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A STUDY CONCERNING THE MEN HANDBALL TEAM UCM REȘIȚA IN THE FIRST YEARS OF THE THIRD MILLENIUM

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ABSTRACT. The evolution of the handball game in the last decades on international level has generated spectacular changes also at the level of club teams in Romania. A very interesting evolution was recorded by the handball team UCM Reșița, in the first years of the third millennium. This study proposes to present, analysing the reference sources for the approached topic, the way in which the men handball game developed in the town of Reșița, succeeding to obtain unique performances in Romania and Europe (wining three times in a row the Challenge Cup). Therewith, it proposes to answer the question: 'Which were the factors which contributed to the team evolution towards the remarkable results obtained?''

Keywords: *handball, favourable context, evolution, performances*

INTRODUCTION

Identified since the Antiquity as a social phenomenon in a continuous evolution and as a type of entertainment preferred by the Greeks and the Romans, practiced for the promotion of the health of body and mind (Pennuto, 2013; Paraschiv, 2016; Petrenko, 2017), the handball game became a sport towards the end of the 19th century, from the traditional ball games in Continental Europe (*hazena* in Czechoslovakia, *handbold* in Denmark, *torball* in Germany). It had a wide spread on international plan and a great upsurge, becoming today one of the most

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popular team sports in the world (Teodor, 2023). At the suggestion of Karl Schellenz, professor at the Normal German School of Physical Education in Leipzig, to adapt the torball for men, in 1919, the handball with eleven players was created. This was played on a football pitch, while the Nordic countries adapted it, from climatic reasons, to be played indoors with seven players. It became an Olympic sport with teams of seven players in 1972, at the Olympic Games in München, for men and in 1976, at the Olympic Games in Montreal, for women (Burcea, 2020; Popescu, 2023).

During the time, handball evolved from several aspects. First of all, there is an evolution of the rules, the game surfaces and the practice venues; then, there is an increase of the game speed (a shorter attack phase, the increase of the movement frequency and passing of the ball, the increase of the goals number) and finally, there is the increase of physical contacts as intensity and frequency (Rohozneanu, 2022).

The occurrence of the handball game in Romania

The handball with 11 players appeared in Romania after the official launch in Berlin in 1919. Professor Wilhelm Binder is considered the father of handball in Romania, the first coach and first referee in the history of the Romanian handball. The 'birth date' of the handball game in Romania is 18th June 1921. In 1936 the Romanian Handball Federation (FRH) is constituted. The same year, 1936, in Berlin handball (men with 11 players) is introduced for the first time in the program of the Olympic Games. The Romanian handball team participated in this first edition of the Olympic Games, obtaining an honourable fifth place from six participating teams.

The handball with 7 players was introduced in our country in 1930. It was played on a small court and it was considered as a way of preparation during the winter for the handball teams of 11 players.

The first international match of Romania was on the 7th of April 1936, against Poland, match which was won by Romania with 6-4. The first handball match indoors probably took place in the Obor Room in 1934 (Popescu, 2009). The period 1963-1972 was considered the golden decade of Romanian handball, due to the remarkable results obtained.

In Romania, the person who laid the basis of the handball game, from a theoretical point of view, is Ioan Kunst-Ghermănescu (born 11 May 1925, Lugoj – dead 30 May 1997, Kumamoto). His writings (*Handball in 7*, Bucharest, 1966; *Handball Course*, 1968; *Handball*: *The technique and tactics of the game*, 1978; *Handball: technique-tactics-rules* de Fritz and Peter Hattig; in collaboration with Ioan Kunst-Ghermănescu, International Handball Federation, Falken Verlag, Niederhausen, Germany, 1979; *The theory and methodics of handball* (co-author), represents the source of the most of the courses and books appeared in the last decades.

Among the Romanian coaches who made history obtaining remarkable results in European and/or world competitions, we must mention: Oprea Vlase, Cornel Oţelea, Nicolae Nedeff, Eugen Trofin, Constantin Popescu „Pilică", Ioan Kunst-Ghermănescu.

The handball players who are in the hall of fame: Petre Ivănescu, Cristian Gaţu, Gheorghe Gruia, Cornel Penu, Ştefan Birtalan, Radu Voina, Vasile Stângă.

Men handball in Reşiţa

With a 90 years' history, from the period when handball was played in 11 players (since 1958 this sport is practiced in 7 players), the male handball was born in Reşiţa in 1934 („Reşiţa, 16 august 1936"). In 1942, the team was sponsored and supported by the Iron Factories of Reşiţa domains, today UCM Reşiţa, and it participated in the final championship in Ploieşti, together with representatives of the cities Bucureşti, Mediaş and Ploieşti.

