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LIMITING FACTORS IN ACHIEVING SWIMMING PERFORMANCE

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Abstract

Aim. The paper focuses on aspects regarding performance swimming in Romania over the past decade, taking into account several variables such as the number of athletes, infrastructure, competition system, issues faced by athletes and coaches, as well as the impact of the COVID-19 pandemic.

Methods. We analyzed data provided by the Romanian Swimming and Modern Pentathlon Federation (F.R.N.P.M.) and conducted surveys to better understand the current situation and challenges facing the swimming community in Romania.

Results. We developed two questionnaires, one addressed to athletes consisting of 23 items and one addressed to coaches, with 17 items. A total of 75 competitive swimmers, with an average age of 15.75 years, and 31 coaches responded to the questionnaires. The results confirmed the hypothesis that in Romania, as well, the adolescent period represents the stage where the dropout rate from competitive swimming is the highest and that the COVID-19 pandemic had negative consequences on athletes' preparation and increased the number of swimmers who withdrew from competitive sports activities.

Conclusions. It is essential to identify the factors that lead athletes to drop out or prematurely cease their sports activity, especially in the case of performance swimming, before they reached their peak performance. This is an initial step in developing solutions that motivate them to continue performing at the highest level, in the senior category.

Keywords: Swimming, performance sports, COVID-19 pandemic.

Introduction

The pyramidal nature of high-performance sports suggests that only a portion of the large number of children advance to the junior category, and afterwards, an even smaller number reach the senior level. This selection occurs naturally, as a result of individual development and physiological adaptation to the demands characteristic for high-performance sports. Planned and gradually supervised, scientific training from a young age has become an objective necessity, due to the high level of international performance and the requirements for future high-performance swimmers, who need continuous training for 8-10 years in order to achieve sporting mastery.

Understanding the variables that lead to abandonment or premature cessation of sports activities, in general, and performance swimming, in particular, before athletes feel they have reached their maximum potential, acts like a first step in implementing solutions that can encourage them to continue high-level performance activities.

In the last decade, performance swimming in Romania has seen significant development, both in terms of the number of athletes involved and the infrastructure and competitive system. However, the number of senior athletes practicing this sport is decreasing year by year, fact which raised our interest for this study topic.

From the analysis of national and international specialized literature, we found that the abandonment rate in sports as an organized activity oriented towards performance is continuously increasing across all age categories and represents a study area for many specialists aiming to understand this phenomenon.

In recent years, national swimming competitions for juniors, youth, and seniors have gathered an extremely reduced number of senior participants, approximately 15 competitors over the age of 18, while globally, the average age in a final is 20 years, with few exceptions of 17-18-year-old athletes.

Usually, high-performance athletes retire from sports due to factors such as: the increasingly difficult achievement of selection criteria for representative teams or squads; physical and mental fatigue; psycho-social difficulties; declining results/performances; injuries or health issues; new social and professional priorities; changes in family relationships.

Retirement represents a natural and expected process that athletes undergo when they believe they have reached their maximum potential, feel satisfied with the work they have put in and the results they have achieved, and, of course, have reached a certain age or had a long sports career. Retirement, according to the specialized literature, which occurs at different ages compared to dropout, also refers to the results obtained, success in competitions, the duration of practicing high-performance and elite sports (longevity in a sports career). (Alfermann et al., 2004; Larsen & Alfermann, 2017; Wylleman et al., 2004)

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Another facet of the limiting factors encountered was addressed in the study conducted by Dos Santos et al. (2020) on the differences in the perception of burnout syndrome among young people aged 14 to 17, in both individual and team sports. The paper highlights the need for better prevention, especially among young people, to combat the abandonment of high-performance sports.

