

## THE EVOLUTION OF PERFORMANCES ON A NATIONAL LEVEL IN AEROBIC GYMNASTICS

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**Abstract.** *Background.* Performance aerobic gymnastics is, indeed, a form of art in motion, harmoniously blending elements from gymnastics, dance, and aerobics. Focusing on aspects such as coordination, mobility, strength, and endurance, this discipline challenges both the physical and mental abilities of athletes. The hallmark of performance aerobic gymnastics is the ability to execute quick and precise movements without compromising technique and accuracy. This requires a unique combination of strength, flexibility, and grace, as well as a good understanding of rhythm and music. Through this combination of traits, performance aerobic gymnastics becomes not just a form of training but also a captivating spectacle, attracting both athletes eager to test their limits and the audience with its dynamism and complexity. It is a discipline that manages to blend technical perfection with artistic expressiveness, thus creating an impressive and memorable spectacle.

*Purpose:* The research aimed to assess the level of preparedness of aerobic gymnastics practitioners from the second category in Romania in relation to the specific requirements of technical, artistic, and execution components imposed by the scoring code. Additionally, the study aimed to identify any errors that athletes may have presented within these components.

*Methods:* The research utilized bibliographic study to obtain a comprehensive understanding of the field of aerobic gymnastics and relevant points for evaluating athletes' performance. Statistical method was applied to analyze and interpret the results obtained by female athletes at the National Aerobic Gymnastics Championships, allowing us to highlight their evolution and identify performance trends. Additionally, graphical method was employed to visually represent the data of our analysis, facilitating their comprehension and interpretation.

*Subjects:* The research period covers the evolution of athletes between the years 2019 and 2021, within the national championship. Our objective is to highlight and analyze the progress, stagnation, or regression of athletes participating in competitions over the course of the three years of study.

*Results:* It is interesting to observe the evolution of the UNEFS sports club over these years and the fluctuations in their positions in the competition's ranking. Although there have been changes in the ranking from year to year, with a variation in the positions occupied, it is remarkable that UNEFS has generally remained in the upper part of the ranking. In 2019, the UNEFS club occupied positions 1, 4, and 6 in the ranking, and the following year, they managed to rise to positions 1 and 2, signifying an improvement in their performance. However, in 2020, they experienced a decline, dropping to 7th place. In 2021, the sports club once again managed to rank in the top two positions, but also found themselves in 6th place in the ranking.

*Conclusions:* These fluctuations in the ranking can be influenced by a variety of factors, such as changes in athletes' training, training strategies, the level of competition, or even external conditions, such as changes in regulations or unexpected events. A detailed examination of these fluctuations can help identify patterns or trends that may affect the performance of the UNEFS club in the future. Based on these analyses, adjustments can be made in training and competition strategies to improve performance and ensure that the club remains competitive in the national championship and other future competitions.

**Keywords:** performance aerobic gymnastics, second category, individual female competition



## Introduction

Aerobic gymnastics is the sports discipline that emerged during the "fitness explosion" of the 1970s–1980s. This sport is a fusion of specific aerobic movements from aerobic maintenance gymnastics, resulting from the combination of the seven basic steps with upper limb movements and gymnastic elements of difficulty, transitions, constructions, interactions, and collaborations between partners.

Aerobic gymnastics exercises are inspired by music, so the melody and theme of the song should be viewed and used as a "whole". Their execution must be in accordance with the rhythm of the selected song phrases.

Competitive aerobic gymnastics offers several possibilities for exploiting the variety, creativity, originality, and complexity of this sport. Both female and male gymnasts can compete in events such as: individual (female/male), mixed pairs (one girl and one boy), trio (3 members), group (5 members), aerobic dance (8 members), and/or step aerobic (8 members).

Since the appearance of aerobic gymnastics on the world stage under the auspices of the International Gymnastics Federation (FIG), Romania has emerged as a leading country in rankings, consistently appearing on the podiums of awards. However, the performances of Romanian athletes present certain deficient characteristics, especially in the "artistic" component, which has contributed over time to the loss of several medals.