During the period 1958-2001 the team was in the A Division of our national championship, the Workers Sport Club Reşiţa, financially supported by UCM Reşiţa. One of the legendary players of CSM Reşiţa remains the international handball player Werner Stöckl, golden medallist in the World Championship in 1974, which took part in the Democratic German Republic (Mitre, 1999).

In 2001 the club merged with CS Universitatea Reşiţa, CS Universitatea UCM Reşiţa, the team being supported also by „Eftimie Murgu" University in Reşiţa. In the 2003-2004 championship, CS Universitatea UCM Reşiţa promoted in the National League of Men Handball.

The team coaches during the period were: Adrian Ştot, Petre Avramescu, Aihan Omer, Gligore Czari.

MATERIALS AND METHODS

In order to achieve the objectives of this research we have used the method of systematic revision, analysing both qualitatively and quantitatively the specialised articles issued in the national and international publications, retaining those which have presented the team evolution in the period we analyse, these offering a detailed image of each match, highlighting the spectacular phases and the players who made them. We also used the inquiry based method in order to highlight the factors which contributed to the team evolution towards the remarkable results obtained as well as the graphical method for the representation of the respective results.

Once stated the research question: Which were the factors which have concurred to the evolution of the men handball team UCM Reşiţa towards the remarkable results? we have identified the local publication from the analysed period, we selected those who had a rubric dedicated to sport, especially to handball. Thus, we have taken information from three representative publications for the approach of the proposed subject: „24 hours", „South-West" and „The Time/ Caraş-Severin journal"

In order to offer explanations for the exceptional results obtained in a short period of time, we administered a seven items questionnaire, built with the help of Likert scale with five answer options, to the players of the team UCM Reşiţa during the analysed period. There were 27 submitted questionnaires filled in by the ex-players.

RESULTS

After the documents analysis containing information about the evolution of the men handball team UCM Reşiţa, we have selected and systematised the results obtained by the team during eight seasons in the internal championship (National League – LN, men handball) in Romania's Cup and in the Challenge Cup. They are presented in Table 1.

Table 1. The results obtained by the men handball team UCM Reşiţa during the period 2004-2010

Season	Place in LN	Romania's Cup	European cups
2004-2005	9	F 8	-
2005-2006	5	F 8	-
2006-2007	4	Place IV	Winner of CC
2007-2008	3	F 8	Winner of CC
2008-2009	2	Place II	Winner of CC
2009-2010	2	Place I	EHF Cup – R 3
2010-2011	4	F 8	Cup Winners' Cup Quarter Final
2011-2012	3	F 4	Challenge Cup, Last 16

As we can observe once with the accession in the National League of men handball (with 14 teams), in 2004, the team has registered a constant evolution. Likewise, in Romania's Cup, it was constantly qualified in its final tournaments. It was on the 4th place during the season 2006-2007, in the edition 2008-2009, it was a semi-finalist and in the next season it won Romania's Cup. But the most important achievement was the winning three years in a row of the Challenge Cup.

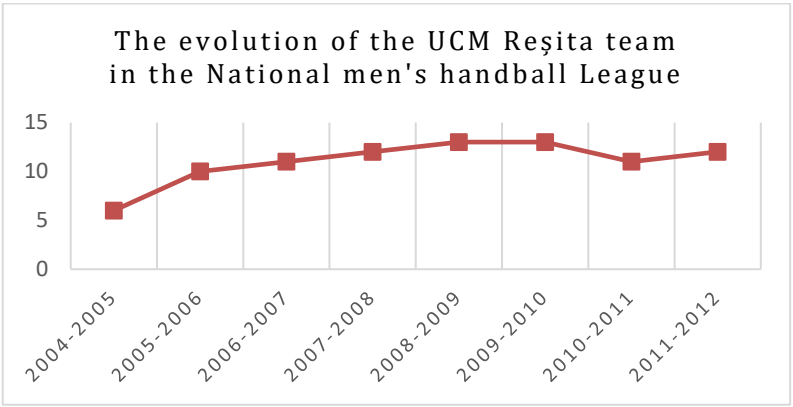

Figure 1. The evolution of the UCM Reşita team in the National men's handball League

The answers received from 27 ex-players of the men handball team UCM Reşiţa are presented as follows: for the first question: „ How much did the financial part matter when you decided to come to play for UCM Reşiţa?" 93% considered that it mattered in a high or very high extent, which proves that the handball players' income was substantial, determining them to sign with the club in Reşiţa, weighing against other clubs.

For the question „How do you consider the conditions of the handball players' activity achievement during the period when you were in the team?" 21 players appreciated them as being excellent, five considered them very good and one player said good conditions. The answers to this question highlight the fact that the handball players of UCM Reşiţa benefitted both of material resources (sport court, balls, equipment, training camps) and of human resources (coach, sport doctor, massagist, fitness coach) at an exceptional level.

