

SZUBERT, Jędrzej and KEMPIŃSKA-PODHORODECKA, Agnieszka. The Impact of the Pandemic Caused by the SARS-COV-2 Virus on the Functional Fitness of Young Football Players Training from 2017 to 2022. (2025). Title of the Paper. Journal of Education, Health and Sport, 80, 60955. eISSN 2391-8306.

<https://doi.org/10.12775/JEHS.2025.80.60955>

<https://apcz.umk.pl/JEHS/article/view/60955>

The journal has had 40 points in the Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).

Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu). © The Authors 2025; This article is published with open access by Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland.

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Received: 21.04.2025. Revised: 25.04.2025. Accepted: 23.05.2025. Published: 26.05.2025.

The Impact of the Pandemic Caused by the SARS-COV-2 Virus on the Functional Fitness of Young Football Players Training from 2017 to 2022

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Abstract

Introduction. Functional fitness, which is essential in football, necessitates consistent training, the absence of which may lead to a decline in physical performance and motor coordination. The COVID-19 pandemic significantly restricted social and athletic activities in Poland during the years 2020–2022. The imposed public health measures—such as the closure of sports facilities and the limitation of training to individual formats—adversely affected the motor development of athletes in football clubs.

Purpose. The aim of this study is to evaluate the impact of the COVID-19 pandemic on the physical fitness of youth athletes from the Pogoń Szczecin Football Academy (AP Pogoń Szczecin).

Material and methods. The study included 83 male participants aged 14, 77 aged 15, 84 aged 17, and 75 aged 19. Selected fitness assessments—including the Beep Test, 30-meter sprint, and Repeat Sprint Ability (RSA) Test—were used to evaluate the motor abilities (speed and endurance) and recovery capacity of athletes from the Pogoń Szczecin Football Academy (AP) between 2019 and 2022. The tests were conducted under the supervision of trained coaching staff using electronic timing gates.

Results. In contrast to the 17- and 19-year-old football players, the COVID-19 pandemic led to a decline in sprint performance and Beep Test results among the 14- and 15-year-old athletes. In the younger age groups, performance began to improve following the resumption of regular training; however, within a two-year period, it did not fully return to pre-pandemic levels.

Conclusion. The COVID-19 pandemic, restrictions on access to sports infrastructure, and the shift to individually conducted training sessions with limited coach supervision had a negative impact on the functional capacity of youth football players.

Keywords:

Youth football, COVID-19 pandemic, Motor performance, Training interruption, Functional fitness

Introduction

The COVID-19 infectious disease pandemic had a profound impact on the entire population in Poland. One of the first measures implemented at the end of March 2020 was the transition of the entire educational system from in-person to remote learning. A ban on non-essential outdoor activity was also introduced, with exceptions limited to activities such as grocery shopping, commuting to and from work, assisting close relatives, and seeking medical care [1]. Shopping malls, restaurants, bars, cinemas, theatres, gyms, and fitness clubs were closed. Public gatherings involving individuals not from the same household were prohibited. In March 2020, all football competitions organized by the Polish Football Association (PZPN) and regional football associations were suspended. Under these conditions, athletes lost access to essential training facilities such as football pitches, gyms, and sports halls. All group training sessions were replaced by individualized training programs based on instructional plans prepared by coaches. In April 2020, for several weeks, access to forests and parks was also restricted, which further hindered athletes' ability to engage in independent physical training [2].

Functional fitness refers to the ability to efficiently perform both simple and complex motor tasks in an ergonomic manner. This includes athletic activities such as football, which require athletes to possess a wide range of integrated motor skills, allowing for the execution of highly coordinated movements and the effective functioning of the body as a whole [3]. Achieving this level of performance demands advanced neuromuscular control, enabling rapid decision-making and precise execution of motor actions [3,4].

All of these components are developed through a long-term training process, which may span several years or even decades, underscoring the importance of consistent and structured training. Factors that can adversely affect functional capacity include chronic psychological stress, reduced training frequency or complete cessation of training, muscular

imbalances resulting from asymmetric muscle activation, suboptimal exercise technique, and inadequate nutrition [4].

The COVID-19 pandemic had a substantial impact on both the psychological and physical well-being of the general population [4]. This was largely due to legal restrictions that prohibited unrestricted movement within urban areas, as well as access to forests and parks. As a consequence, many individuals were forced to forgo outdoor physical activities and structured exercise in designated facilities, replacing them with limited in-home physical activity and a shift toward a sedentary lifestyle.

