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Assessment of physical fitness of young rugby players of the club „MKS Ogniwo Sopot" after a year of systematic training

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Summary

Introduction: The aim of the study was to assess the physical fitness of young players from the club "MKS Ogniwo Sopot" after a year of systematic training and to evaluate the components of physical fitness supporting the motor performance of young rugby players. Overall balance, responsiveness, coordination, running speed and agility, and endurance were assessed to align with selected EUROFIT tests.

Results: Thirteen players took part in the study. Physical fitness was tested by using five EUROFIT tests. Statistically significant differences were found in the results of the following tests: Plate Tapping test, Standing Long Jump test, 10 x 5 m Shuttle test, Beep test. The only test with a statistically insignificant difference was the Flamingo Balance test.

Conclusion: Analyzing the presented research results, it can be concluded that the athletes obtained higher results than in the previous year, indicating the development of physical fitness components that support the motor achievements their. Physical fitness depends on these components, so we can conclude that an annual period of systematic training has had a positive effect on the physical fitness of young athletes.

Keywords: rugby; motor skills; testing

Introduction

Rugby is a team game that is perceived as a brutal and injury-prone sport, but it teaches discipline, overcoming one's own weaknesses and quick decision-making, which are features useful in the everyday life of every person (1,2). Quoting the words of the famous Winston Churchill „Football is a gentleman's game played by hooligans, while rugby is a hooligan's game played by gentlemen". This sport is diverse when it comes to the skills of players, there will be people with a higher level of speed, flexibility and agility, as well as strength (3-5). Thanks to the large range of physical fitness components that players; use during the match, training must be aimed at supporting players' skills. Multi-directional shaping is especially important in the second apogee of motor skills, that is „golden period of motor skills" in children, which means that children already have mastered all the motor activities characteristic of an adult human being, thanks to this, young players can focus on developing optimal motor shaping (6).

Regular tests to check the physical fitness of the players allow observation of physical fitness components supporting the motor performance of the players. The last stage of praxeological action, that is, the analysis of effectiveness, provides feedback on whether the teaching process has brought the expected results and whether there is a need to change the

nature of general development training. Demonstrating an increased level of physical fitness in these components can motivate young players to further engage in sports, developing confidence, self-belief, and a lifelong passion for movement (7-12).

Club „MKS Ogniwo Sopot" gives young athletes the opportunity to compete in the most important national tournaments for children, such as the Polish Junior Championships, the National Youth Olympics, or the Finals of the Tournament of the Regions. The club also organizes camps and trips to international tournaments, where players can improve their skills and compete and train with peers from other countries.

The aim of study

The aim of the study is to assess the physical fitness of young rugby players at the 'MKS Ogniwo Sopot' club after a year of systematic training. Further objectives include assessing the level of physical fitness components that support the motor performance of these young rugby players. The main research hypothesis assumes that the annual period of systematic training has a positive effect on the physical fitness of young athletes. This is leading to the development of physical fitness components that support their motor achievements.

Materials and methods of research

Thirteen players aged 10 to 12 years from the club participated in the study. The players trained three times a week for 90 minutes each session.

In order to verify the main hypothesis of the study, five EUROFIT tests were conducted, and an interview was conducted using a proprietary questionnaire. Approval was obtained from the bioethics committee (no. KB 277/2023) and the legal guardians of the young athletes.

The research presented in the work is based on a developed through scientific cooperation of a group of experts and European governments. Physical fitness was assessed using selected tests from the European Physical Fitness Test (EUROFIT), which evaluate general balance, hand movement speed, explosive strength, running speed, agility, and cardiopulmonary endurance.

The test subject begins the flamingo balance test. Player is standing with his foot on a special beam (length 50 cm, height 5 cm, width 3 cm) along its longitudinal axis. Then he grabs the foot of the non-dominant leg, bent at the knee and with the other hand rests on the trainer. The timer starts when the player stops using the trainer's support, and the test lasts until the moment of loss of balance, that is, letting go of the held foot or touching the surface

of the pitch with some part of the body. After each fall, the player resumes the starting position independently or with support. The total number of attempts is limited to a maximum of 15 trials in the first 30 seconds. The result of the test is the total number of tests needed to maintain balance on the beam for 60 seconds.