Then, the handball players were asked to offer multiple answers in order to characterise the atmosphere in the team during the trainings and during the official matches. This atmosphere was considered by 23 handball players as friendly, 24 collaborative, 27 positive and other 27 respectful. These answers reveal the fact that the atmosphere within the team both during the trainings and during the development of the official matches was a trustful, encouragement and mutual supportive one.

The relationship between the players (question 4) is added to all the previous aspects, all the 27 respondents considering that there were sympathy relations and the discipline showed by the sportsmen both in the training room, during the matches and in their personal life, a fact which comes out also from the answers to question 5: „ In what extent the sport and the personal discipline

have contributed to the performance achieved?", the answer of seven handball players was that it contributed in a high extent, the other 20 players saying that it contributed in a very high extent to the achievement of performances.

As concerning the role of the public in the achievement of the team's performance, 11 handball players answered that it was a high one, 16 players considering it very high. Indeed, a court full of enthusiastic people, a gallery which chants continuously the name of the team and which accompanies the team everywhere contributes to the players' propel, awarding them a supplementary motivation to obtain victory.

For the last question, „ If it were to characterise in some words the period you spent in the team UCM Reşiţa, how will you describe it?", the handball players have made a lot of appreciations from which we have selected some:

„With a big pleasure I permanently remember the supporters, the club people, the technical staff and of course my team-mates who helped the years spent at UCM Reşiţa to be the most beautiful part of my sport career."

„First of all, I would like to thank all those who have contributed to the performances of the team UCM Reşiţa. Leaders, coaches, medical staff, players... Likewise, a grateful thought for the wonderful supporters who have encouraged us, standing by the team everywhere we played."

„It is a big honour for me and the uppermost pleasure that I was part of the team UCM Reşiţa, together we achieved high performances, reaching the success of my sport career."

„In a handball court full of supporters, together with wonderful colleagues, I have lived unforgettable moments in Reşiţa in the Challenge Cup."

„I thank all the wonderful people who supported us in this adventure!"

DISCUSSIONS

The performances of a team do not appear overnight. A series of factors should be taken into account, followed, analysed and improved anytime it is necessary.

The financial factor, concerning the level of the players' salaries, it is a primordial one, which explains the coming in the team, the stay for several seasons of the questioned players and involving them in obtaining remarkable performances. More by token, there are proves of the relation between the players' salaries (the real cost of obtaining success) and the team performances (Forest, 2002; Lee, 2012), The salary structure having effects on the playing style of the team (Franck, 2011).

In close connection to this first factor, there is the climate installed in the team (Mercea, 2011), that the respondents considered positive, based on trust, collaboration, respect.

Thus, we can outline the image of an atmosphere of encouragement and permanent support, seriousness, responsibility but also correctness, exigence and a lot of discipline both during the trainings and during the development of the matches. Al these are needed in order to improve the cognitive results, the affective results, of the processes of team work and to obtain performance (Salas, 2008). Because, eventually, every team can meet glory or on the contrary, decline, according to the group of those who share the same aims, the same passion and work together in order to obtain success (McEwan, 2014). The performance of a team is connected to and based on the individual's performance (Soltanzadeh, 2018) and on the cohesion of the team (Narimani, 2008; Rezae, 2009). The construction and coagulation of a real, united, homogeneous team which is perfectly harmonised with the objectives to be accomplished, represents one of the basic problems of the coach and the relation coach-sportsmen is a defining element in the preparation and harmonisation of the team. (Şufaru, 2009), the motivational climate that the coach installs at team level influencing the sportsmen's motivation (Gillet, 2016). In this context we must highlight the importance of communication between the handball players on the one side and the coach and the players on the other side. According to Yulkelson (2001), the communication of a coach directly influences the dynamics of the group and subsequently, the collective performance. The communication in the trainings is qualitative when it is fluid and the receiver receives the correct message and during the game, especially between team-mates, when it generates understanding between sportsmen on the sport court. Understanding one glimpse, one gesture or a spoken sentence at distance is essential for what the team-mate is about to do (Iacob, 2008).

The material and human resources also constitute a factor which contribute to obtaining the performance. The studies prove that the players who prepare themselves in clubs which are modern endowed have greater chances of professional success (Arraujo, 2014). The answers to this question highlight the fact that the handball players of the team UCM Reşiţa have benefitted of both material resources (sport court, balls, equipment, training camps) and human resources (coach, sport doctor, massagist, fitness coach) at an exceptional level which contributed to obtaining the special results of that period (Drust, 2013). More by token, the coaches, sportsmen and the sport medical staff identify different ways to improve the performance and health of the sportsmen they work with (Odetoyinbo, 2019), pursuing the creation of a dynamic and positive sport atmosphere within the team (Gu, 2023).