Purpose

The aim of this study is to assess the impact of the COVID-19 infectious disease pandemic and its associated social context on the motor performance of youth football players at the Pogoń Szczecin Football Academy (AP Pogoń Szczecin).

Material and methods

The study was conducted from March 2019 to July 2022. Only male participants were included: 83 in the under-14 (U14) age category, 77 in under-15 (U15), 84 in under-17 (U17), and 75 in under-19 (U19). The inclusion criteria comprised regular participation in football training, age ≤ 19 years, and informed consent to participate in the assessments. Exclusion criteria included poor general health status or an active musculoskeletal injury.

The athletes' training microcycle consisted of one week, including four on-field sessions and one gym-based session. During the lockdown period (March to May 2020), both on-field and gym training were suspended. As of May 2020, on-field training was resumed in small groups of up to eight players. Functional fitness assessments—including the Beep Test, 30-meter Sprint Test, and Repeat Sprint Ability (RSA) Test—were administered regularly at several-month intervals. All tests were conducted using electronic timing gates under the supervision of certified coaching staff.

The Beep Test is a 20-meter shuttle run in which athletes run back and forth between two points. Electronic timing gates detect when the player crosses the designated line [6]. The test is divided into progressive stages, with the pace increasing at each level. The athlete must reach the opposite line before the auditory signal indicates the start of the next shuttle. The test assesses aerobic endurance and the ability to sustain high-intensity effort.

The 30-meter Sprint Test is a linear sprint assessment used to evaluate maximum running speed and sprinting capacity. The athlete is instructed to cover the 30-meter distance as fast as possible, with timing recorded from the start to the moment the athlete crosses the finish line. Each player performs three attempts, with the fastest time used as the final result. This test is widely used to monitor progress in speed development [7,8].

The Repeated Sprint Ability (RSA) Test evaluates the athlete's capacity to perform multiple high-intensity sprints with brief recovery periods—an essential ability in football, which demands intermittent bursts of maximal effort. The RSA protocol consists of eight 20-meter sprints, each separated by a 10-second rest interval. Athletes perform each sprint at maximal intensity, rest briefly, then repeat the effort. The test assesses the ability to maintain high sprint performance across repeated bouts and the efficiency of recovery mechanisms. It is particularly valuable for identifying anaerobic endurance and neuromuscular resilience in sports requiring repeated acceleration during match play or competition [8,9].

Results

Functional fitness is closely related to the training experience of athletes. Lower results in the 30-meter sprint test were observed in 14-year-old athletes (U14) compared to 19-year-old athletes (U19) (4.6 ± 0.3 vs. 4.1 ± 0.1 , $p < 0.0001$) (Fig. 1).

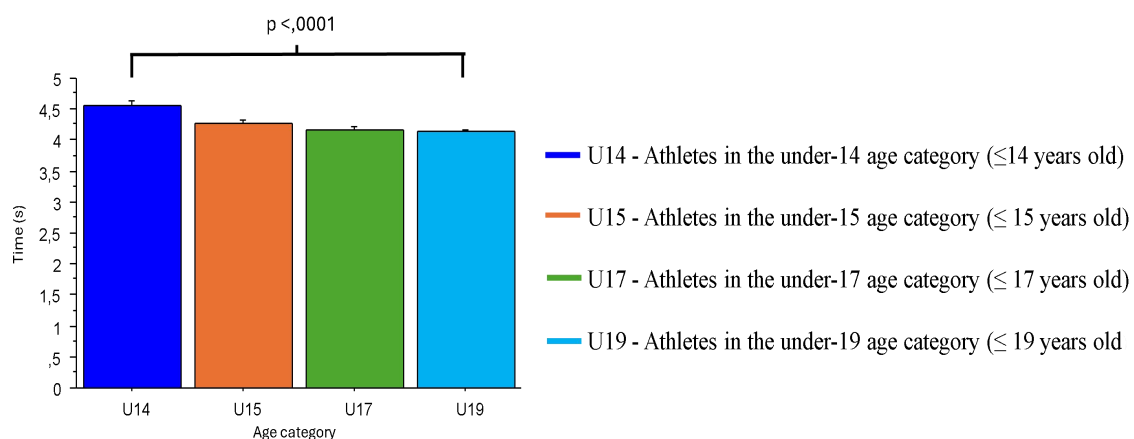


Fig. 1. 30-meter sprint test results on march 2019

The results of the 30-meter sprint test clearly demonstrated the negative impact of the COVID-19 pandemic on athletes' sprint performance, particularly in the U14 age group, where the decline in physical condition was most pronounced when comparing results from

January 2019 and August 2020 (4.6 ± 0.3 vs. 4.9 ± 0.2 ; $p = 0.0002$). The test results from 2022 suggest a positive effect of the resumption of team-based training under the supervision of coaching staff (4.9 ± 0.2 vs. 4.6 ± 0.2 ; $p = 0.003$), approaching pre-pandemic levels recorded in January 2020.