The psycho-pedagogical side of the training process was emphasized in the study authored by Razmaite & Grajauskas (2021) which investigated the relationship between the teaching styles of swimming coaches and the motivation of their athletes, based on self-determination theory. It examined 148 young swimmers and their 18 coaches by means of questionnaires, in order to to categorize teaching styles and measure motivation. The research partially confirms its hypothesis: while the coaches' teaching styles significantly influence the athletes' external motivation, they do not have a substantial effect on intrinsic motivation. This suggests that more authoritarian, reproductive methods (such as command and practice) may increase external motivation but do not influence the athletes' internal drive. The research highlights the complexity of motivational dynamics in swimming, influenced by the demanding nature of the sport and the prevalent use of command-based training.

Objectives

The aim of this study is to highlight the bio-psycho-social difficulties encountered by athletes in competitive swimming, which can lead to early or voluntary cessation before athletes have reached their full potential.

In this regard, we aimed at collecting and correlating as much data as possible to scientifically analyze the process that leads athletes to abandon competitive swimming and to explain why we face such a small number of senior athletes in national swimming competitions. Additionally, we are interested to assess the extent to which the COVID-19 pandemic has impacted the training and competitive activities of performance swimmers, in terms of training schedules and competition participation, and to identify the psychological and physical consequences of this situation on the athletes.

Methods

The high dropout rate among adolescents in competitive swimming in Romania is driven by a combination of limiting factors, including insufficient sports infrastructure, lack of adequate funding, prolonged interruptions in training due to the COVID-19 pandemic, and the failure to adapt training methods to the psychological and social needs of the athletes.

From October 2022 to January 2023, we analyzed the databases managed by the Romanian Swimming and Modern Pentathlon Federation, supervised by the Ministry of Sports, for the period between 2012 and 2021. The primary purpose of this analysis was to determine the annual number of registered athletes and active participants within the national competitive structure, categorized by age groups, including children, cadets/juniors/youth, and seniors.

Following this data analysis, we developed questionnaires, which were subsequently distributed to coaches and athletes in the cadets, juniors, youth, and seniors categories within the federation. The main goal of these surveys was to identify the factors leading to athletes' withdrawal from competitive swimming and to assess the psychological, morphological, and functional effects of the COVID-19 pandemic on swimmers.

The questionnaire for swimming coaches included: 5 introductory questions, focusing on their professional experience and the level of the athlete groups they work with, 2 questions regarding the composition and homogeneity of the group, and 10 open-ended questions with multiple response options, focused on the challenges encountered during training sessions.

At the same time, the questionnaire for athletes consisted of: 10 introductory questions to determine the age category, performance level, and professional category of the subjects, 9 questions regarding the difficulties encountered, and 4 questions on how the COVID-19 pandemic affected their sporting activities and psychological state.

It is important to note that the survey participants included 74 athletes and 31 coaches. The athletes' ages ranged from 14 to 18 years, with an average age of 15.75 years, while the emphasis for the coaches was on accumulated years of experience, highlighting particularly those with ten or more years of involvement in the field.

Results

The motivation of athletes has changed throughout the time; simple trips abroad or food supplements no longer constitute motivating factors. Also, it is necessary to adapt the methodology of teaching swimming and training methods to the perception and thinking models of current generations" (F.R.N.P.M., 2019).

The varied motivations for practicing swimming reflect the complexity of factors that influence athletes' involvement. Identifying and understanding these motivations are crucial for developing effective dropout prevention strategies. Personalized approaches that address the individual needs of athletes can help maintain their participation in competitive sports and improve their sporting experience.