Referring to the role of the public in supporting the team both at home and away, the specialists state that the moral support of the public compensates the power of monetary resources (Cotella, 2021, Pollard, 2017). Therewith, they consider that the team performances are substantially better in the sport leagues when they play on their own court, as compared to those of the guest team (Courneya, 1992; Pic, 2018). Nevertheless, in the final of the Challenge Cup in the season 2008-2009, when the men handball team UCM Reşiţa played the return match at HC Suceava, it won the game and implicitly the cup. There are also studies which support that the presence of a numerous public has negative effects on the sportsmen's evolution, suffocating them, putting too much pressure on them (Toma, 2017), the conclusion being that the relations between the spectators and the advantage of the home team are rather low, the hypothesis of the „social support" according to which the bigger number of supporters help the home team to be more competitive was not confirmed (Straus, 2001; Schwartz, 1977).

Figure 2. Factors which contribute to the team performance

CONCLUSION

This study outlines two aspects of the same subject, the men handball team UCM Reşiţa: the team *evolution* and *the factors* which have generated the respective evolution. The evolution was ascendant and the factors which were the basis of the ascendant pathway were:

* Of *financial* nature, the UCM Reșița making possible the provision of very good salaries for the players and the other staff members, acquiring some valuable handball players who have contributed to the victories of the team and implicitly the winning of the mentioned trophies, bringing to the team the best Romanian coach at the time, Aihan Omer;

* Very good preparation *conditions* offered to the players both for the matches in the National League and for the European matches (training, training camps, equipment, preparation matches)

* *The atmosphere* within the team and *the relations* between the players, communication, collaboration, cohesion of the team have fully contributed to the good and very good play of the handball players on the court, in the matches they had, besides the sportsmen *discipline*, their seriousness in trainings, in the preparation and development of matches had a very important role in the evolution of the team UCM Reșița.

* *The public*, the eighth player, has supported and encouraged the team both on their own court and in the away matches, having a very important contribution to the outline of the victory of their favourite team.

The subsequent studies could be centred on the identification and analysis of the factors which led to the descendent pathway of the men handball team in Reșița, since 2012 until the present and on the identification of solutions aiming the recovery of the team in a not too far future.

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ASSESSMENT OF GLENOHUMERAL INTERNAL ROTATION DEFICIT AND SCAPULA UPWARD ROTATION DIFFERENCY WITHIN HUNGARIAN NB2 HANDBALL PLAYERS

Máté PINTÉR[1], Iuliana BOROS-BALINT[2], Márta HOCK[1], Melinda JÁROMI[1], Alexandra MAKAI[1], Eleonóra LEIDECKER[1*]

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ABSTRACT. The aim of our cross-sectional study was to assess the rotational range of motion of the shoulder joint and the scapula movement of Hungarian NBII handball players, to find out how many athletes may be affected by a rotational range of motion deficit. We also wanted to gain insight into whether players with GIRD report more pain. The study was conducted between September and October 2023. We studied 31 male handball players, all of whom participated in training sessions at least 3 times a week. The survey showed that more than half of the athletes were affected by some level of range of motion deficit. Of those assessed, 29% were affected by Glenohumeral Internal Rotation Deficit (GIRD) and 55% by Total Arc of Motion Deficit (TAMD). Those who had at least 15° of internal rotation deficit during pretesting had significantly less scapula upward rotation in the neutral shoulder, 60° abduction and 90° abduction positions. No significant difference was found in the 120° shoulder abduction position. For the non-dominant upper limb, no significant difference was found between the two groups. Athletes with GIRD reported significantly greater pain on the VAS scale than those without internal rotation deficit.