Currently, the fiercest opponents that Romania's representatives must surpass in major competitions are distinguished by a complex and complete performance (maximum difficulty, outstanding artistry, clean execution). The progress of other countries, which has overlapped in recent times with a slight stagnation recorded nationally, makes achieving excellence in aerobic gymnastics increasingly difficult for Romanians.

In order to propose and apply a variety of means to improve the results of athletes, it is necessary to initially establish their level of performance. Therefore, by conducting a comparative analysis between the performances of Romanian athletes and those of foreign athletes, both their level of preparation and the causes that determine significant differences in the final ranking (final score) can be identified.

Numerous specialists have made extensive presentations regarding the technique of difficulty elements, in relation to the implications manifested in sports training management, which include descriptive elements as well as methodical recommendations.

Aerobic gymnastics gained popularity in Romania in the 1990s and quickly became an appreciated performance sport, with a strong tradition in international competitions. The Romanian Gymnastics Federation (FRG) plays an essential role in promoting and developing this sport at the national level.

Since the first national competitions organized in the 1990s, Romanian aerobic gymnastics has evolved steadily, becoming a benchmark in the national sports landscape. Sports clubs in major cities such as Bucharest, Arad, Iasi, and Constanta have significantly contributed to the popularity of this sport by training specialized coaches and attracting an increasing number of young athletes.

The National Aerobic Gymnastics Championship, organized annually by the Romanian Gymnastics Federation (FRG), is the most important event in the competition calendar for this sport in Romania. This championship represents the main opportunity for athletes of all ages and levels to demonstrate their skills and compete for the national title. The event attracts the participation of the best gymnasts in the country and serves as a showcase for their talent and hard work.

In addition to the National Championship, there are numerous other regional and local competitions that play a crucial role in discovering and promoting new talents. These offer opportunities for young and beginner gymnasts to test their skills in less formal but still competitive contests. Sporting events are essential for the development of the sport at grassroots level and for ensuring a steady flow of talent that ultimately reaches national and international levels.

Thus, the competitive structure in aerobic gymnastics in Romania is well-balanced, with events from local to national level, contributing to the growth and evolution of athletes at all stages of their careers.

Romania boasts several centers of excellence in aerobic gymnastics, where athletes benefit from intensive training and the support of elite coaches. These coaches are often former performance gymnasts who bring extensive experience and technical knowledge to the training of the new generation of gymnasts.

Romania has achieved remarkable results in international aerobic gymnastics competitions, such as the World and European Championships, bringing home numerous gold, silver, and bronze medals. Among the athletes who have excelled are Izabela Lăcătuș, Mircea Zamfir, and Corina Constantin, who have become role models for young gymnasts.

Despite notable successes, aerobic gymnastics in Romania faces challenges related to funding, infrastructure, and attracting new talent. Greater involvement of authorities and sponsors is needed to ensure the resources necessary for the continued development of this sport. However, the outlook for aerobic gymnastics in Romania remains optimistic. The sustained efforts of the FRG, together with the passion and dedication of athletes and coaches, will continue to contribute to keeping Romania on the map of performance aerobic gymnastics.

*The purpose of the research* consists of evaluating the level of preparation of aerobic gymnastics practitioners from the second category in Romania in relation to the specific requirements of the technical, artistic, and execution components imposed by the scoring code. Additionally, the aim was to identify any errors that athletes may have presented within these components.

*The research objectives* refer, on the one hand, to assessing the level of preparation of aerobic gymnastics practitioners from the second category in Romania regarding the specific requirements of the technical, artistic, and execution components imposed by the scoring code, and on the other hand, to identifying potential or real errors encountered by athletes within these components, with the aim of providing constructive feedback and improving their performance in the future.

