

The physical education performance evolution of university students in athletics

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Abstract:

At the times of reduced physical activity (also PA), physical education (also PE) as a school subjects becoming the only PA during the week for many children leading to their lower motor skills (stamina, speed and strength). The quality of PE classes ensured by the teacher is one of the decisive factors in whether children will voluntarily engage in PA in the future. Therefore, the future PE teachers should not only be prepared by the university with regard to knowledge, but they should also master a series of skills related to various physical activities. We hereby report a longitudinal study in future PE education teachers' performance. The purpose of this longitudinal study was to compare the long-term performance of university students in the field of physical education in the practical subject of Athletics. This study includes the measurement of motor abilities and skills of physical education students over 10 years. We tested the level of PE students' motor skills in 4 athletic events: 100-metre sprint, 1,500-metre men's run (800-metre women's run), long jump, and shot-put. The presented study was performed using data of 424 students in the field of physical education at the University of Ostrava in the Czech Republic. They were anonymous data of 154 women and 270 men from 2009 to 2018. The biggest decrease was 1 second between the first and the third period for the female students' performance in the sprint. There were statistically and practically significant differences in the results of three out of four selected athletic events (100-metre sprint, 1,500-metre men's run, or 800-metre women's run, long jump) in the men and women categories. Only one event (shot-putting) has not statistically and practically significant differences in the students' performance in both categories. We conclude that the performance of physical education students is decreasing in speed, endurance, and technical skills but they have still strength.

Keywords: Physical education, teacher, physical activity, athletics

Introduction

The changes in the lifestyle and the increasing living standard of the population are related to the continuous technological development, while these changes generate substantial alterations in our lifestyle. One of the important attributes of technological development is the reduction in physical activity, which used to be an essential condition of survival for many centuries (Smith & Biddle, 2008). Physical activity (also PA) and sports are important attributes of an individual's lifestyle which contains integrity of standards, values, and physical and social behaviour of the individual. Existing studies (Cueto-Martín et al., 2018; Sackett & Edwards, 2019) indicate that PA in the common population is significantly influenced by several factors, while the effect of certain factors can be considered positive or negative.

The quantity and structure of PA also change with the age of the individual and depend on other factors, such as gender, cultural surroundings, and the environment in which the individual exists (Al-Hadabi & Sassi, 2019; Cooper et al., 2005; Haga et al., 2015; Sandu et al., 2018; Sumption & Burnett, 2021). Small children love to move and a movement is a natural form of entertainment for them, however, this movement is later often replaced with other forms of entertainment and distraction and thus we witness the lack of physical activity in children at elementary schools, as well as high schools (Smith et al., 2017).

The human body, especially that of a child, is highly sensitive and also quite susceptible to various influences (positive and negative), the effects of which are manifested much later in life, which needs to be taken into account (Alhassan et al., 2019; Kostov, 2017). The foundations of lifestyle are laid in childhood and lifestyle also includes various forms of PA, therefore the majority of studies are specifically performed on the child and youth population from the age of 5 to 18 (Al Dababseh et al., 2017; Gu et al., 2019; Harvey et al., 2017; Petiot & Desbiens, 2022) to detect any potential changes in the population's lifestyle as early as possible.

As mentioned above, the lifestyle has changed overall, with PA limited to the minimum, with increasing nervous tension, and occurrence of stressful events (Engberg et al., 2012). The physical activity of children is gradually decreasing and it becomes insufficient as early as in younger school age. Children prefer less demanding activities, such as PC gaming or watching television. Studies from more than 10 years ago showed (Tammelin et al., 2007; Davison et al., 2005) that up to 48 % of children watch television for more than two

hours a day and that the time spent by watching television continuously increases in almost all age groups (Mielke et al., 2014). Some recent publications indicate up to the total of 6 hours spent by the computer, television, and game consoles. Children thus have almost no time left to get involved in some extracurricular physical activity, as (Ward et al., 2007) state that up to 70 % of young people do not do any sports and 50 % are not involved in any extracurricular physical activity. Watching television for more than two hours a day is demonstrably related to reduced fitness and the reduction in the physical activity of children is usually accompanied by a worsened level of general motor performance, health, increased occurrence of childhood obesity, and the related medical problems (Bondyra-Wiśniewska et al., 2021; Williams et al., 2015).