Table 1. Descriptive analysis of athletes' questionnaire responses

	N	MEAN	MEDIAN	MODE	STD. DEV.	VARIANCE	SKEWNESS	STD. ERROR SKEWNESS	KURTOSIS	STD. ERROR KURTOSIS	MIN	MAX
AGE	74	15.74	14	14	6.09	37.04	4.17	0.28	19.46	0.55	10	50



START	74	6.19	6	6 ^a	1.91	3.66	0.64	0.28	1.02	0.55	3	12
ORGANIZATION	74	1.76	2	2	0.49	0.24	-1.91	0.28	2.96	0.55	0	2
SPORT	74	1.96	2	2	0.20	0.04	-4.76	0.28	21.19	0.55	1	2
STATEMENT 1	74	4.64	4	4	1.95	3.80	-0.47	0.28	-0.09	0.55	0	7
STATEMENT 2	74	3.73	5	5	2.21	4.88	-0.62	0.28	-0.84	0.55	0	7
STATEMENT 3	74	2.77	2	2	2.24	5.03	0.62	0.28	-0.56	0.55	0	7
STATEMENT 4	74	2.99	3	3	2.23	4.97	0.12	0.28	-0.87	0.55	0	7
STATEMENT 5	74	3.05	2	0	2.92	8.52	0.21	0.28	-1.71	0.55	0	7
STATEMENT 6	74	2.28	1	0	2.63	6.92	0.59	0.28	-1.32	0.55	0	7
STATEMENT 7	74	1.32	0	0	2.09	4.36	1.62	0.28	1.36	0.55	0	7
TRAINING	74	7.32	7	6	2.49	6.19	1.55	0.28	3.58	0.55	4	17
STROKE	74											
NATIONAL CHAMPIONS HIP	74	3.41	4	5	1.65	2.71	-0.59	0.28	-1.11	0.55	0	5
ACTIVSP	74	.16	0	0	0.37	0.14	1.87	0.28	1.54	0.55	0	1
SWIMMING PROGRAM	74	.89	1	1	0.31	0.10	-2.58	0.28	4.77	0.55	0	1
PROBLEMS1	74	2.43	3	3	1.57	2.47	-0.25	0.28	-1.07	0.55	0	5
PROBLEMS2	74	1.73	1	0	1.99	3.95	0.59	0.28	-1.27	0.55	0	5
PROBLEMS3	74	1.36	0	0	1.93	3.71	0.94	0.28	-0.80	0.55	0	5
PROBLEMS4	74	1.03	0	0	1.77	3.12	1.38	0.28	0.22	0.55	0	5
PROBLEMS5	74	.92	0	0	1.73	3.01	1.68	0.28	1.18	0.55	0	5
AREA	74	2.89	3	3	1.03	1.06	-0.56	0.28	-0.81	0.55	1	4
FINANCIAL	74	1.24	1	1	0.49	0.24	1.20	0.28	1.39	0.55	0	3
ACHIEVEMENTS1	74	4.14	4	6	1.82	3.30	-0.86	0.28	0.13	0.55	0	6
ACHIEVEMENTS2	74	2.57	3	3	1.58	2.50	-0.36	0.28	-0.36	0.55	0	6
ACHIEVEMENTS3	74	2.95	4	4	2.14	4.57	-0.11	0.28	-1.36	0.55	0	6
ACHIEVEMENTS4	74	1.64	1	0	1.89	3.58	1.13	0.28	0.11	0.55	0	6
ACHIEVEMENTS5	74	2.11	2	0	2.29	5.25	0.57	0.28	-1.26	0.55	0	6
ACHIEVEMENTS6	74	2.34	2	0	2.37	5.62	0.22	0.28	-1.78	0.55	0	6
RENOUNCEMENT	74	.784	0	0.0	0.98	0.97	0.99	0.28	-0.20	0.55	0	3
OBSTACLES	74	3.122	2	0.0	2.99	8.93	0.45	0.28	-1.27	0.55	0	8
OBSTACLES1	74	2.122	0	0.0	2.95	8.71	1.06	0.28	-0.48	0.55	0	8
OBSTACLES2	74	1.541	0	0.0	2.57	6.61	1.46	0.28	0.71	0.55	0	8
OBSTACLES3	74	1.608	0	0.0	2.75	7.56	1.45	0.28	0.58	0.55	0	8
OBSTACLES4	74	1.622	0	0.0	2.77	7.66	1.39	0.28	0.35	0.55	0	8
OBSTACLES5	74	1.324	0	0.0	2.42	5.84	1.68	0.28	1.54	0.55	0	8
OBSTACLES6	74	1.338	0	0.0	2.54	6.47	1.73	0.28	1.53	0.55	0	8
OBSTACLES7	74	1.473	0	0.0	2.58	6.66	1.63	0.28	1.29	0.55	0	8
SOCIAL MEDIA	74	1.689	2	1.0	0.78	0.60	0.97	0.28	0.53	0.55	1	4
STUDY	74	2.541	3	3.0	0.97	0.94	-0.35	0.28	-0.47	0.55	0	4
SPECIFIC TRAINING	74	2.541	3	3.0	1.20	1.43	-0.12	0.28	0.05	0.55	0	5
ABANDON COLLEAGUES	74	1.311	2	2.0	0.81	0.66	-0.63	0.28	-1.18	0.55	0	2
THOUGHT	74	.432	0	0.0	0.50	0.25	0.28	0.28	-1.98	0.55	0	1
READJUSTMENT	74	3.189	3	4.0	0.85	0.73	-0.65	0.28	-0.62	0.55	1	4