*The research tasks* consist of:

1. Selecting a representative sample of aerobic gymnastics practitioners from the second category from various sports clubs in Romania;
2. Conducting a systematic and objective evaluation process of athletes' performance regarding the scoring of components (technical, artistic, and execution);
3. Identifying and documenting errors observed during the evaluation, highlighting aspects that require improvement and development;
4. Analyzing the obtained results and interpreting them in the context of the research objectives and requirements;
5. Developing practical and specific recommendations for improving athletes' preparation in aerobic gymnastics, considering the identified errors and assessed level of preparation;
6. Disseminating the research results and conclusions within the academic and sports community, thus contributing to the continuous development of this field.

*Research Hypothesis:* There is a significant correlation between the level of preparation of aerobic gymnastics practitioners from the second category in Romania and their ability to meet the specific requirements of the technical, artistic, and execution components imposed by the scoring code.

This hypothesis assumes that there is a connection between the athletes' level of preparation and their ability to correctly and efficiently perform the technical, artistic, and execution components required according to the scoring code. Therefore, the research would investigate whether athletes with a higher level of preparation make fewer errors and achieve higher scores in aerobic gymnastics competitions from the second category in Romania.

*Evaluation methods* used in the research included a literature review to gain a comprehensive understanding of the field of aerobic gymnastics and relevant points for assessing athletes' performance. Additionally, a statistical method was applied to analyze and interpret the results obtained by female athletes at the National Aerobic Gymnastics Championships, so as to highlight their progress and identify performance trends. The graphical method included in the research aimed to visually highlight the data of our analysis, facilitating their understanding and interpretation.

The study took place over a period of three years, between 2019 and 2021, and aimed to analyze the evolution of athletes participating in the national championship, providing a detailed perspective on their progress and performances during this time frame.

## Results

Tables 1, 2, and 3 highlight the performances of various sports clubs in the competitions of 2019, 2020, and 2021, presenting the scores obtained for the execution, artistic, and difficulty components, as well as the total score and ranking position.

**Table 1.** Results of the women's individual event for the year 2019

2019					
SPORTS CLUB	TOTAL EXECUTION SCORE	TOTAL ARTISTIC SCORE	TOTAL DIFFICULTY SCORE	TOTAL SCORE	PLACEMENT IN RANKING
C.S. UNEFS BUC.	8.150	8.350	2.050	18.550	I
C.S. UNIV. ARAD	7.850	8.250	2.050	18.150	II
C.S.M. ARAD	7.800	8.400	1.900	18.100	III
C.S. UNEFS BUC.	7.950	8.050	2.000	18.000	IV
C.S. UNIV. ARAD	7.600	8.200	2.000	17.800	V
C.S. UNEFS BUC.	7.650	8.350	1.700	17.700	VI
L.P.S. CETATE DEVA	7.750	7.900	1.950	17.600	VII
C.S. FARUL CTA.	7.550	8.100	1.900	17.550	VIII

In Table 1, the results obtained by sports clubs in the women's individual event in 2019, at the National Aerobic Gymnastics Championship, Junior II category, can be observed. Each club is evaluated based on three components: execution, artistic, and difficulty, and the respective scores are combined to obtain the total score. The final ranking of the clubs is based on these total scores, from highest to lowest, indicating the placement in the competition. C.S. UNEFS BUC. Club ranks first with a total score of 18.550, followed by C.S. UNIV. ARAD and C.S.M. ARAD.

