones in bed is associated with adolescent sleep issues, i.e. shorter sleep duration and worse sleep quality (Song & Kim, 2022). More time spent on smartphone use is associated with lower well-being and symptoms of anxiety and depression (Ozer & Kılıç, 2018). Believe it or not, smartphone screen time also has some positive aspects, helping adolescent

boys and girls, particularly in learning (access to news), communication (connection with peers) and entertainment (Ross et al., 2016). Monitoring physical activity with the help of smartphone apps may help adolescent boys increase their activity levels (Körmendi, 2015). Following professional literature trends, the present study aims at analysing and comparing the relationship between smartphone screen time and physical activity in the sample of Czech and Slovak secondary school male students.

Methods

Participants

In terms of the study aim, the target population consisted of adolescent boys who attended the last year of selected secondary schools (i.e. conservatory, grammar school and vocational school) and regions (cities and towns) in the Czech Republic (Prague and Brno) and Slovakia (Bratislava and Košice). The adolescent boys who constituted the research sample were recruited via various sources, particularly through social media (e.g., Meta – Facebook and Instagram). The recruitment process was conducted regularly, in intervals of 3 weeks, aiming at an intentional sampling regarding age, gender, year of study, category of school and region (town/ city) / country. 1 303 correctly filled-in debriefing forms (non-standardised survey) were included in the data interpretation process, however 5.98% ($n = 78$) of them did not meet the inclusion criteria: (i) Not having health issues (e.g., being ill for a long time or medically exempt from participating in physical education classes); (ii) Pre-selected gender (male); (iii) Pre-selected year of study (4th and 5th); Pre-selected secondary school (conservatory, grammar school and vocational school); (iiii) Pre-selected region (town/ city) and country (Prague and Brno in the Czech Republic and Bratislava and Košice in Slovakia); (iiiii) Owning a smartphone. Having met the inclusion criteria (data cleaning), the survey group consisted of 1225 Czech (39.34%, $n = 482$) and Slovak (60.66%, $n = 743$) secondary school male students (adolescent boys). The distribution of the survey group ($n = 1225$), regarding the inclusion criteria was as follows: (i) the Czech Republic – Conservatory (5.54%, $n = 23$), Grammar school (10.60%, $n = 44$) and Vocational school (83.86%, $n = 415$); (ii) Slovakia – Grammar school (31.50%, $n = 234$) and Vocational school (68.50%, $n = 509$).

Measures and Procedures

A single-measure comparative cross-sectional study (descriptive) was carried out, in order to determine the relationship between smartphone use and physical activity in the sample of Czech and Slovak secondary school male stu-

dents (adolescent boys, $n = 1225$). The research instrument of non-standardised survey was created with an intent and consisted of 2 sections: (i) Primary demographic information (e.g., age, gender, year of study, category of school and region (town/ city) / country); (ii) Non-standardised survey items, which consisted of 4 closed questions referring to: (i) Average smartphone screen time (5 closed questions: None (screen time), ≤ 1 hour, 1 – 3 hours, 3 – 5 hours, ≥ 5 hours); (ii) Smartphone screen time and self-evaluation (4 closed questions: Little time, Adequate time, a lot of time, Inadequately big amount of time); (iii) Smartphone screen time activity (4 closed questions: Social networking services, Physical activity, Artistic activity, Playing video games); (iiii) Smartphone use and physical activity (4 closed questions: Using a smartphone regularly, Using a smartphone irregularly, Not using a smartphone, Not doing any physical activity).

During the unlimited time session of December, 2020 – August, 2021, the survey group ($n = 1225$) took part in the non-standardised survey, which was available online, and reviewed the survey data in order to clarify the content of the non-standardised survey (available only to full-aged adolescent boys). Online feedback during the unlimited time did not indicate any problems with the cross-sectional design (technical) and the non-standardised survey (grammar and vocabulary). As for the underage adolescent boys, the debriefing survey forms of the non-standardised survey were distributed (face-to-face) by the authors (meeting the parental consent requirements) in their native language (Czech and Slovak), not revealing any possible information about their identity. Financial incentives were not given (voluntary participation); the survey group ($n = 1225$) received the final report with their personal results afterwards. The online version of the non-standardised survey was chosen due to its cost effectiveness, time saving, easy accessibility and changing epidemic situation of Covid-19. The online version of the non-standardised survey was created and distributed using the online survey portal of Microsoft Forms, Office 365 (Microsoft Corp., Redmond, WA, USA) (Andrade, 2020; Adamčák et al., 2023).