Among 15-year-old athletes, a statistically significant deterioration in sprint performance was observed when compared to pre-pandemic data (4.3 ± 0.2 vs. 4.5 ± 0.2 ; $p = 0.005$). In contrast, no statistically significant differences were found in the performance of the U17 and U19 age groups during and after the pandemic period (Fig. 2).

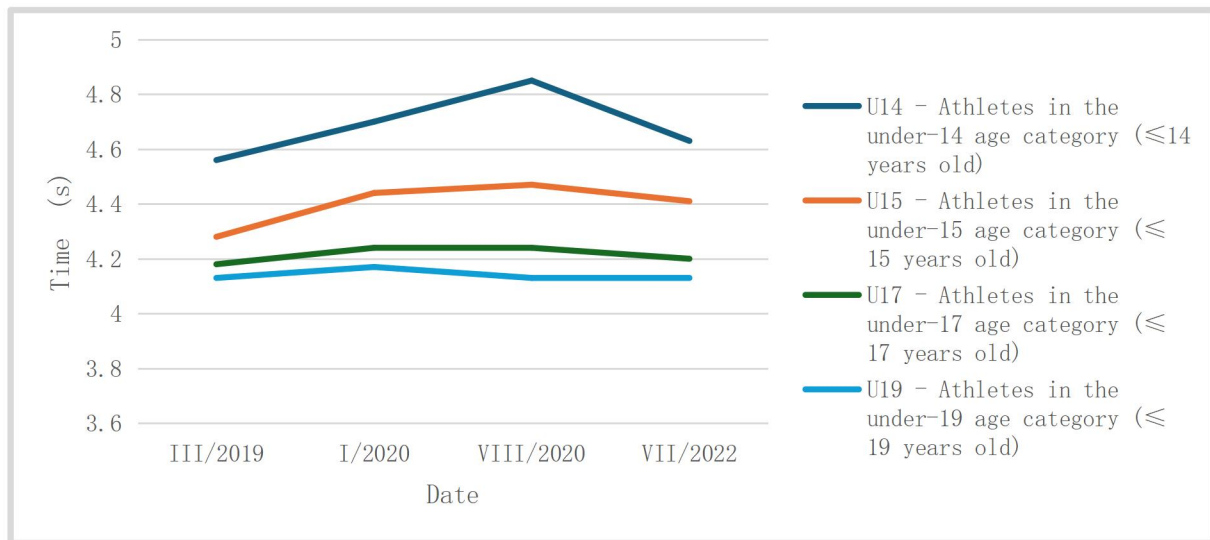


Fig. 2. Average time to cover the 30-meter distance by athletes from the following age categories.