Keywords: *GIRD, handball players, shoulder joint, scapula up rotation, pain*

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INTRODUCTION

Today the most overhead athletes are affected by Glenohumeral Internal Rotation Deficit (GIRD), in which the internal rotation range of motion (ROM) of the dominant shoulder is reduced compared to the non-dominant side (Aldridge, Stephen Guffey, Whitehead & Head, 2012; Bailey, Thigpen, Hawkins, Beattie & Shanley, 2017; Ohuchi, Kijima, Saito, Sugimura, Yoshikawa & Miyakoshi, 2023). On average, a difference of more than 18-20° is defined as GIRD (Johnson, Fullmer, Nielsen, Johnson, & Moorman, 2018). It is also important to mention the Total Arc of Motion Deficit (TAMD), which represents a 5° decrease in the total rotational range of motion between the dominant and non-dominant shoulder (Amin, Ryan, Fening, Soloff, Schickendantz & Jones, 2015; Guzowski, Stolarczyk, Czyrny, Dębek & Kranc, 2019). These changes are closely related, since, if the internal rotation is reduced, the total rotational range will also change. Most of the research on GIRD tends to focus on baseball players, but handball players are at similar risk, as it is a very explosive overhead contact sport with frequent changes of direction and different throwing techniques (Lubiatowski, et al., 2018). Handball players make at least 48 000 throwing movements in a season in training and matches, with the ball weighing between 425 - 475 grams and leaving their hands at an average speed of 130 km/h after the throw (Almeida, et al., 2013). Bony and articular capsular adaptations are thought to underlie GIRD (Kibler, Ludewig, McClure, Michener, Bak & Sciascia, 2013; Le Gal, Begon, Gillet, & Rogowski, 2018; Tucker & Slone, 2016). These adaptations are thought to be closely associated with repetitive and sometimes extreme throwing stress (Seabra, Van Eck, Sá, & Torres, 2017; Thomas, et al., 2011). During increased humeral retroversion (HR), the humerus exhibits increased adaptive longitudinal torsion compared to its physiological state (Kay, et al., 2018). In capsular changes, thickening of the posterior capsule is usually highlighted (Tooth, Schwartz, Gofflot, Bornheim, Croisier, & Forthomme, 2023). In some sports, such as handball, water polo and baseball, GIRD is an advantage, as the ROM of the external rotation is usually increased. As a result, they can rotate their shoulders backwards more and throw harder, but some research suggests that at a 20° internal rotation deficit, they are 2 times more likely to be injured (Reuther, Sheridan, & Thomas, 2018). Some research shows that the prevalence of shoulder pain among competitive athletes is as high as 30-45% (Hosseinimehr, Anbarian, Norasteh, Fardmal & Khosravi, 2015). It is important to underline that it is not a single disease, but can be associated with a number of pathologies (Kibler, Sciascia & Thomas, 2012), most commonly postero-superior impingement syndrome (PSI), rotator cuff injuries, anterior instability or labral pathologies (Fairall et al., 2017; Thomas et al. 2013). GIRD is associated with altered kinematics of the glenohumeral and scapulothoracic junction due to shortening of the posterior part of the joint capsule, with shrinkage of the soft tissues, abnormal scapular

positioning, increased anterior tilt and protraction, and reduced the upward rotation of the scapula (Guney & Baltaci, 2015). It is important to recognize GIRD as soon as possible to avoid various injuries such as impingement syndrome due to impingement of the supraspinatus tendon, injuries to the posterior superior labrum and anterior inferior capsular structures (Suszter, Nicolas, Mollee & John, 2015).

OBJECTIVE

The aim of our study is to assess the percentage of handball players with a shoulder joint internal rotation deficit and a total rotation deficit. In addition, we want to find out whether those with a greater internal rotation deficit will have less upward rotation of the scapula. Furthermore, we aim to find out whether the presence of GIRD is associated with greater pain. Three hypotheses were formulated, our first hypothesis being that at least 25% of athletes have GIRD and more than 50% have TAMD. Our second hypothesis is that those with an internal rotation deficit greater than 15 degrees will have less scapular upward rotation on the dominant side. Finally, our third hypothesis is that players with rotational deficits will have greater pain in their shoulder during throwing than those without deficits.

METHODS

Before the measurements, we asked the athletes about their demographics, how long they had been playing handball, and assessed their pain level using a VAS scale. During the survey, we examined the athletes' active rotational range of motion. Participants were in a prone position with their shoulders in 90° abduction and elbows in 90° flexion. After stabilizing the scapula, the examiner asked the participant to perform internal- and external rotations with the mobile stem of the goniometer in line with the participant's ulna and the stable stem in a diagonal line with the ground. The range of motion continues until the scapula is in motion. The active total rotation range of motion was calculated from the sum of the active internal- and external rotation (Thomas, Swanik, Swanik & Kelly, 2010). The passive ROM assessment was performed in a similar manner, differing only in that the participants were in supine position (Thomas, Swanik, Swanik & Kelly, 2010). For scapula rotation measurement, the participant stood in a normal, relaxed posture. For the measurement, a helper positioned the upper limb in 60°, 90° and 120° abduction positions, and a goniometer was used to adjust the degrees. The upward rotation of the scapula was then measured at rest, 60°, 90° and 120° abduction positions by positioning the

lateral arm of the inclinometer posterolateral over the acromion and the medial arm at the medial, spina scapulae origin of the scapula margo (Thomas, Swanik, Swanik & Kelly, 2010). To measure the scapula upward rotation in our research, we used Xiaomi Duka LI1 Laser Protractor Digital Inclinometer with an accuracy of ±0.5°. Measurements were performed on both dominant and non-dominant upper limbs.

We included male NBII handball players who had been playing handball at least 3 times a week for at least 5 years for at least one and a half hours for at least 3 times a week and were at least 18 years old. They attended the training sessions during the measurement period. Athletes who had undergone shoulder surgery within one year, shoulder trauma within six months (humerus proximal end fracture, dislocation) were excluded (Guzowski et al., 2019).