Test of the speed of movement of the hand, in which the subject is placed in front of the table, on which two rubber discs with a diameter of 20 cm are attached horizontally, whose centers are 60 cm apart and in the middle of the discs there is a rectangular plate with dimensions of 20x30 cm. The player stands with a slight step, places the less efficient hand on the rectangular plate, and positions the more efficient hand over the opposite disc.

The player then touches each disc alternately, as quickly as possible, completing a total of 50 movements (25 touches per disc). The total number of movements is 50, which means that each of the discs is touched 25 times. The test is performed twice, of which we record a better (shorter) time obtained by the subject, measured with an accuracy of 0.1 seconds.

Standing long jump test, in which the player assumes a position with feet in front of the starting line. Then, he flexes his knees and simultaneously moves his arms backwards. After making this move, then swing his arms forward and jumps, pushing off the ground with both feet to achieve the maximum possible distance. Landing should take place on both feet, while maintaining a vertical posture. Based on two jumps of the competitor, measuring the measure from the starting line to the nearest trace left by the heel of the test subject, we determine the longest jump with an accuracy of 1 centimeter.

10 x 5m Shuttle test, in which the the player starts running at the 'start signal,' aiming to reach the second line as quickly as possible, then returns, crossing both lines with their feet. This cycle is repeated 10 times in total. The result is determined on the basis of the time needed to run 10 cycles with an accuracy of 0.1 seconds.

The beep test player runs back and forth along a 20-meter stretch, following rhythmic sounds from a speaker to control their speed. At the sound of the signal, the player aims to be at one end of the section or the other, touching the line with their foot at each end. Initially, the speed is low, but gradually increases with every minute. The aim of the subject is to maintain a set rhythm, fed from the speaker, for as long as possible. The subject stops when he is unable to maintain a steady rhythm or when he feels unable to continue to the next stage. The result is the number of complete completed running levels.

In the interview questionnaire, the questions concerned the period of participation in systematic rugby training, physical activity with parents, involvement in other types of physical activity, and socio-demographic data.

The research was conducted during the children's training sessions at the club stadium in Sopot on an artificial surface. The results were compared with those from the previous year. They were made in the presence of coaches and a club physiotherapist.

Statistical analysis was carried out in the Statistica 13 program. The results were analyzed using various statistical methods, including the assessment of mean values, differences, standard deviations, and the Student's t-test, with a significance level set at $p \leq 0.05$.

Results

1) Characteristics of the study group

The characteristics of the test group are shown in Table I. The answers to the question about spending free time actively with parents were also taken into account. Below, in Figure 1, the sports that players trained in before they started attending rugby and the number of players who declared a given sport are shown.

Table I Average values (\pm SD) of body weight, height, BMI and period of participation in regular workouts.

Body weight [kg]	Height [cm]	BMI	Period of participation in regular training	Spending time actively with parents
47,5 \pm 8	150,5 \pm 11	22,5 \pm 3,5	3 years \pm 2 years	100 % players

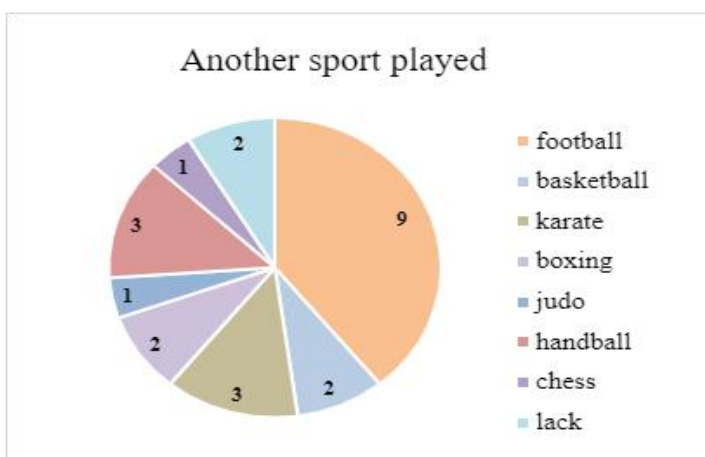


Figure 1. Declared sports practiced in the past by players.