A. MULTIPLE MODES EXIST. THE SMALLEST VALUE IS SHOWN

Descriptive analysis of the measured variables provides essential information for understanding the distribution and characteristics of the data. We will interpret the main variables from the provided table 2 from the athletes' perspective. Given that most of our variables are measured on a nominal or ordinal scale, we calculated the mode (the most frequent value). In this case, the mean and median are not very relevant. The standard deviation values for most variables (colored ones) indicate that our data series is not homogeneous, meaning significant variations between athletes based on their motives and training intensity. The Skewness values fall within the normal curve for all variables except age. The standard error for Skewness is 0.28, reasonably low. The closer the standard error values are to zero, the more accurate the calculations.

Most variables fall within an almost normal distribution, but there are notable exceptions (e.g., age, sport type, training, program) showing skewed distributions and pronounced peaks.

Next, we will analyze the factors, we consider relevant to our study in order to better understand the obstacles that swimmer athletes face on their path to high athletic achievement.

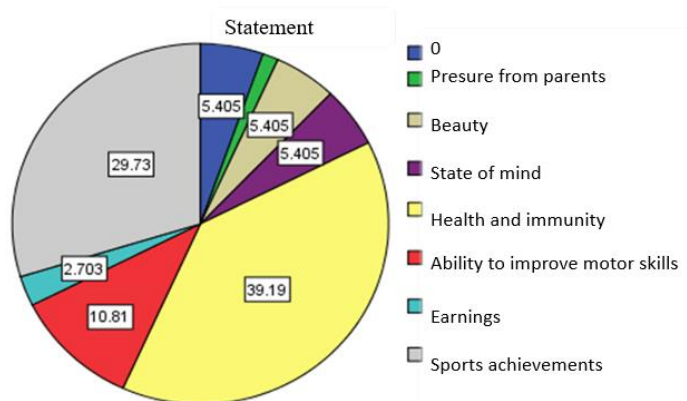


Figure 1. Athletes' Motivation for Practicing Performance Swimming

The analysis of the questionnaire responses reveals that the motivation for practicing swimming is complex and diversified. The primary reason for the majority of athletes is health, representing 39.19% of the responses. This reflects an increased awareness of the health benefits induced by swimming, such as improving the immune system, developing physical endurance, and cardiovascular capacities. Motivation for athletic achievements and recognition is also significant, with 29.73% of athletes indicating this reason. The desire for self-improvement and recognition of achievements are important factors in motivating athletes.

The motivation to improve motor skills is present in 10.81% of athletes. Technical mastery has a significant impact on performance, and athletes are motivated to enhance these skills.

Pressures from parents (5.405%), physical beauty (5.405%), mood (5.405%), and financial gains or status (2.703%) are less frequent but still relevant reasons. These factors indicate external and personal influences that can play a role in athletes' decision to practice swimming.