For statistical analysis of the study results, data were recorded and analyzed in Microsoft Excel 2021. Descriptive statistics were used to process demographic data and to determine the prevalence of GIRD and TAMD. A two-sample t-test was performed to statistically compare the groups with smaller as well as larger scapula up-rotation. The significance level was set at $p < 0.05$.

RESULTS

The study population consisted of 31 athletes, with a mean age of 19.23±1.34 years and 9.42±1.88 years of handball playing experience. They averaged 181.94±5.89 cm in height and 78.74±6.16 kg in body weight, with a BMI level of 23.79±1.49. At the time of the survey, the athletes reported an average of 2.52±1.12 pain levels.

Table 1. Characteristics of the population

Population (person)	**31**
Age (year)	19.23±1.34
Height (cm)	181.94±5.89
Weight (kg)	78.74±6.16
BMI (kg/m2)	23.79±1.49
Years of playing (year)	9.42±1.88
Pain (VAS)	2.52±1.12

The mean passive internal rotation range of motion in the dominant upper limb of the athletes assessed was 66.77°±9.67°, the mean passive rotational range of motion was 94.84±1.63° and the mean total rotational range of motion was 161.61°±9.26°. For the non-dominant upper limb, the mean passive internal rotation was 76.39°±4.90°, the mean passive external rotation

was 93.23±1.96° and the mean total rotational ROM was 169.58°±5.51°. There were also significant differences in passive internal rotation ($p<0.001$), external rotation ($p<0.001$), and total rotational range of motion ($p<0.001$), as well as active internal rotation ($p<0.001$) and total rotational ROM ($p=0.002$) between dominant and non-dominant upper limbs. No significant difference was found bilaterally in the active rotational ROM ($p=0.476$). Of the athletes assessed, 9 had an internal rotation deficit greater than 18°, i.e. 29% had GIRD and 55% had TAMD, i.e. 17 athletes had a total rotational difference greater than 5°.

Table 2. Comparison of rotational ranges of motion between dominant and non-dominant limbs handball players assessed

	Dominant side (n=31)	**Non dominant side (n=31)**	**p-value**
Active internal rotation	61.23°±9.45°	69.06°±6.65°	<0.001*
Passive internal rotation	66.77°±9.67°	76.39°±4.90°	<0.001*
Active external rotation	89.06°±2.11°	88.52°±3.69°	0.476
Passive external rotation	94.84±1.63°	93.23±1.96°	<0.001*
Active internal rotation	150.29°±9.57°	157.58°±8.27°	0.002*
Passive rotation	161.61°±9.26°	169.58°±5.51°	<0.001*
GIRD rate – 29%		**TAMD rate – 55%**	

The mean scapula upward rotation of the dominant upper limb was found to be significantly lower in the neutral ($p<0.001$), 60° ($p<0.001$) and 90° abduction ($p<0.001$) positions of the shoulder joint in subjects with at least 15° internal rotation deficit. No significant difference was detected in the 120° abduction position of the shoulder joint between the two groups ($p=0.085$). Also, no significant difference was detected in the different positions of the shoulder joint on the non-dominant side.

Table 3. Comparison of the scapula upward rotation of the dominant side in different abduction positions of the shoulder joint in groups greater than 15° internal rotation deficit and less than 15° deficit

glenohumeral joint	**internal rotation deficit <15° (n=17)**	**internal rotation deficit >15° (n=14)**	**p-value**
neutral	6.39°±1.63°	3.59°±1.26°	<0.001*
60° abduction	16.98°±1.24°	14.59°±0.76°	<0.001*
90° abduction	29.48°±1.77°	26.26°±1.08°	<0.001*
120° abduction	37.74°±1.47°	36.79°±1.48°	0.085

Significantly greater pain was reported in the assessments by athletes with GIRD ($p<0.001$). The 9 players with GIRD reported a pain severity of 3.44±0.53 on the VAS scale, compared to those without GIRD who reported a pain severity of 2.05±0.95.

Table 4. Comparison of pain levels between GIRD and non-GIRD groups

GIRD	**nonGIRD**	**p-value**
3.44±0.53	2.05±0.95	<0.001
Whole population	***2.52±1.12***	**-**

DISCUSSION

In addition to assessing the shoulder internal rotation and full rotation range of motion deficits, our research sought to explore whether players with at least a 15° deficit have greater scapula upward rotation than those without such a deficit.