Data analysis

Available survey data (online and in person) collected through the non-standardised survey (debriefing forms) was tabulated (figured) in a database designed precisely for a single-measure comparative cross-sectional (descriptive) study. In terms of incidence of responses, each item of the survey group ($n = 1225$) was analysed, compared, and evaluated by using Tap3 – Gamo programme (Banská Bystrica, Slovakia). Available survey data of the survey group ($n = 1225$) was pooled after cleaning, analysed, and compared by using basic descriptive statistical methods such as multiplicity (n), arithmetic mean (\bar{x}) and percentage frequency analysis (%). The method of inductive statistics – chi-

square test (χ^2), whose significance level (α) was .01 and .05., evaluated the difference between 1225 Czech (39.34%, $n = 482$) and Slovak (60.66%, $n = 743$) secondary school male students (adolescent boys) (Sharpe, 2015).

Results

Average Smartphone Screen Time and Self-evaluation

According to the study aim, Figure 1 illustrates the average smartphone screen time within the survey group ($n = 1225$) and confirms that the survey answer of 1 – 3 hours predominated, as it was selected by 41.62% ($n = 510$) of Czech (42.32%, $n = 204$) and Slovak (40.92%, $n = 304$) secondary school male students (adolescent boys). The survey answer of 3 – 5 hours was chosen by 27.39% of Czech ($n = 132$) and 17.90% of Slovak ($n = 132$) secondary school male students (22.65%, $n = 278$). Another survey answer of ≤ 1 hour was pointed by 19.78% ($n = 242$) of Czech (11.83%, $n = 57$) and Slovak (27.73%, $n = 206$) secondary school male students. Smartphone screen time of ≥ 5 hours was chosen by 13.80% ($n = 169$) of Czech (18.05%, $n = 87$) and Slovak (9.56%, $n = 71$) secondary school male students. 0 hours (none) of smartphone screen time within the survey group ($n = 1225$) was reported by 2.17% ($n = 26$) of Czech (.41%, $n = 2$) and Slovak (3.90%, $n = 29$) secondary school male students.

Considering the average smartphone screen time within the survey group ($n = 1225$), the intergroup difference of Czech (39.34%, $n = 482$) and Slovak (60.66%, $n = 743$) secondary school male students revealed the significant difference ($p < .01$) ($\chi^2(4) = 77.13$; $p = 7.05E-16$).

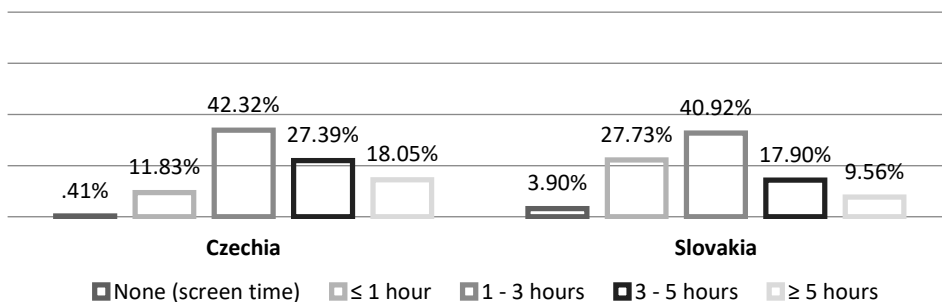


Figure 1

Average smartphone screen time within the survey group ($n = 1225$)

When it comes to self-evaluating smartphone screen time within the survey group ($n = 1225$), the Czech ($n = 482$) and Slovak (743) secondary school male students reported spending an adequate amount of time (58.21%, $n = 713$) on

their smartphones. According to Figure 2, 21.99 % (n = 106) of Czech and 23.42% (n = 174) of Slovak secondary school male students indicated devoting a lot of time to their smartphone screen time. Little time (29.30%, n = 359) devoted to smartphone screen time was chosen by 13.28% (n = 64) of Czech and 16.02% (n = 109) of Slovak secondary school male students. Spending an inadequately big amount of time on smartphone screen time was reported by 6.85% (n = 33) of Czech and 2.02% (n = 15) of Slovak secondary school male students.