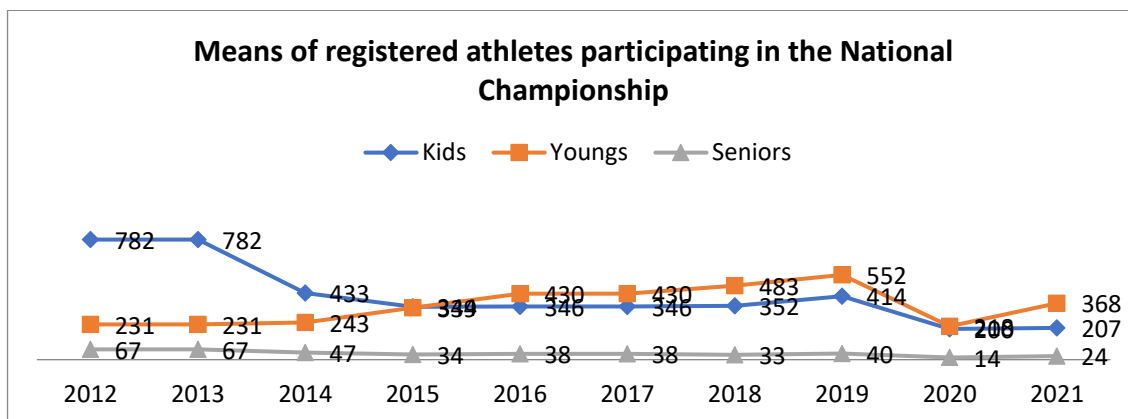


Figure 2. Annual averages by categories of athletes F.R.N.P.M

The downward trend (Figure 2) in the annual average number of senior athletes, from 67 in 2012 to 24 in 2021, could be attributed to various factors, including changes in the funding of sports programs, shifts in societal priorities, or even the individual preferences of senior athletes to pursue other activities or careers. Additionally, the Covid-19 pandemic likely had an impact, disrupting training programs, limiting access to facilities, and creating uncertainties linked to the future of performance sports, leading some senior athletes to discontinue their participation.

The study conducted by Teodorescu et al. (2021) revealed that Romanian coaches faced significant difficulties in conducting online training sessions during the first lockdown caused by COVID-19. They had to adjust their initial goals and use their own financial resources to provide the necessary IT tools. The efficiency of online training was influenced by the ability to use IT tools and the professional experience of the coaches, and more than half of them failed to engage all athletes in online training sessions. These challenges had consequences on the professional self-efficacy of the coaches.

The steady decline in the annual average number of children participating in swimming, from 782 in 2012, to 207 in 2021, might also be influenced by demographic factors. Economic conditions can affect parents' decisions to enroll their children in sports programs, as participation often involves financial costs for equipment, training, and travel expenses. Additionally, the Covid-19 pandemic likely exacerbated the decline by limiting opportunities for children to engage in swimming activities due to facility closures, social distancing measures, and concerns about virus transmission.

Based on this data, we identified key aspects that helped us better understand the difficulties caused by the COVID-19 pandemic on athletes' training programs. The presented data clearly showed that the majority of athletes were significantly affected by the pandemic, especially in the 2019-2020 season. Approximately 45.95% of athletes were unable to conduct specific training sessions for 2-3 months, representing a significant period without access to the pool. Additionally, approximately 20.27% had a period of about 2 months without any specific training (see Figure 3).