Our first hypothesis that at least 25% of the handball players surveyed would fall within the definition of GIRD was confirmed. Of the 31 athletes surveyed, 9 subjects had a passive internal rotation range of motion of their dominant upper limb at least 18° less than the same value for the non-dominant lateral upper limb. In a study published in 2018, Prateek Srivastav et al. looked at 127 athletes to find out the prevalence of GIRD in athletes and whether it was associated with scapula dyskinesis and rotator cuff muscle strength. Of the athletes they assessed, 37 had an internal rotation deficit, so 29.1% had GIRD (Prateek, Ganesh & Siddharth, 2018). Schlechter J. et al. also examined the prevalence of GIRD in the population they assessed, but they used a higher cut-off point, defining the deficit as a 25° difference. In their survey, 14% of athletes had GIRD. They also mentioned 4 other studies that also investigated the prevalence of internal rotation deficits. Of these, 3 studies used a similar number of elements as ours and averaged similar results around 30%. The fourth study had an order of magnitude higher prevalence of GIRD of 18% out of 288 person (Suszter, et al., 2015). Nakamizo et al. reported similar results, with 10 out of 25 athletes in their study showing a difference of at least 20° when comparing the range of internal rotation motion of the two upper limbs (Nakamizo, et al. 2008). Although they reported a difference of 40%, the athletes they assessed were baseball players, who are at even greater risk due to different throwing techniques than handball players. More than 50% of handball players are affected by TAMD, with 17 of 31 athletes assessed, or 55%, having a passive

total rotational range of motion of their dominant upper limb more than 5° less than the same value for the non-dominant lateral upper limb in the preliminary survey. A 2019 study by Guzowski K. et al. found similar results, with 38 of the 66 athletes they assessed having a difference of more than 5° between their dominant and non-dominant upper limb, representing 57.6% (Guzowski et al., 2019).

Our second hypothesis, that those with an internal rotation deficit greater than 15° will have less upward scapula rotation, was partially correct. There was significantly less scapula upward rotation in the shoulder joint neutral, 60° and 90° abduction positions for those with a 15° internal rotation deficit between the dominant and non-dominant upper limb ($p<0.001$). There was no significant difference between the two groups in the 120° abduction position ($p=0.085$). Similar results were obtained in 2010 by Thomas et al., they conducted their measurements on baseball players. In their study, 43 athletes were divided into two groups, a case group (GIRD >15°), which included 22 players, and a control group (GIRD <15°), which included 21. The results showed that scapula upward rotation was significantly less in the 60° ($p=0.025$), 90° ($p=0.004$) and 120° ($p=0.039$) abduction positions of the shoulder joint in the group with 15° deficit than in the group with less than 15° deficit (Thomas, et al., 2010). Thomas et al. in their study found no significant difference in scapula upward rotation measured in the neutral position of the shoulder joint between the two groups, but there was a significant difference in the 120° abduction position of the shoulder joint, which was not observed in our study. This difference may be explained by the difference in throwing techniques between the two sports, as handball players not only use overhead throwing techniques, but also often throw from the body, unlike baseball players. Laudner et al. compared the scapular position and movements of pitchers with pathological internal impingement of the shoulder to asymptomatic pitchers. Their results showed that in the group of players with significantly greater internal rotation deficits, sternoclavicular elevation and posterior scapular tilt increased during glenohumeral elevation and scapular upward rotation decreased (Laudner, et al., 2006).

Our third hypothesis, which hypothesized that players with rotational deficits would have greater shoulder pain during throwing than those without deficits, proved to be true. Of the 31 athletes we assessed, the 9 athletes who had a rotational deficit had significantly greater pain on the VAS scale than those who did not have a deficit. Almeida et al. divided athletes into a pain group and a non-pain group. Their results showed that the pain group had a significantly smaller range of internal rotation motion than the non-pain group, and the degree of internal rotation deficit was also greater between the two groups (Almeida, et al., 2013). In 2019 Ahmed Mohammed Alqarni et al. investigated the association between pain and rotational deficit. They divided athletes into two groups, a painful case group and a pain-free control group. Their results showed that the case

group had significantly lower internal rotation range of motion than the control group. When testing the correlation between pain level and internal rotation deficit, no significant correlation was found between pain level and shoulder rotational range of motion adaptations (Alqarni, Nuhmani, & Muaidi, 2024).

CONCLUSION

More than a quarter of handball players are affected by GIRD and more than half by TAMD. These phenomena have been observed in several previous studies, mostly focused on baseball players, but it has been shown that the prevalence of these lesions is similar among handball players. Players who had an internal rotation deficit of at least 15° relative to non-dominant sides had significantly lower scapula upward rotation. This type of deformity may be the basis for many injuries as it can lead to disruption of scapulohumeral rhythm. The dynamic stabilizing function of the rotator cuff is reduced, putting the static stabilisers at greater risk of injury. In terms of pain, athletes with GIRD have reported greater pain, which may be a predictor of pathologies such as impingement syndrome.

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DOES THE EXTERNAL LOAD HAVE AN IMPACT ON WINNING MATCHES IN FOOTBALL?