Another important factor influencing lifestyle and the reduction in PA is computers, PC gaming or game consoles (including on-line games), and Internet browsing (Hart et al., 2011; Serban & Simona, 2012; Piotr et al., 2018; Ružič-Baf et al., 2014; Salmon et al., 2005; Danielle et al., 2014). The development of computer technology is generally a chapter on its own. PCs are used by almost everyone at work, for shopping, entertainment or getting information. Moreover, their use has spread even more thanks to the availability of Wi-Fi. Today, people no longer need to sit at home with their PC connected to the Internet; it is not even required to bring a laptop anymore as tablets and especially smartphones provide the same (if not better) function, presenting another leisure activity for children (Christakis et al., 2004). Physical education as a school subject thus often becomes the only physical activity during the week for many children (sedentary lifestyle) (Dendup et al., 2020). The quality of PE classes provided by the teacher is often a critical factor in whether or not children will voluntarily engage in physical activity in their future lives. The quality of PE classes at elementary and high schools depends on the quality of the teacher who should not only be prepared by the university about knowledge but who should also master a series of skills related to various physical activities. And last, but not least, the teacher should have some level of physical fitness that influences the quality of the learned skills.

The graduates in the field of physical education acquire basic education in the field of physical education and kinanthropology, pedagogy, and psychology (Ward & Ayvazo, 2016; Nishimura et al., 2020; Mastagli et al., 2020; Moon, 2022). Their study programs require them to take a lot of theoretical tests (anatomy, physiology, biomechanics, statistics, and others) and they also have to successfully pass credit requirements in practical courses, such as gymnastics, swimming, sports games, and athletics. Athletics is an integral part of school physical education and its traditional position in education is indisputable. Teachers, trainers as well as the public should not underestimate it as running, jumping, and throwing significantly contributes to the development of all physical skills (speed, strength of lower and upper limbs, agility, and coordination) and abilities that are essential for everyday life of children and youth. Athletics, with its content and character, is one of the sports that substantially contribute to versatile development, increase in physical fitness and general cultivation of movement of children and youth. Children learn about most athletic events as early as in the first stage of elementary school in the form of natural exercises and small movement games or competitions, and they learn, improve and gradually expand their physical activities in the second stage of elementary education. Correspondingly applied athletic events can also be an effective means for removing unilateral load and for compensating for an unhealthy environment or lifestyle (Heath et al., 2019; Cho et al., 2009; McCrorie et al., 2014; Sawicki, 2021).

The university students in the studied period were a generation of students that demonstrated changes in lifestyle (watching TV, using PCs, tablets, and smartphones, sedentary lifestyle, and gradually increasing obesity occurrence). Therefore, we decided to implement this study focused on the comparison of performance in selected athletic events of university students in the field of physical education over ten years. The purpose of this longitudinal study was to verify whether or not there is a reduction in the fitness of future PE teachers in the practical subject of Athletics.

Although there are studies in PA and free time investigating the amount of PA or reasons for a decrease in PA in children and youth (Heath et al., 2019; Kohl III et al., 2019; Sauerwein & Rees, 2020; Sfyri et al., 2021), longitudinal studies focusing on PE teachers or future PE teachers are missing. Considering their enthusiasm and PA competencies, PE teachers have played an important role in influencing children and youth as a passion for PA (Dicke et al., 2018; Taxer et al., 2019; McEvoy et al., 2015). Studies dealing with mutual correlations of PA and academic success point towards a positive impact of the amount of PA on academic success (Rasberry et al., 2011). The aim of this article is to compare the level of long-term performance of university students in the field of physical education in selected athletic events from 2009 to 2018 at Ostrava University, the Czech Republic.

Aim

The aim of this article is to compare the level of long-term performance of university students in the field of physical education in selected athletic events from 2009 to 2018 at Ostrava University, the Czech Republic.