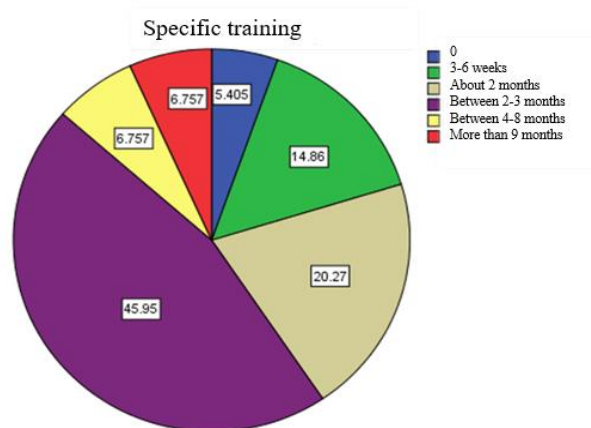


Figure 3. Number of training sessions during the pandemic

Table 2. Analysis of the frequency of training sessions during the pandemic

Valid		Frequency	Percent	Valid	Cumulative
				Percent	Percent
	0	4	5.4	5.4	5.4
	3-6 weeks	11	14.9	14.9	20.3
	Approximately 2 months	15	20.3	20.3	40.5
	Between 2-3 months	34	45.9	45.9	86.5
	Between 4 - 8 months	5	6.8	6.8	93.2
	> 9 months	5	6.8	6.8	100.0
	Total	74	100.0	100.0	

This break in training had a significant impact on the athletes' level of preparation and performance. Moreover, approximately 14.86% of athletes had a period of 3-6 weeks without specific training, while 6.75% had a longer break, ranging from 4-8 months or even more than 9 months. These prolonged periods of training interruption can significantly affect athletes' performance and create difficulties in returning to their previous level.

Frequency analysis is a method of descriptive statistical analysis that summarizes data by counting the frequency of occurrence of each variable's values in a dataset. In this study, data regarding the interruption period of athletes' training were categorized and analyzed to determine the percentage and frequency of each specified time interval. (Table 2)

Table 3. Communalities^a

	Initial	Extraction
<i>Training</i>	1.000	.744
<i>Obstacles</i>	1.000	.663
<i>Achievements</i>	1.000	.840
<i>Financial</i>	1.000	.589
<i>Social Media</i>	1.000	.635
<i>Study</i>	1.000	.558
<i>Area</i>	1.000	.376
<i>Time schedule</i>	1.000	.516

Extraction Method: Principal Component Analysis.

a. Only cases for which National Championship = Podium are used in the analysis phase.

The results of the frequency analysis and communalities provide a clear understanding of the factors influencing performance in competitive swimming (Table 3). Identifying essential variables and eliminating irrelevant ones contributes to creating a robust model that can guide strategies for improving performance and reducing dropout rates among young athletes.

- Frequent training sessions contribute to performance improvement by increasing the athletes' physical and technical capacity.
- Identifying and managing obstacles allows athletes to optimize their training and focus on performance.
- Intrinsic and extrinsic motivation influences the level of commitment and effort exerted by athletes.
- Adequate financial resources allow access to quality training facilities, optimal nutrition, and proper equipment.
- Balancing academic and sports activities is essential for the overall well-being of student-athletes.
- The time dedicated to these activities can negatively influence training if not managed properly.
- A structured and tailored program to each athlete's needs is crucial for achieving maximum performance.

The scree plot is a graph determining how many factors to retain. The point of interest is where the curve begins to flatten. It can be observed that in the graph below, the curve starts to flatten between factors 3 and 4. Starting from factor 4, the eigenvalues are less than 1, thus only the first 3 factors were retained.