**Table 2.** Results of the women's individual event for the year 2020

2020					
SPORTS CLUB	TOTAL EXECUTION SCORE	TOTAL ARTISTIC SCORE	TOTAL DIFFICULTY SCORE	TOTAL SCORE	PLACEMENT IN RANKING
C.S. UNEFS BUC.	8.700	8.450	2.050	19.200	I
C.S. UNEFS BUC.	8.600	8.450	2.050	19.000	II
C.S.S. TRIUMF BUC.	8.500	8.400	1.950	18.850	III

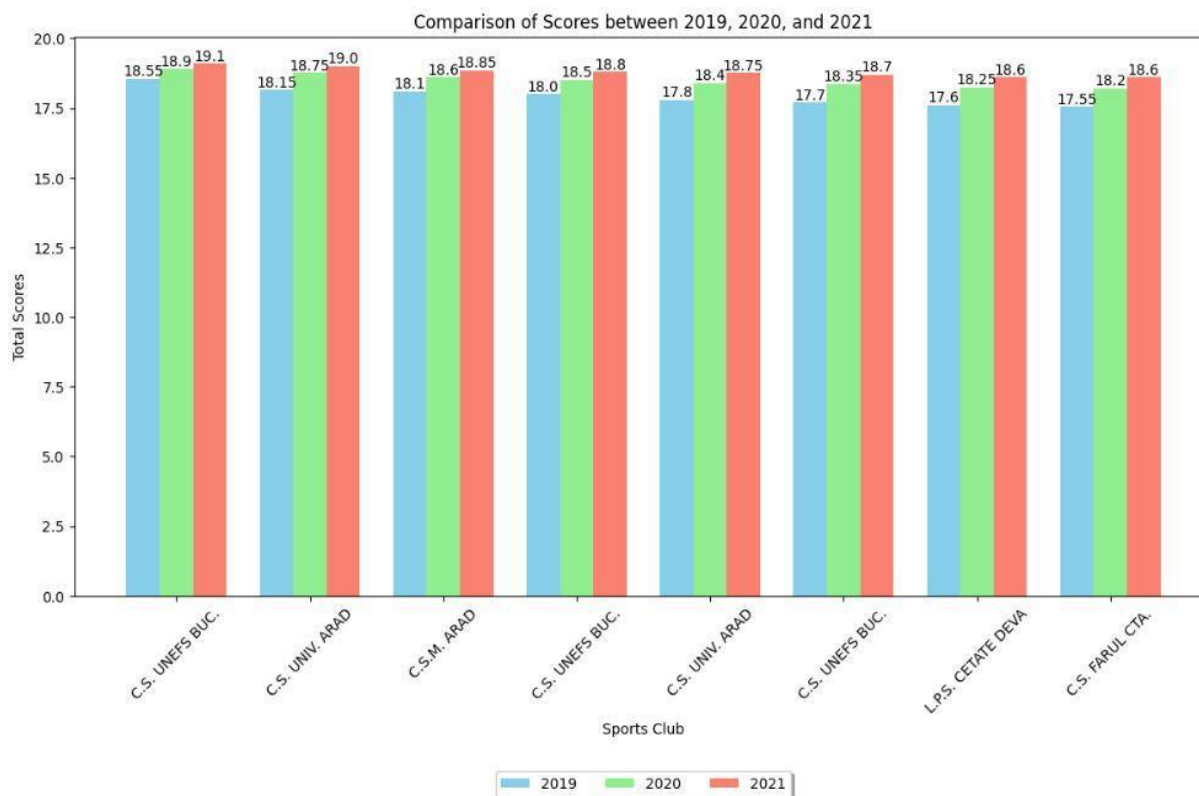
<b>C.S. FARUL CTA.</b>	8.450	8.150	2.050	18.650	IV
<b>C.S. UNIV. ARAD</b>	8.300	8.200	2.000	18.500	V
<b>C.S.S. TRIUMF BUC.</b>	8.325	8.150	2.000	18.475	VI
<b>C.S. UNEFS BUC.</b>	<b>8.100</b>	<b>8.250</b>	<b>1.950</b>	<b>18.300</b>	VII
<b>C.S. UNIV. ARAD</b>	8.200	8.000	2.000	18.200	VIII

Table 2 provides an overview of the performance of sports clubs in the 2020 competition. Scores for execution, artistic, and difficulty, along with the total score and ranking of each club, are presented. Participants include C.S. UNEFS BUC., C.S.S. TRIUMF BUC., C.S. FARUL CTA., and C.S. UNIV. ARAD.