Material & methods

Ethics

The submitted study was performed using data of university students in the field of physical education at the University of Ostrava in the Czech Republic. All the presented data were completely anonymous and all measures to protect personal data were observed.

Participants

The presented study was performed using data of 424 students in the field of physical education at the University of Ostrava in the Czech Republic. They were anonymous data of 154 women and 270 men from 2009 to 2018.

Procedures

A whole series of standardized motor tests (Mackenzie, 2005) or entire test sets such as the Eurofit Test (Lovecchio et al., 2012; Haugen & Johansen, 2018) are used in the studies of the level of motor skills and abilities. All students in the field of physical education passed the credit requirements for the subject of Athletics in four athletic events: 100-metre sprint, 1,500-metre men’s run (800-metre women’s run), long jump and shot-putting. All events were performed according to the athletic rules, with the exception of shot-putting where a shot designed for junior categories was used (i.e. 4 kg for women and 5 kg for men).

Statistical analysis

IBM SPSS Statistics 22.0 was used for the statistical processing of the obtained data. The statistic decision was made at 5% level of significance. Data normality as a condition for the parametric forms of tests was rejected in most cases (Shapiro-Wilk test, p-value <0.05) and thus as summary statistics median and interquartile range (IQR) was used. Non-parametric forms of tests were used for the assessment of statistical significance of the determined differences during time periods (Kruskal-Wallis test). As random selection is not very common in the sports practice (Vala et al., 2018), the obtained results were also assessed with regard to practical significance using the effect of size (ES) according to (Richardson, 2011) and (Morse, 1999), while both recommend the value of “Eta Squared η^2 ” for the effect of size (0.01 = small effect, 0.06 = medium effect, 0.14 = large effect). The entire studied period of ten years was divided into three shorter periods (one 4-year and two 3-year) so that we could determine potential tendencies and also compare the set of students, which included only 9 to 22 women and 20 to 40 men each year. This measure also helped eliminate other factors, such as the presence of excellent athletes in some years.

Results & discussion

The opinions on the reduction in physical activity, usually accompanied by the reduction in the level of motor skills and abilities, are becoming more and more common not only in the Czech Republic. The outcomes of our study performed on university students in the field of physical education at the University of Ostrava confirm these opinions to a large extent. In case of successfully admitted students in the field of physical education, both male and female, statistically and practically significant differences in the results of 3 out of 4 selected athletic events were confirmed during the studied period. There were no statistically or practically significant differences in the students’ performance only in one event (shot-putting) over the course of 10 years. In the men’s category, the actual difference between the first time period of 2009-2012 and the second period when the worst performance was analyzed was only 24 cm (p-value = 0.235). This statistically insignificant difference can also be considered practically insignificant (Eta Squared $\eta^2 = 0.005$) according to (Richardson, 2011) and (Morse, 1999). In the women’s category, no statistically or practically significant differences in performance ($\eta^2 = 0.009$) were found in the same events (p-value = 0.311). Specifically, there was a mean reduction in performance by 20 centimeters (see Table 2 and Figure 1) between the first and second studied period (2013-2015).

Table 1: Basic descriptive statistics of male university students in the field of physical education