2) Flamingo balance test analysis

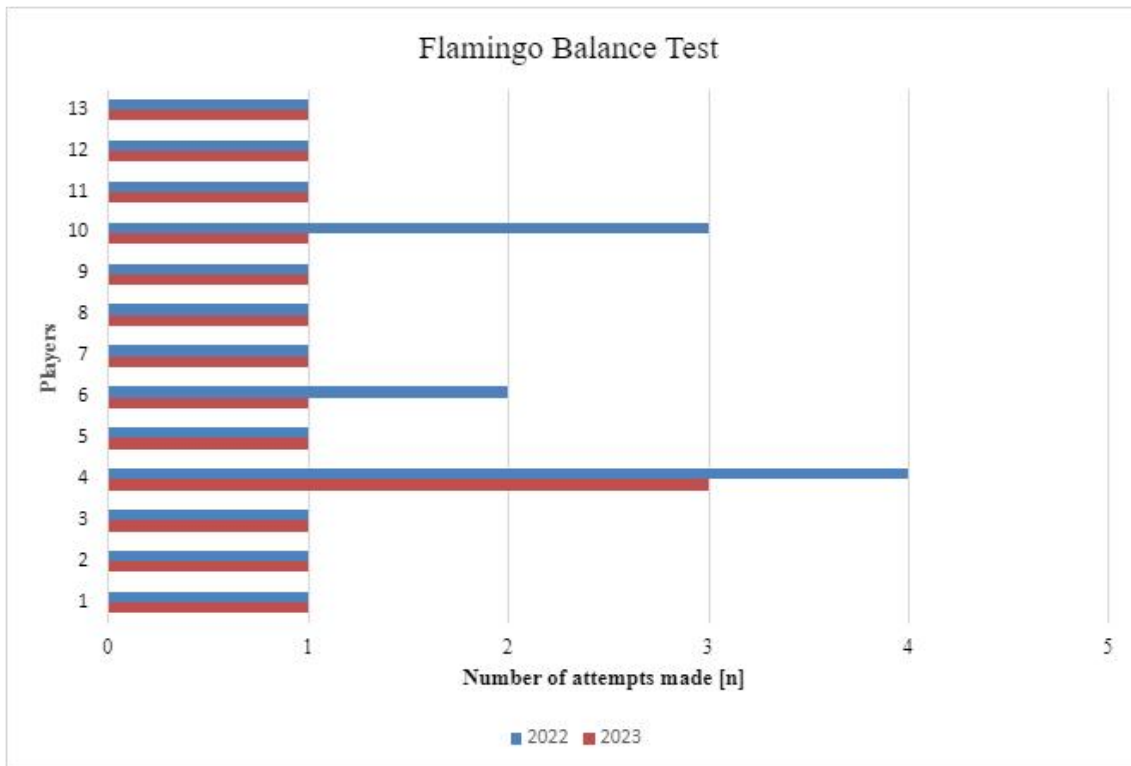


Figure 2. Comparison of the number of attempts to maintain the balance of individual players in 2022 and 2023.

Figure 2 indicates the number of trials that players need to complete a general equilibrium test. It has been shown that the best result is the completion of the trial on the first approach. The worst result in 2022 was the completion of the test with 4 attempts; however, this improved to 3 attempts the following year.

Table II Mean value of study results with difference.

Research year	Flamingo Balance Test				
	Mean	SD	Difference	SD difference	p
2022	1,462	0,967	0,308	0,630	0,104
2023	1,154	0,555			

Table II shows that the difference between the average scores of the players is small, with an improvement of 0.308, which is not statistically significant.