**Table 3.** Results of the women's individual event for the year 2021

<b>2021</b>					
<b>SPORTS CLUB</b>	<b>TOTAL EXECUTION SCORE</b>	<b>TOTAL ARTISTIC SCORE</b>	<b>TOTAL DIFFICULTY SCORE</b>	<b>TOTAL SCORE</b>	<b>PLACEMENT IN RANKING</b>
<b>C.S. UNEFS BUC.</b>	<b>8.650</b>	<b>8.400</b>	<b>2.050</b>	<b>19.100</b>	<b>I</b>
<b>C.S. UNEFS BUC.</b>	<b>8.450</b>	<b>8.500</b>	<b>2.050</b>	<b>19.000</b>	<b>II</b>
<b>C.S.M. ARAD</b>	8.450	8.350	2.050	18.850	III
<b>C.S.M. ARAD</b>	8.350	8.400	2.050	18.800	IV
<b>C.S. UNIV. ARAD</b>	8.300	8.400	2.050	18.750	V
<b>C.S. UNEFS BUC</b>	<b>8.300</b>	<b>8.350</b>	<b>2.050</b>	<b>18.700</b>	<b>VI</b>
<b>C.S. FARUL CTA.</b>	8.350	8.300	1.950	18.600	VII
<b>C.S. UNIV. ARAD</b>	8.350	8.200	2.050	18.600	VIII

Table 3 provides details about the performances recorded at the 2021 National Aerobic Gymnastics Championship, within the Junior II category, women's individual event. After each athlete's presentation, the panel of judges analyzed the execution, artistic aspects, and level of difficulty of the exercises, providing scores accordingly.



**Figure 1.** Comparison of Scores in the Period 2019–2021

The above graph presents a comparison of the total scores obtained by different sports clubs at the National Aerobic Gymnastics Championships for the years 2019, 2020, and 2021.

We observe that the majority of sports clubs have recorded an increase in scores from one year to another. For example, the sports club "C.S. UNEFS BUC." has consistently increased its total scores each year, reaching a peak in 2021. On the other hand, "L.P.S. CETATE DEVA" and "C.S. FARUL CTA." experienced a slight decrease in scores in 2020 but managed to recover in 2021.

Overall, there is a trend of improvement in performance at the level of sports clubs from year to year, suggesting a continuous development of competition level at the National Aerobic Gymnastics Championships.

The analysis reveals the constant commitment of sports clubs to improving the quality and performance in aerobic gymnastics over the years, thus emphasizing the importance of sustained effort and dedication in this sport discipline.

Regarding the statistical analysis, for a clearer highlighting of trends and variations over time in the evolution of performances and analyzed variables throughout the three years investigated, the means and standard deviations were calculated for each variable (Table 4).

**Table 4.** Analysis of the Evolution of Performances and Variables Included in the Research

VARIABLE	2019 (MEAN ± SD)	2019 (SE)	2020 (MEAN ± SD)	2020 (SE)	(MEAN ± SD)	2021 (SE)
<b>EXECUTION</b>	43.28 0.638	± 0.225	45.21 ± 0.321	0.113	44.63 0.456	± 0.161
<b>ARTISTIC</b>	45.33 0.887	± 0.313	44.15 ± 0.527	0.186	44.35 0.403	± 0.142
<b>DIFFICULTY</b>	10.94 0.530	± 0.187	10.74 ± 0.117	0.041	10.85 0.215	± 0.076
<b>TOTAL</b>	18.25 0.270	± 0.096	18.63 ± 0.246	0.087	18.51 0.295	± 0.104

From the interpretation of the data included in the table, we can affirm that among the three years investigated, the score of the "Execution" component increased in 2020, followed by a decrease in 2021. "Artistic" had a negative evolution in 2020, followed by an increase in values in 2021. Regarding the "Difficulty" variable, it remained almost constant, with minor variations. The "Total" score increased in 2020, followed by a decrease in 2021. These presented values highlight the trends and fluctuations in performance during the period 2019-2021.