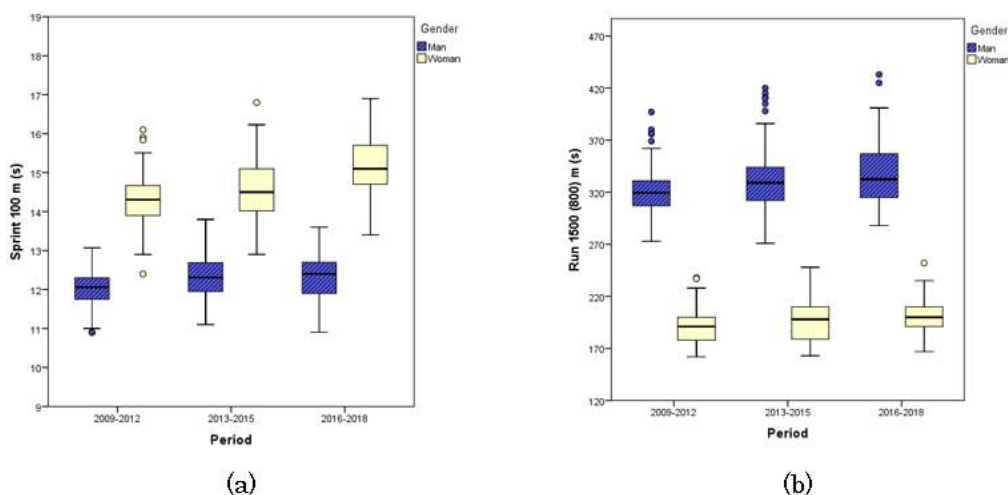
Event	Period	Mean (95 % CI)	Med	IQR	Min	Max	p-value	ES
Sprint 100m (s)	2009-2012	11.99 (11.89; 12.08)	12.09	0.56	10.9	13.1	< 0.001	0.076
	2013-2015	12.34 (12.22; 12.45)	12.31	0.75	11.1	13.8		
	2016-2018	12.35 (12.22; 12.47)	12.40	0.81	10.9	13.6		
Long Jump (m)	2009-2012	5.28 (5.20; 5.37)	5.22	0.40	4.2	6.3	< 0.001	0.060
	2013-2015	5.07 (4.98; 5.15)	5.05	0.50	3.8	6.2		
	2016-2018	5.04 (4.96; 5.13)	5.10	0.51	4.0	6.2		
Shot Put (m)	2009-2012	11.02 (10.75; 11.29)	11.15	1.53	8.5	13.9	0.235	0.005
	2013-2015	10.78 (10.49; 11.08)	10.60	2.21	8.2	14.8		
	2016-2018	10.88 (10.59; 11.16)	10.71	1.74	7.9	14.5		
Run 1500m (s)	2009-2012	321.9 (316.6; 327.2)	319.5	25	273	397	0.002	0.049
	2013-2015	332.3 (326.3; 338.4)	329.0	32	271	420		
	2016-2018	338.1 (331.9; 344.3)	332.5	43	288	433		

Note: n(2009-2012) = 78, n(2013-2015) = 102, n(2016-2018) = 90, 95% CI – 95% Confidence Interval for Mean (Lower Bound; Upper Bound), Med – Median, IQR – Interquartile Range, ES – Effect Size (η^2).

As Table 1 and 2, as well as Figure 1 and 2 show, there was a gradual reduction in the students’ performances in the remaining three events in both genders. These analyzed differences in students’ performances can be considered to be statistically significant, and the tables indicate that with regard to practical significance, the difference can also be considered to be at least of small significance (Cohen, 2013). The greatest decrease in the students’ performances can be found in the results of the women’s 100-metre run, where there was a decrease in the mean performances by 0.88 second (decrease in the median 0.81 seconds), which is a

large difference with regard to practical significance ($\eta^2 = 0.165$, large effect). The man time of female students in the field of physical education in the last studied period got over the limit of 15 seconds. Also, the best female students' performance in sprint was 1 second slower than in the first studied period (Table 2). There was also a significant decrease in mean performances in the men's category (specifically by 0.36 second), but at least the best performances are comparable with the previous periods. The third column in Table No. 1 and No. 2 (95% confidence interval for mean) shows that 95 % of students achieved better results in sprint in the first period than 12.08 seconds (men), or 14.48 seconds (women). On the contrary, only 5 % of the best participants achieved such times in the last period (2016-2018), and more than 50 % of performance by women were above the limit of 15 seconds.

Figure 1: Comparison of the level of performance in the selected athletic events (Sprint 100m and Run 1500 (800) m) during the studied period of 2009-2018.



Also, in the men's 1,500-metre run, there was a gradual decrease in the mean times during the studied 10 years, specifically, the difference was 26 seconds, which can be considered a statistically (p -value = 0.002) and practically significant difference ($\eta^2 = 0.049$). The subject of Athletics also includes 800-metre run for women, which also indicated a gradual reduction in performance. The mean performances decreased by 10 seconds, which are, once again, statistically significant difference (p -value = 0.005) and the difference is medium with regard to practical significance ($\eta^2 = 0.54$). Since the study confirmed statistically and practically significant differences in the students' performances in 3 athletic events, we have to state that the students currently studying at the University of Ostrava in the field of physical education do not have the same performance as 7 – 10 years ago.