Considering the smartphone screen time and self-evaluation within the survey group (n = 1225), the intergroup difference of Czech (39.34%, n = 482) and Slovak (60.66%, n = 743) secondary school male students revealed the significant difference ($p < .01$) ($\chi^2(3) = 19.13$; $p = 2.56E-04$).

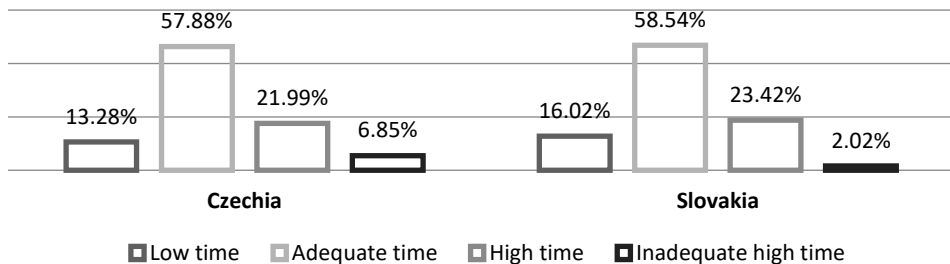


Figure 2

Smartphone screen time and self-evaluation within the survey group (n = 1225)

Smartphone Screen Time Activity and Physical Activity

Smartphone screen time activity within the survey group (n = 1225) is illustrated by Figure 3 and confirms that social networking services (e.g., Meta – Facebook, Instagram) predominated, i.e. this option was chosen by 51.45% (n = 248) of Czech and 55.72% (n = 414) of Slovak secondary school male students. Smartphone screen time artistic activity (e.g., taking photos, listening to music, and recording videos) (27.81%, n = 340) was selected by 28.42% (n = 137) of Czech and 27.19% (n = 202) of Slovak secondary school male students. According to Figure 3, 16.18% (n = 78) of Czech and 13.73% (n = 102) of Slovak secondary school male students reported playing video games. Monitoring physical activity with the use of their smartphone was reported by 19 (3.94%) Czech and 25 (3.36 %) Slovak secondary school male students.

Considering the smartphone screen time activity within the survey group (n = 1225), the intergroup difference of Czech (39.34%, n = 482) and Slovak (60.66%, n = 743) secondary school male students revealed the significant difference ($p < .01$) ($\chi^2(3) = 2.61$; $p = 4.55E-01$).

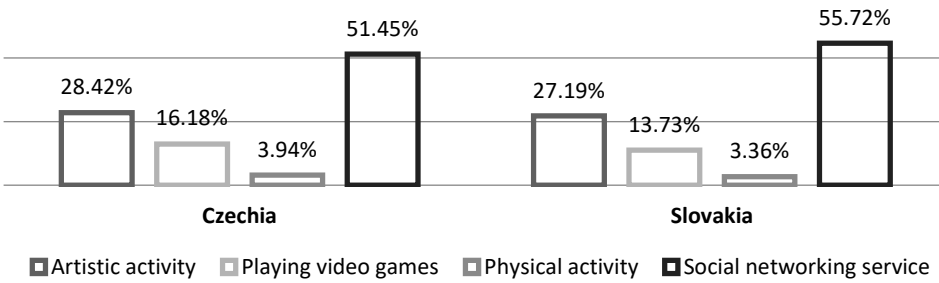


Figure 3
Smartphone screen time activity within the survey group (n = 1225)

Figure 4 illustrates smartphone use and physical activity within the survey group (n = 1225) and reveals that 167 (34.65%) Czech and 332 (44.68%) Slovak secondary school male students were using their smartphones irregularly (39.67%, n = 486). Using a smartphone regularly (17.51%, n = 215) was reported by 16.18% (n = 78) of Czech and 18.84% (n = 140) of Slovak secondary school male students. Not using a smartphone at all (35.01%, n = 430) was selected by 40.25% (n = 194) of Czech and 29.88% (n = 222) of Slovak secondary school male students. According to Figure 4, 43 (8.92%) Czech and 49 (6.60%) Slovak secondary school male students admitted to not doing any physical activity.

Considering smartphone use and physical activity within the survey group (n = 1225), the intergroup difference of Czech (39.34%, n = 482) and Slovak (60.66%, n = 743) secondary school male students revealed the significant difference ($p < .01$) ($\chi^2(3) = 19.75$; $p = 1.91E-04$).