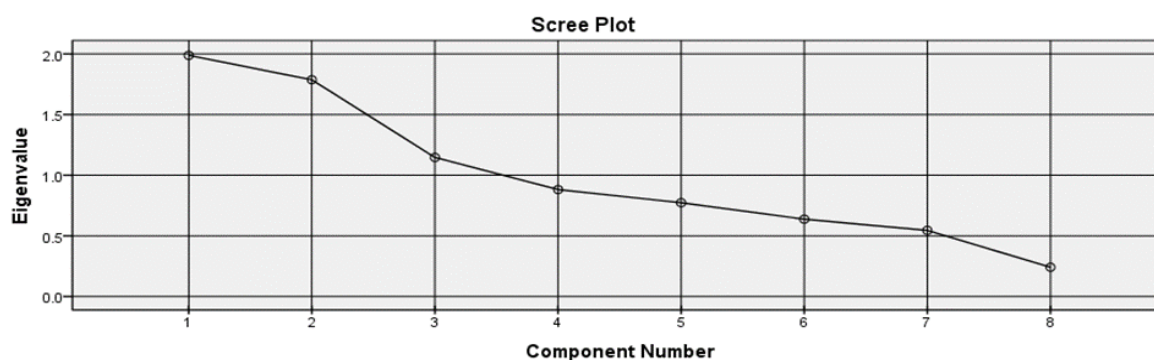


Figura 4. Scree plot

Table 4. Component Transformation Matrix^a

Component	1	2	3
<i>Training</i>	.996	.079	.050
<i>Obstacles</i>	-.029	.770	-.637

Motives					
		-089	.633	.769	
Extraction	Method:	Principal	Component	Analysis.	
Rotation Method: Varimax with Kaiser Normalization.					
a. Only cases for which National Championship = Podium are used in the analysis phase.					

This analysis shows that in order to achieve a podium position at the National Championship, regular training, obstacle management, and athlete motivation are essential. The variable "Access to infrastructure (pool in the vicinity of home)" was not included in this table as it did not meet the minimum threshold to be considered relevant in this specific analysis.

Component 1 is strongly correlated with the variable "Training" (0.996), indicating that this factor explains most of the variation in this variable after rotation. The low values for the other two variables suggest they are less explained by this factor.

Component 2 is positively correlated with "Obstacles" (0.770) and negatively with "Motives" (-0.637), indicating that this factor captures the variation in the obstacles encountered and, to a lesser extent, the athletes' motivations, but in opposite directions.

Component 3 is strongly correlated with "Motives" (0.769) and to a lesser extent with "Obstacles" (0.633), indicating that this factor captures the variation in the reasons athletes practice swimming and, to a lesser extent, the obstacles encountered.

Discussions

The above analysis indicates that in order to improve performance in Romanian competitive swimming, a holistic approach is mandatory, addressing both physical and technical training factors as well as psychological and social factors. Investments in infrastructure and adequate funding for sports programs are essential to support the development of high-performance athletes and prevent premature dropout from sports activities. Adapting training and motivation methods to the needs and perceptions of the current generations of athletes is also crucial for maintaining and increasing the number of athletes competing at the senior level.

Conclusions

The pandemic had a significant impact on athletes' training, with extended periods of interruption in sports activities. Approximately 45.95% of athletes did not have access to specific training for 2-3 months, significantly affecting their level of preparation and performance.

A prolonged break of 4-8 months was reported by 6.75% of athletes, while 6.75% experienced a break of over 9 months. These extended periods of interruption have led to significant difficulties in returning to the previous level of performance.

The motivation for athletes to practice swimming varies, with health and sports achievements being the main reasons (39.19% and 29.73%, respectively). Psychological and social factors, such as parental pressure, physical appearance, and mood, were also mentioned but to a lesser extent.

The analysis of communalities revealed that access to infrastructure (pool in the vicinity of home) does not significantly influence achieving a podium position, having a value below the minimum necessary threshold.

Table 5 showed that the number of training sessions per week is an essential and independent factor in achieving sports performance. Regular training is critical for athletes' preparation and success.

The obstacles encountered and the athletes' reasons for practicing swimming are interdependent, together influencing performance. These psychological and social factors are crucial in motivating and supporting athletes in their sports careers.

The downward trend in the number of senior athletes, from 67 in 2012, to 24 in 2021, indicates the challenges faced in maintaining athletes in competitive sports. This decline can be attributed to insufficient funding, changes in social and economic priorities, and the impact of the pandemic.

The results of the analysis provide a solid basis for formulating future strategies aimed at increasing retention and performance in competitive swimming in Romania, highlighting the need for multidimensional interventions to address the complexity of the factors involved.

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