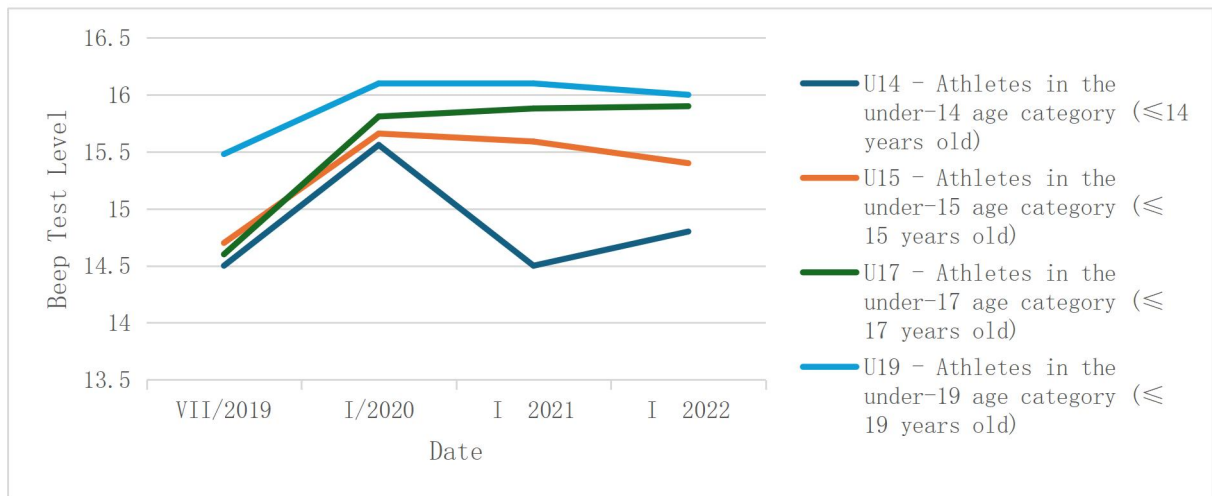


Fig. 3. Average Beep Test level at which athletes from the following age categories finished

In the case of the Beep Test, a significant decline in performance was observed in the U14 age group between January 2020 and January 2021 (14.5 ± 0.9 vs. 15.6 ± 0.6 ; $p < 0.0001$), indicating a decrease of one stage in aerobic capacity. In contrast, no statistically significant differences were observed among the U15, U17, or U19 age groups during the same period (Fig. 3).

The average time to complete eight 20-meter sprints performed at short intervals (RSA test) indicated reduced motor performance in the U14 age group. Results from January 2020 were significantly better than those recorded in September 2020 (21.5 ± 1.1 vs. 22.1 ± 0.9 ; $p = 0.03$) (Fig. 4).

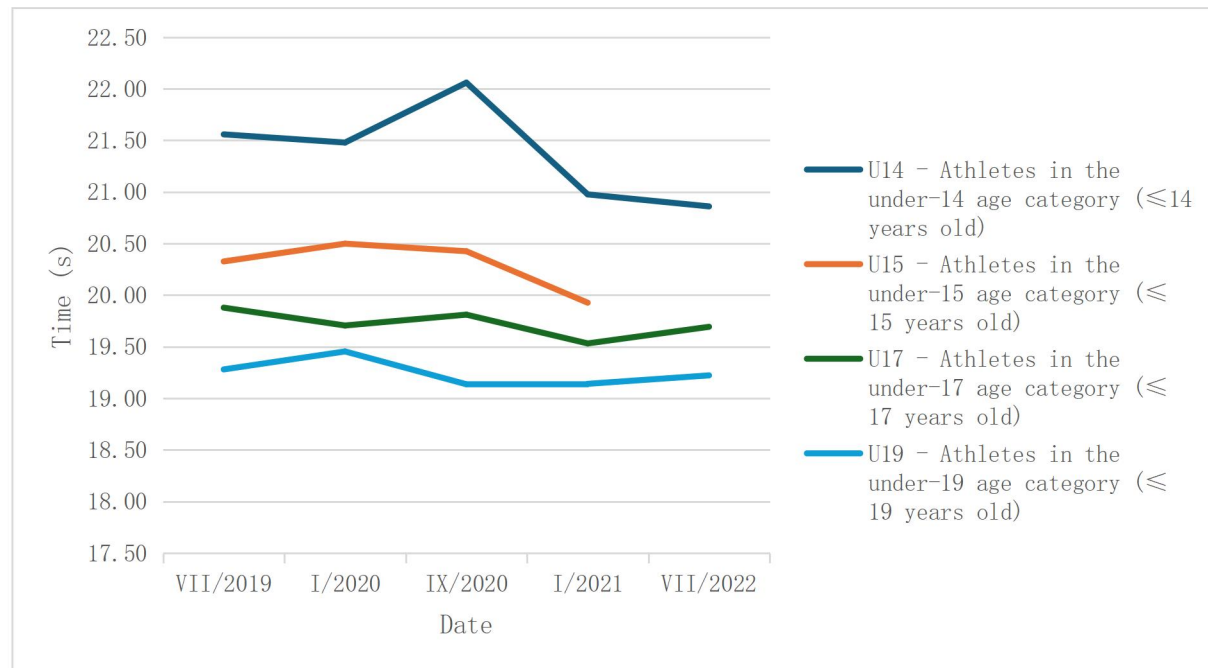


Fig. 4. Average time to complete the eight distances by athletes from the following age categories

Discussion

The effects of lockdown and training restrictions had a long-term impact on the motor development of young athletes. Players with greater training experience consistently maintained high performance levels in the Beep Test, RSA Test, and 30-meter sprint throughout the study period, which can be attributed to a more developed neuromusculoskeletal system.