3) Plate Tapping Test analysis

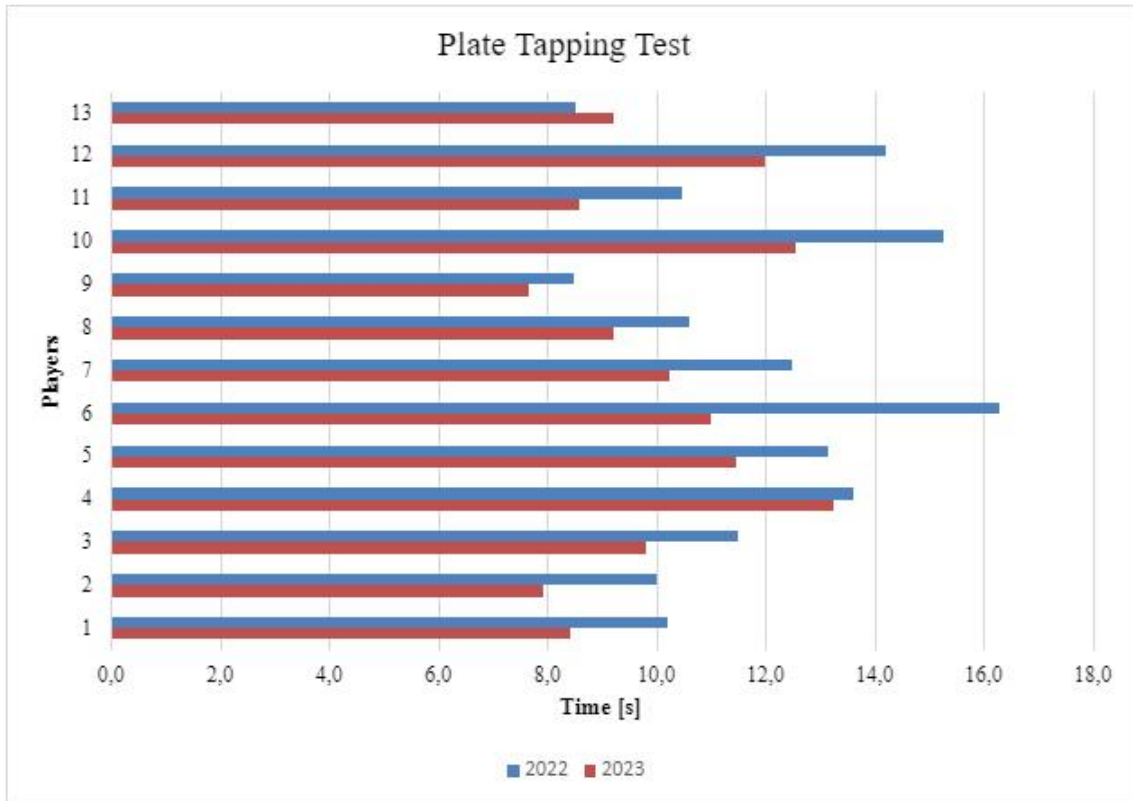


Figure 3. Comparison of the time obtained when trying the speed of hand movements by individual players in 2022 and 2023.

Figure 3 shows the times, in seconds, when players tested the speed of their hand movements. The best result in both 2022 and 2023 was achieved by player no. 9. The worst result in 2022 was scored by player no. 6, and in 2023 by player no. 4. It was also shown that only player 13 did not improve their result from 2022.

Table III Mean value of study results with difference.

Research year	Plate Tapping Test				
	Mean	SD	Difference	SD difference	p
2022	11,908	2,483	1,808	1,380	0,000
2023	10,101	1,823			

Table III presents the difference indicates a statistically significant improvement in the average score of players by 1,808 seconds.