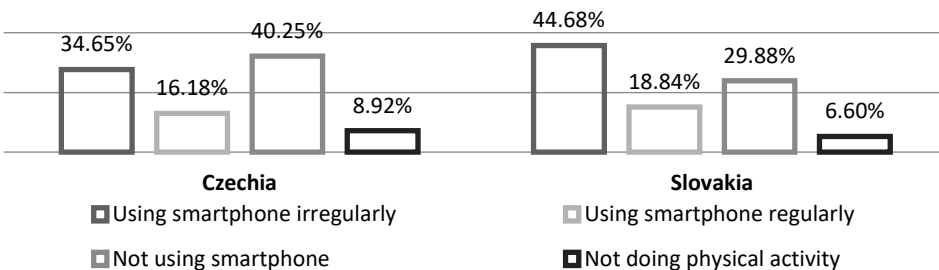


Figure 4
Smartphone use and physical activity within the survey group (n = 1225)

Discussion

Average Smartphone Screen Time and Self-evaluation

Adolescent boys are described as “digital natives”, with smartphones embedded in their lives. Czech (39.34%, $n = 482$) and Slovak (60.66%, $n = 743$) secondary school male students are no exception because 204 (42.32%) Czech and 304 (40.92%) Slovak secondary school male students reported smartphone screen time of 1 – 3 hours/ day. American adolescent boys and girls consumed 9 hours and 33 minutes of digital screen time/ day, half of which was spent on their smartphones (Rideout & Robb, 2019). As for the survey group of 263 Hungarian secondary school students, their average smartphone screen time was 4.48 hours/ day (adolescent boys – 3.40 hours/ day and girls – 5.39 hours) (Körmendi, 2015). The research conducted on 226 Spanish adolescent boys and girls (aged 17 – 18 years) revealed that their smartphone screen time averaged 3.5 hours/ day (Cabré-Riera et al., 2019). The examination of Chinese adolescent boys and girls (aged 17 years) revealed an excessive increase in smartphone screen time from 27.2% in 2011 to $\geq 70\%$ in 2019 (Liu et al., 2022). Another study of Chinese adolescent girls (Hong Kong) revealed that about 83% of 390 adolescent girls (aged 12.5 years) spent 1 – 3 hours/ day using a smartphone [6]. Having ≤ 2 hours/ day of smartphone screen time was reported by 58% and 53% of Indian adolescent boys and girls, while 14% of adolescent boys and 4% of adolescent girls spent ≥ 3 hours/ day using smartphones (Maurya et al., 2022). Existing evidence of Brazilian data shows high prevalence of smartphone screen time among university male and female students (aged + 18 years) who spent almost 5 hours/ day on their smartphones, which constituted 21% of their day (Mescollotto et al., 2019). Weekdays average more smartphone screen time than weekends (Deng et al., 2019).

Smartphone Screen Time Activity and Physical Activity

Adolescent boys use their smartphones at varying times and for various purposes. The most common smartphone activity differs between contemporary adolescent boys (Generation Z; currently 5 to 25 years) and all other age groups who appear to use their smartphones for productive purposes, namely e-mail writing and following directions (maps). Generation Z (Gen Z) appears to use their smartphones for entertainment purposes, in particular for social networking services (e.g., Meta – Facebook and Instagram) and artistic activity (e.g., taking photos, listening to music, and recording videos). And again, Gen Z of Czech (39.34%, $n = 482$) and Slovak (60.66%, $n = 743$) secondary school male students are no exception because social networking services (e.g., Meta – Facebook, Instagram) dominated among the research sample of Czech (51.45%, $n = 248$) and