Restrictions on access to sports facilities such as gyms, fields, forests, and parks had a significant impact on the overall well-being of the population. According to studies conducted among individuals engaging in recreational strength training, the percentage of physically active individuals reporting spinal pain increased by as much as 28 percentage points [10]. Other research has demonstrated that SARS-CoV-2 infection itself has adverse effects on the cardiorespiratory system in members of the German federal athletic squad.

Approximately 60 days post-infection, a decrease in anaerobic threshold power and maximal oxygen uptake ($\text{VO}_{2\text{max}}$) was observed [11].

The data collected at the Pogoń Szczecin Football Academy indicate that the social conditions during the SARS-CoV-2 infectious disease pandemic had a substantial impact on both the psychological well-being and functional fitness of athletes aged 14–15. Speed-related motor abilities develop most dynamically during childhood and the early stages of puberty. Between the ages of 12 and 14, the rate of maturation of the nervous system may vary significantly among individuals; therefore, training programs should be tailored to the specific developmental needs of young athletes [12]. Notably, the greatest improvements in aerobic capacity among swimmers occur around the ages of 14–15, as demonstrated by research conducted on female swimmers from the Szczecin Swimming Club [13].

Another study conducted in China demonstrated a correlation between the duration of lockdown and a decline in physical fitness levels [14]. The study included both female and male university students. It was observed that during annual physical fitness assessments, performance in endurance, speed, and general fitness tests conducted one year prior to the pandemic was significantly better than the results obtained one year after the pandemic [14].

Other researchers found that young adults who had recovered from COVID-19 exhibited impaired physiological performance compared to non-infected peers—showing lower oxygen saturation levels and increased respiratory rates following exertion. These findings suggest potential long-term compromise of the respiratory and/or cardiovascular systems. Post-COVID individuals also reported lower sleep quality, which may negatively affect recovery and overall well-being. However, no significant differences were noted in body composition or quality of life measures [15].

In contrast, studies evaluating the effect of training on motor performance in physically inactive individuals showed that after six weeks, participants engaging in high-intensity functional training exhibited significantly greater improvements in motor performance and exercise motivation compared to those undergoing moderate-intensity aerobic training [16].

In the case of 17- and 19-year-old players training at the Pogoń Szczecin Football Academy, no significant impact of the COVID-19 pandemic was observed on motor performance parameters such as speed and endurance. In this age category, this stability may

be attributed to a more consistent and disciplined approach to completing individualized training programs during the lockdown period, greater awareness of the consequences of training limitations on the neuromuscular and musculoskeletal systems, and overall commitment to the training process. One of the limitations of our study may have been incomplete test data due to errors in timing system recordings using photocells, as well as missing RSA test results for the U17 group from August 2022.

Conclusion

The absence of individualized on-field training and the lack of direct supervision of 14- and 15-year-old football players during the SARS-CoV-2 infectious disease pandemic led to a deterioration in athletic performance outcomes. The performance metrics of young athletes gradually returned to baseline after approximately 4 to 6 months of consistent team-based training conducted under the supervision of a qualified coaching staff. This finding may suggest a higher level of intrinsic and extrinsic motivation among youth athletes to participate in structured team training, as opposed to independently following prescribed individual training plans provided during the lockdown period.

Disclosure

Conceptualization, Jędrzej Szubert and Agnieszka Kempieńska-Podhorodecka; methodology, Jędrzej Szubert; check, Agnieszka Kempieńska-Podhorodecka; formal analysis, Jędrzej Szubert; investigation, Jędrzej Szubert; resources, Agnieszka Kempieńska-Podhorodecka; data curation, Jędrzej Szubert; writing - rough preparation, Jędrzej Szubert; writing - review and editing, Agnieszka Kempieńska-Podhorodecka; visualization, Jędrzej Szubert; supervision, Agnieszka Kempieńska-Podhorodecka; project administration, Agnieszka Kempieńska-Podhorodecka. All authors have read and agreed with the published version of the manuscript.

In preparing this work, the author(s) used CHATGPT for the purpose of improving language and readability. After using this tool/service, the author(s) have reviewed and edited

the content as needed and accept full responsibility for the substantive content of the publication.

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