4) Standing Long Jump Test analysis

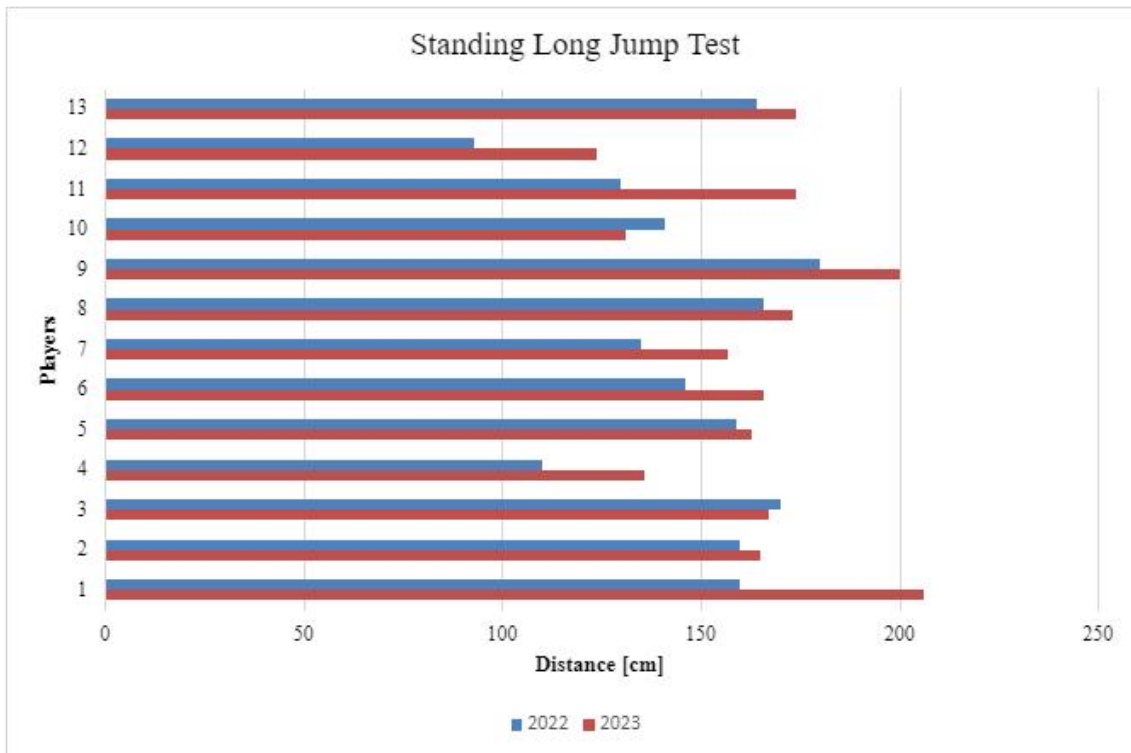


Figure 4. Comparison of distances obtained during the test of explosive strength by individual players in 2022 and 2023.

Figure 4 shows the distance of the jump in the standing long jump test. In 2022, player number 9 achieved the longest jump, while in 2023, player number 1 surpassed all others. Player number 12 had the poorest result in both 2022 and 2023 but managed to improve from 2022. However, only player number 3 and player number 10 failed to surpass their 2022 performances.

Table IV Mean value of study results with difference.

Research year	Standing Long Jump Test				
	Mean	SD	Difference	SD difference	p
2022	147,231	25,007	-17,077	17,032	0,004
2023	164,308	23,939			

The difference in the average score shows a statistically significant improvement of 17,077 cm which is present in Table IV.