Slovak (55.72%, n = 414) secondary school male students. Czech adolescent boys (49.83%, n = 13542) and girls (50.17%, n = 13635), aged ± 12 years, reported making/ receiving phone calls (72%), followed by typing/ sending messages through social networking services (66%) to be the most common smartphone screen time activities (Kopecký et al., 2021). Existing evidence of Hungarian data shows calling and visiting social networking services as the most common smartphone screen time activity among 263 secondary school students (Körmendi, 2015). According to recent data, 70% of adolescent boys use social networking services several times a day, up from a third of adolescent boys in 2012 (Rideout & Robb, 2019). Canadian (Ontario) adolescent boys and girls reported spending ≥ 5 hours/ day on social networking services, which increased from 11% in 2013, to 16% in 2015 and to 20% in 2017 (Boak et al., 2018). Another analysis of Slovak data revealed that 519 adolescent boys and girls (aged ± 19.40 years) were using their smartphones for chatting and making calls (Niklová et al., 2020). An age of initial use of social networking services is getting lower, namely to 12 – 13 years, reflecting the need to create personal social identity (Spoina et al., 2021). Taking photos, listening to music, and recording videos (27.81%, n = 340) was chosen by 137 (28.42%) Czech and 202 (27.19%) Slovak secondary school male students. Some believe that listening to music and podcasts on one's smartphone does not add to one's smartphone screen time. However, it applies to listening to music and podcasts played through smartphone apps like Apple Music or Spotify. Taking photos (51.66%), followed by listening to music (47.10%) (e.g., Apple Music, Spotify) through a smartphone was a common smartphone screen time activity among Czech adolescent boys and girls (Kopecký et al., 2021). Among adolescents, in addition to listening to music and taking photos, smartphones are frequently used for communication purposes (e.g., phone calls, social networking services) and Internet browsing (Lopez-Fernandez et al., 2018). Playing video games (14.96%, n = 183) was reported by 78 (16.18%) Czech and 102 (13.73%) Slovak secondary school male students, which was less compared to Czech adolescent boys and girls (49.52%) (Kopecký et al., 2021). According to recent data, the majority of smartphone use is devoted to leisure and learning, and 90.9% of Chinese adolescent boys (51.64%, n = 489) and girls (48.36%, n = 458) (Guandong Province) on average admitted to sitting during these activities. Problematic smartphone use positively correlated with sedentary behaviour (Xiang et al., 2020). At present, an increasing number of adolescent boys is searching for health-related data and guiding their fitness via smartphone apps (He et al., 2021). Smartphone use (apps) and physical activity revealed that 16.18% (n = 78) of Czech and 18.84% (n = 140) of Slovak secondary school male students regularly used their smartphone for that purpose (Figure 4). According to Australian data, 26.5% (n = 255) of adolescent boys (28.9%, n = 278) and girls (71.1%, n = 685) reported using digital platforms (apps) for physical

activity (Parker et al., 2021). Physical activity decreases during the adolescent period (Demirbilek & Minaz, 2020), therefore smartphones are an ideal tool for promoting physical activity in those with little intrinsic motivation (Harries et al., 2016).

Conclusions

Excessive smartphone screen time may negatively affect adolescent boys' health by reducing their physical activity level. Smartphones are an integral part of adolescent boys' daily lives, influencing their whole lives, thus they should be used effectively. Therefore, the present study was aimed at analysing and comparing the relationship between smartphone screen time and physical activity in the sample of Czech and Slovak secondary school male students.

When self-evaluating their smartphone screen time, the survey group (n = 1225) considered it to be adequate (58.21%, n = 713) ($p < .01$), whereas 33 (6.85%) Czech and 15 (2.02%) Slovak secondary school male students believed that they devote too much time to their screens ($p < .01$). Average smartphone screen time of Czech (39.34%, n = 482) and Slovak (60.66%, n = 743) secondary school male students revealed the statistical significance ($p < .01$) in favour of Slovak secondary school male students (< smartphone screen time).

An influence of new (smartphone) technology will certainly intervene in our everyday life. Therefore, it is important that today's adolescent boys, for whom a smartphone is an "integral part of being", be motivated to increase their activity level. Playful activities such as Pokémon Go, Geocaching, or physical activity challenges implemented through various apps on a smartphone set a good example (e.g., Samsung Health, Garmin and Strava). An early adolescence period offers an opportunity to shape young persons, taking into account their holistic development. That could be achieved by guiding them and playing with them, familiarising them with various useful (playful) smartphone apps associated with increasing activity levels. Better understanding of adolescent boys' smartphone use, screen time and purpose may help their parents and PE teachers develop and implement preventive measures.

STATEMENT OF ETHICS

This study was conducted in accordance with the World Medical Association Declaration of Helsinki. The study protocol was reviewed and approved by the *Artistic and Pedagogical Council of the Faculty of Performing Arts, Academy of Arts in Banská Bystrica, Slovakia (May 30, 2023, Banská Bystrica, Slovakia)*. All participants provided written informed consent to participate in this study.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of the article *Smartphone Screen Time and Physical Activity in a Sample of Czech and Slovak Secondary School Male Students*.

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