The students who apply and are admitted to study in the field of physical education are often current or former athletes at various performance levels, however, their number has been continuously decreasing. While in the first studied period (2009-2012), the group included several athletes from the highest competitions, including Czech representatives, for example in handball, there were only few athletes from the highest competitions in the last studied period (2016-2018), and the number of athletes at lower levels also dropped. By contrast, the number of students who have never engaged in any sport at any level has been increasing, which confirms the theory that the lifestyle of the youth has been truly changing.

The fact that there was a gradual decrease in the number of people born in the individual years of birth of the applicants might also have a negative effect. The students who studied at university in 2009-2012 were born in 1987-1989, which is a period when more than 128 thousand children were born in the Czech Republic. The third period included students who were born in 1997-1999, which is a period when the birth rate was only 90 thousand and the base of potential students was thus 30% smaller than in the previous years. The selection of students for the field of physical education used to be more thorough as there were about 130 – 170 applicants every year and only about 15 students were accepted.

This ratio of accepted students (about 10 % of applicants) indicates that the University of Ostrava was able to choose the best students out of all the applicants interested in studying the field of physical education every year. As successful graduates of this field of study who later started working in the sports (physical education teachers, or trainers) where they could show at least the same level of performance as their predecessors, which was very gratifying and positive. The ratio has decreased in recent years, also due to the lower number of applicants (110 – 130 applicants), however, more students are being accepted ($n = 40$), which means about 30 % of accepted applicants. The outcomes of our study are not in compliance with the outcomes of a similar study in the Czech Republic that was performed on applicants for the field of sports management, where the authors did not find any significant differences in the performances of the applicants in selected motor tests (Vala et al., 2018).

Table 2: Basic descriptive statistics of female university students in the field of physical education

Event	Period	Mean (95 % CI)	Med	IQR	Min	Max	p-value	ES
Sprint 100m (s)	2009-2012	14.30 (14.13; 14.48)	14.30	0.78	12.4	16.1	< 0.001	0.165
	2013-2015	14.6 (14.38; 14.82)	14.51	1.13	12.9	16.8		
	2016-2018	15.18 (14.88; 15.47)	15.11	1.10	13.4	16.9		
Long Jump (m)	2009-2012	4.36 (4.28; 4.44)	4.40	0.49	3.6	5.1	< 0.001	0.102
	2013-2015	4.13 (4.06; 4.22)	4.15	0.33	3.4	4.7		
	2016-2018	4.19 (4.09; 4.29)	4.11	0.33	3.6	4.8		
Shot Put (m)	2009-2012	8.47 (8.21; 8.74)	8.32	1.35	6.5	12.6	0.311	0.009
	2013-2015	8.67 (8.42; 8.92)	8.71	1.07	6.8	11.2		
	2016-2018	8.68 (8.26; 9.10)	8.70	1.63	6.7	12.9		
Run 800m (s)	2009-2012	190.9 (186.9; 194.8)	191	23	162	238	0.005	0.054
	2013-2015	195.7 (190.4; 200.9)	198	32	163	248		
	2016-2018	201.1 (195.8; 206.5)	200	20	167	252		

Note: n(2009-2012) = 64, n(2013-2015) = 53, n(2016-2018) = 37, 95% CI – 95% Confidence Interval for Mean (Lower Bound; Upper Bound), Med – Median, IQR – Interquartile Range, ES – Effect Size (η^2).