5) 10 x 5m Shuttle Test analysis

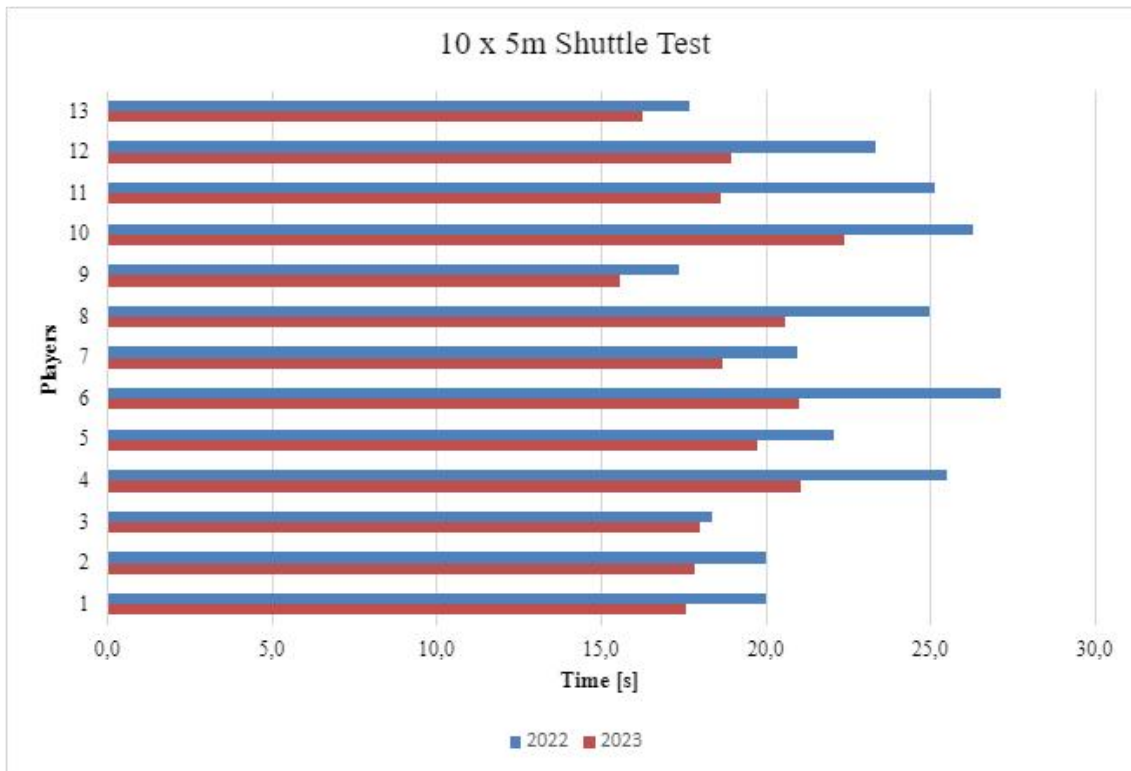


Figure 5. Comparison of the time obtained during the running speed test, agility by individual players in 2022 and 2023.

Figure 5 shows the time during which the competitors performed the test of running speed and agility. In both 2022 and 2023, player no. 9 achieved the best result. The worst result was achieved in 2022 by player no. 6, and in 2023 by player no. 10. All competitors in 2023 completed the test faster than the previous year.

Table V Mean value of study results with difference.

Research year	10 x 5m Shuttle Test				
	Mean	SD	Difference	SD difference	p
2022	22,225	3,406	3,271	1,836	0,000
2023	18,955	1,978			

Table V demonstrates a statistically significant improvement in the average score of players by 3,271 seconds compared to 2022.