Through the statistical method of ANOVA test (Table 5), the means of the targeted components in the three years included in the research were compared to determine the existence of possible significant differences between them.

**Table 5.** Statistical Analysis of Data through ANOVA

ONE - WAY ANOVA (WELCH'S)				
CRITERION	F	df1	df2	p
<b>EXECUTION</b>	31.665	2	21	4.574
<b>ARTISTIC</b>	14.604	2	21	<.001
<b>DIFFICULTY</b>	0.118	2	21	0.888
<b>TOTAL</b>	19.447	2	21	1.662

The ANOVA analysis indicates that the tested factors have a significant effect on artistic performance ( $F = 14.604$ ,  $p < 0.001$ ), but they do not have a significant effect on difficulty ( $F = 0.118$ ,  $p = 0.888$ ). Regarding execution, the  $F$  value of 31.665 and the  $p$  value of 4.574 indicate a significant effect of the factors on this criterion. For the total score ( $F = 19.447$ ,  $p = 1.662$ ), the  $F$  value suggests a significant effect. Thus, this statistical processing highlights a continuous development and increasingly challenging competition in aerobic gymnastics, reflected both in the total scores obtained by clubs and in the statistical analysis of performance.

In the context of data analysis, we can assert that the hypothesis is confirmed because there is a possible link between the level of preparation and performance in aerobic gymnastics competitions.

The statistical analysis also required the Levene test (Table 6) to assess the similarity of dispersion within each analyzed variable.



**Table 6.** *Levene Test*

VARIABLE	F VALUE	P VALUE	APPROXIMATE DEGREES OF FREEDOM (DF)	OBSERVATION
EXECUTION	1.105	0.350	2	Not significantly different
ARTISTIC	5.613	0.011	2	Significantly different
DIFFICULTY	1.321	0.288	2	Not significantly different
TOTAL	1.841	0.183	2	Not significantly different

We can state that for the execution variable, the results indicate an F value of 1.105, with a p-value of 0.350 and 2 approximate degrees of freedom (DF), leading to the conclusion that there is no significant difference between the analyzed years. However, for the artistic variable, an F value of 5.613 was recorded, with a p-value of 0.011 and 2 approximate degrees of freedom, suggesting a significant difference between the years of the analyzed period. For the difficulty and total variables, the F values were 1.321 and 1.841, and the p-values were 0.288 and 0.183, indicating no significant difference between the aspects subjected to statistical processing.

From the analysis conducted through the Levene test, we can observe that the level of preparation of aerobic gymnasts significantly influences their ability to execute the artistic requirements imposed by the scoring code.

## Conclusions

In general, the results obtained in the National Aerobic Gymnastics Championships indicate a significant improvement in the performance of all athletes in the second category. Most clubs have recorded increases in total scores each year, suggesting that the level of competition in this field has continued to develop.

The data interpretation reveals a strong association between the athletes' level of preparation and their ability to meet the scoring code requirements at the technical, artistic, and execution levels. The better prepared the athletes are, the more points they obtain and the fewer errors they make in aerobic gymnastics.

We observe an improvement in athletes' performance over time, and data analysis has highlighted some fluctuations in scores obtained in different components (execution, artistic, difficulty) over the research period.

Identifying and documenting errors observed during evaluation is a crucial part of the process of improving athletes' performance in aerobic gymnastics. Constructive feedback and specific recommendations for training improvement can significantly contribute to their development and refinement.

The research conducted makes a significant contribution to understanding the evolution and performance of athletes in aerobic gymnastics in Romania, providing relevant data and information for coaches, athletes, and other stakeholders in the sports field. Therefore, it is essential to continue investigating and monitoring athletes' performance in aerobic gymnastics, aiming for the continuous development of this field and performance enhancement.



## Authors' Contributions

All authors have equally contributed to this study.

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