However, the study was performed on applicants and university students in 2003 – 2013 and the authors state that it is possible to anticipate a reduction in the students' performance in the future, i.e. after 2013, namely due to the decrease in the number of university students. As there are fewer students applying to universities in general and their level is decreasing, some universities lowered the minimum acceptance limits, and some universities even completely canceled the practical part of their acceptance criteria. The question is whether or not the reduction of the minimal limits for practical university acceptance exams, or even their complete cancellation, is the proper way? Many studies indicate that it is possible to achieve significantly better performances in tests focused on the strength of upper limbs (Pereira Neiva et al., 2018), development of quickness and endurance skills through systematic training in quite a short time (8 – 12 weeks). Thus, it is possible to eliminate major deficiencies of students in a particular area during one term, with the main factors being motivation, effort and will of the students. One of the possible solutions could be the procedure applied by the Charles University in Prague, as the most prestigious university in the Czech Republic with its own department of physical education and sports that offers preparatory courses to prospective students with the aim to improve, train and prepare students to a particular level of minimum performances in the activities required for the acceptance procedure, or for the fulfillment of the credit requirements.

Improving the level of skills and abilities of future teachers could have a positive impact on their future work experience, similarly to the findings regarding students of medicine who did not feel competent enough to advise other people on physical activity unless they themselves practiced sports. However, when they did sports, they felt more confident because they had broader knowledge and skills in the area of physical activity and could demonstrate it (Kohl III et al., 2019).

Strengths and limitations

A great advantage of the presented study is the overall length of the studied period and the size of the set where the results of 424 students in the field of physical education over the course of 10 years were compared. Long-term studies involving a large group are usually more valuable as they allow to eliminate many random factors and may indicate a potential long-term effect of one of the factors. In our case, unfortunately, some of the aforementioned factors, such as manifested changes in lifestyle, had a negative effect on the results of the students' motor skills. On the other hand, the limitations of the study have to be taken into account as well, especially the fact that the outcomes we state can be generalized mostly for the students of the University of Ostrava. For generalization including the entire Czech Republic, it would be appropriate to perform similar studies at other universities that offer field of study focused on physical education and where students are subjected to standardized motor tests, or athletic events within the acceptance procedure, or the actual education.

Conclusion

The quality of PE classes at elementary and high schools depends on the quality and readiness of the teacher who should not only be prepared by the university with regard to knowledge, but who should also master a series of skills related to various physical activities, as well as have some level of physical fitness that influences the quality of the learned skills. Unfortunately, we have to state that the changes in the lifestyle of the youth, together with other factors, have a negative effect on the performance of students in the field of physical education in the selected athletic events. The number of subjects focused on theory increases in the study of physical education and the number of lessons dedicated to practical training decreases, together with the decreasing credit requirements. Students then lose their current performance during the study and they are often not able to reinforce the new skills to the point where they would be able to use them practically in their role of a teacher at elementary and high school. The new teachers often do not have the courage to teach more "complicated" activities due to the fact that they would not be able to demonstrate them and PE lessons are then managed one-sidedly, making use of sports games without previous practice and demonstration of skills, or

monotonous timed running in athletics. PE classes are losing their aspects of diversity and fun, thus failing in creating the much desired relationship of children to any physical activity. As children learn through imitation, good-quality and proper demonstration is crucial for children at elementary school. What often happens is that many older teachers are much more skilled than a fresh university graduate, which might be also caused by the fact that older teachers also had to pass a practical final state examination in addition to the theoretical one. As PE classes are often the only physical activity for many children during the week and one of the important tasks of a PE teacher is to teach the youth to enjoy a regular exercise, the outcomes of our study are a very negative message for work experience and therefore we propose the following practical recommendations with the view of remedying the current situation in the future.

Practical recommendations

“Diagnostic courses” offered to applicants for PE study prior to the acceptance procedure where a suitable training plan would be recommended and implemented based on the level of their skills and abilities determined by initial diagnostics. Introduce a “preparatory course for students” in the first week of the study with the aim to check their readiness for the study and eliminate major deficiencies. Increase the number of practical training lessons for PE students. Do not decrease the minimal limits for acceptance or credit requirements for the students. Re-introduce “practical state final examinations from gymnastics and athletics” at the end of the study. Lay emphasis on practical demonstrations by teachers in PE classes as early as in the first stage of elementary education. Build a positive relationship to physical activity by providing positive experience with PA, and by getting students actively involved in PA.

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