6) 20m Multistage Fitness Test (Beep Test) analysis

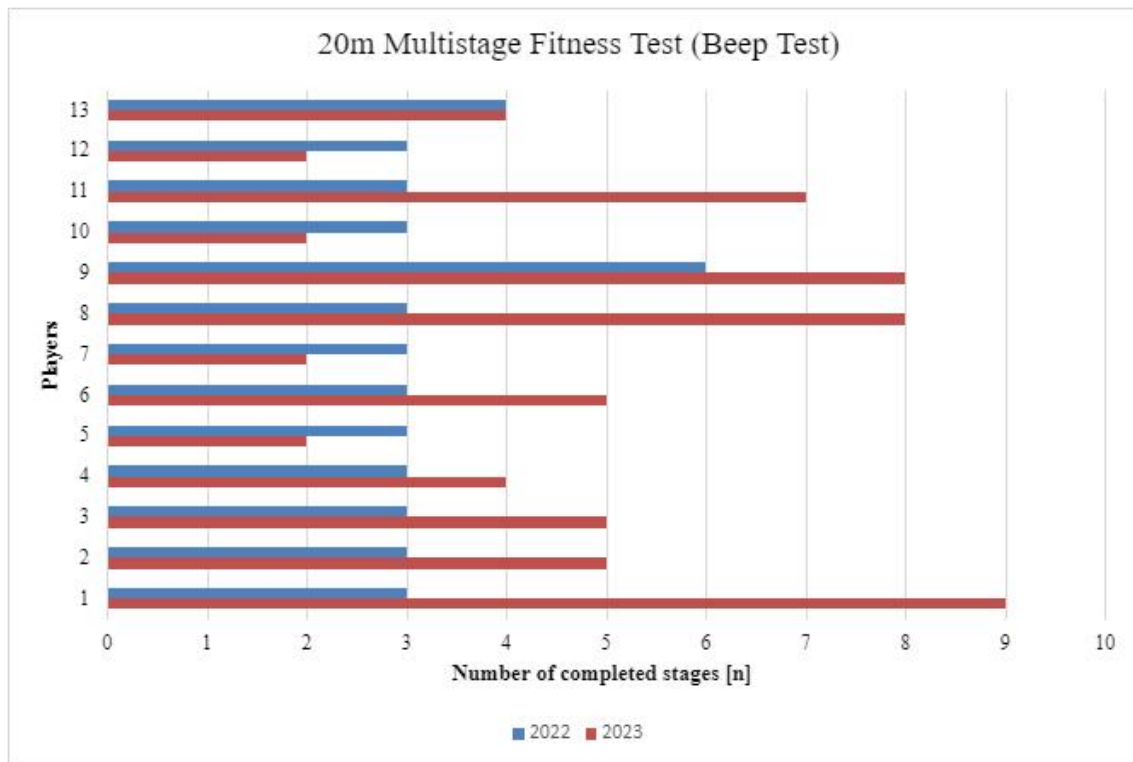


Figure 6. Comparison of the number of completed stages during the beep test by individual players in 2022 and 2023

Figure 6 shows the number of completed beep test stages. In 2022, player no. 9 achieved the highest number of completed stages, and this was also the case in 2023. However, the worst result differed between the two years. In 2022, 10 players reached only 3 completed stages, while in 2023, 4 players completed only 2 stages. One competitor completed the test at the same stage in both 2022 and 2023. Additionally, 7 players improved their results from 2022 to 2023.

Table VI. Mean value of study results with difference.

Research year	20m Multistage Fitness Test (Beep Test)				
	Mean	SD	Difference	SD difference	p
2022	3,308	0,855	-1,538	2,367	0,037
2023	4,846	2,512			

Table VI shows the difference in the average score of the players shows that the players statistically significant improvement by 1.538 stage.

Discussion

The presented research aimed to determine whether the annual period of systematic training has a positive effect on the physical fitness of young athletes and whether it leads to the development of physical fitness components that support their motor performance.

The study utilized selected samples from the EUROFIT test, recommended by the Council of Europe to assess the components of physical fitness. The quality of these tests shows that they have moderate to excellent reliability, which is why they are one of the most frequently used physical fitness tests (13-16). EUROFIT tests are used not only in schools during physical education lessons (17-19) but also to study players of various sports activities including dance, yoga, football, swimming, tennis, kickboxing, karate or volleyball (10,20-27). Physical fitness studies should focus on pre-adolescent and adolescence, so our study selected the age group of 10-12 years. Monitoring physical fitness in young athletes is crucial for coaches, as it helps identify strengths and weaknesses, providing feedback that can address deficiencies.

The study used various tests from the EUROFIT battery, allowing for a comprehensive assessment of different aspects of physical fitness, such as general balance, hand movement speed, explosive strength, running speed (agility), and cardiopulmonary endurance. It is worth noting that each of these aspects plays an important role in rugby, but the results focused mainly on strength and speed. Future research should also consider extending the analysis to include aspects such as flexibility and endurance

Rutkowski et al. examined physical fitness after a 10-week period of karate training for school-age children using EUROFIT tests. Their research found positive improvements in the training group's results. According to this study, children with normal body mass showed a greater improvement during the 10-week training period compared to those with overweight or obese bodies (28). In 2021, EUROFIT tests were also used to evaluate the development of skills in school children after basic training and karate training, showing improvements in some physical fitness parameters (29). In 2024, a study by Arsian et al. also found statistically significant improvements in motor performance after 10 weeks of karate training in children just starting the sport, indicating an increase in physical fitness levels (21).

Studies conducted by Momola(30) also show higher physical fitness scores of young ship players. The author concludes that the motor skills of volleyball players are more beneficial compared to national trials and trials of girls from Krakow schools. As shown by research conducted in 2020 by Hrycyna and Dabrowska, better results of EUROFIT tests during regular training of players were also observed. It was found that the high level of physical fitness of young volleyball players may be influenced, among others, by the time spent on physical activity (22). In the study, all rugby players declared that on non-workout days they spend time actively with their parents, which may give additional benefits to the physical fitness of the respondents. In my opinion, sports that players practiced before starting rugby training, ie football, basketball, karate, boxing, judo, handball, handball, chess could have influenced the development of various components of physical fitness, thanks to which such a variety of studies were obtained.

A study conducted in 2016 by Stankiewicz etc. (7) using the EUROFIT test trials at the football club "Gedania" Gdansk also showed an improvement in the results obtained by the players. What is important, the authors paid attention to showing by the test the problematic features of young players, thanks to which the players and the coach received feedback on what skills are worth focusing on to achieve even better sports achievements.

The effect of tennis training on the physical fitness of children aged 10-12 years was studied in 2016 (25). The study showed that playing tennis has a positive effect on children's motor skills. The authors also noted that long-term and regular workouts will have even more positive results on their physical fitness. These conclusions confirm the results of this study, in which physical fitness was tested after a year of regular training.

In 2017 Pabianek and etc. (31) examined the level of motor skills of young rugby players on the basis of selected EUROFIT test attempts and their impact on the effectiveness of players during games. The authors, based on the results, found that the majority of respondents with the best results in trials constantly occur in matches and regularly score points.

Undeniably, the study encountered some challenges and limitations. Controlling variable factors such as injuries or differences in player motivation were difficult to achieve. In addition, limiting the research sample to young players of one club may make it difficult to generalize the results to other age groups or clubs. In subsequent studies, these factors should

therefore be taken into account and an attempt to broaden the scope of the research sample should be made. Most of the available literature indicates insufficient research on the impact of regular training on the physical fitness of young rugby players. Most reports of cross-sectional studies do not show the impact of long-term, systematic training on physical fitness, and thus the health of young rugbyists.

Further research may focus on the analysis of the long-term effects of the training program and possible modifications that can further improve the physical fitness of young players. In addition, you can also explore the impact of regular workouts on other aspects of the game, such as technique, tactics or mental endurance, which can contribute to a more comprehensive understanding of the training process during rugby training. It is worth checking whether there is a dependence of the results on the position of the player's game and the formation in which he plays.

In the light of the results obtained, it can be concluded that the study brought important insights into the impact of systematic training on the physical fitness of young rugby players. However, there is a need for further research to better understand the changes in physical fitness levels under the influence of regular rugby workouts.

Conclusion

Analyzing the presented research results, it can be concluded that the athletes achieved higher results than in the previous year, demonstrating the development of physical fitness components that support their motor achievements. Physical fitness depends on these components, so we can conclude that an annual period of systematic training has a positive effect on the physical fitness of young athletes. These results are important for players and coaches, because they provide information on the strengths and weaknesses of the athletes' physical fitness and indicate which components are worth developing to help young athletes achieve better sports results.

Disclosures

Author's contribution:

Conceptualization, Martyna Póltoranos, Radosław Perkowski;

Methodology, Martyna Póltoranos, Radosław Perkowski;

Software, Martyna Póltoranos;

Check, Martyna Póltoranos, Radosław Perkowski;

Formal analysis, Radosław Perkowski;

Investigation, Martyna Półtoranos;

Resources, Martyna Półtoranos, Radosław Perkowski;

Data curation, Martyna Półtoranos, Radosław Perkowski;

Writing - rough preparation, Martyna Półtoranos;

Writing - review and editing, Radosław Perkowski;

Visualization, Martyna Półtoranos, Radosław Perkowski;

Supervision, Martyna Półtoranos, Radosław Perkowski;

Project administration, Martyna Półtoranos, Radosław Perkowski;

All authors have read and agreed with the published version of the manuscript.

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The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of the bioethics committee (no. KB 277/2023, 11.07.2023).

Informed Consent Statement:

Informed consent was obtained from all subjects involved in the study.

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Conflict of Interest Statement: non

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