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ABSTRACT. The present study was conducted to examine the impact of external load on winning matches in football. The study group comprised players of the football team in the Spor Toto 1 st League. A total of 13 matches, including 6 won matches and 7 lost matches, were used in the analysis. The data on matches were taken from the 2022-2023 season of the Spor Toto 1st League. The following external load parameters were used in the analysis: total running distance (m), total high-speed running (HSR) distance, total sprint distance (m), acceleration distance (m), deceleration distance (m), ACD load, and maximum sprint reached (km/h). Data were collected with the wearable technology tracking system on football players during matches via GPS. The independent t-test was used in the program (SPSS 26.0) when analyzing normally distributed research data. The analysis of research data found a statistically significant difference in the total distance covered, total HSR distance, total sprint distance, and acceleration values among the external load results for the won and lost matches ($p<0.05$) but did not find a statistically significant difference in the deceleration, ACD load, and sprint speed values ($p>0.05$). Consequently, it can be concluded that differences in many values that are considered necessary for success in the football field have an effect on winning matches in football. For values with no statistical difference, it may be recommended to conduct studies in a higher league, with more matches and more players.

Keywords: *football, external load, gps*

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INTRODUCTION

Football is one of the sports branches followed by large masses in the world (Güllü & Yıldız, 2019; Ergen, 2018; Yaşar & Sunay, 2018). The unpredictability of match results is the main reason why soccer is watched and loved by millions of people (Lago 2010).

Football is a complex competitive game that requires bio motor skills such as speed, strength, endurance, coordination, dribbling, kicking, tackling, tackling, quickness, agility, jumping, and high neuromuscular endurance, where tactics and technique are of great importance (Djaoui, 2017). Players need to have optimal performance in each of these bio motor and skill areas (Stølen et al., 2005). The physical performance of the players individually and as a team during the match directly affects the outcome of the match (Faude, 2012). In football matches played in top leagues, a player covers an average distance of 7 to 14 kilometers (Krustrup, 2006; Thatcher, 2004; Rampinini, 2007; Carling et al., 2008). Of this distance, 2-3 kilometers are completed as high-speed running (>15 km/h) and 0.6 kilometers as sprinting (>20 km/h) (Iaia, Ermanno, & Bangsbo, 2009). In addition, elite players perform more than 700 turns and 30-40 sprints at different speeds and distances until the end of the match (Bloomfield, Polman, & O'Donoghue, 2007). Workloads of players differ according to the position they play. For example, defenders have less total running distance than midfielders (Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009). However, the workload of soccer, which is still competitive in nature, is increasing regardless of position due to advances in exercise physiology, ergogenic supplements and training science (Eniseler, 2010). The concept of workload in soccer is divided into external load and internal load. While external load refers to concepts such as total distance run, total high-speed running distance, acceleration-deceleration distance, total sprint distance and maximum speed reached during the match, internal load refers to relative physiological and psychological stressors (Vanrenterghem et al., 2017). External loads are objective measures that can be used in the evaluation of players (Bourdon et al., 2017). There are many methods used to measure the external burdens of players (Akyıldız & Akarçeşme, 2020). Among these methods, the most reliable and valid measurements are made with GPS devices (Global Positioning Systems) (Scott et al., 2016; Varley, Fairweather, & Aughey, 2012; Coutts & Duffield, 2010). Since 2003, GPS devices have been used extensively to measure external load outputs in team sports (Cunniffe et al., 2009; Jennings et al., 2012). The use of GPS devices in soccer provides ease of use in analyzing distance, time, speed and movement (Arrones, 2014).

In previous studies, it has been stated that external loads such as the total distance run by players during the match are related to the outcome of the match (Stolen, 2005; Lago, 2010; Bradley, 2009). The aim of this study is to analyze selected parameters that constitute the external load in soccer and to evaluate the effect of these parameters on match winning.

METHOD

This study was conducted to examine the effect of external load on match winning in football. The study data were collected in the 2022-2023 football season. Experimental research model was used in the study. Before the external load data of the football players were monitored, study permission was obtained from Aydın Adnan Menderes University Faculty of Medicine Ethics Committee (E- 453308) with decision number (05). In addition, a study permission letter was obtained from Denizlispor Club for the use of the data.

Research Group

The players of a soccer team competing in the Turkish Spor Toto 1st League voluntarily participated in this study. The data tracking of the players were analyzed over a total of (n=13) matches, including wins (n=6) and losses (n=7). While goalkeepers were not included in the study, the external load follow-ups of defenders, midfielders and forwards were evaluated. The external load parameters used in the study analysis were total running distance (m), total high-speed running (hsr) distance, total sprint distance (m), acceleration distance (m), deceleration distance (m), acdload and sprint speed (km/h).

Vehicle Used for External Load Data Collection (GPS)

Global Positioning Systems (GPS) were used for data collection of won and lost matches and data tracking. GPS systems were made ready 30 minutes before the footballers went to the matches. Each soccer player's GPS sensor was previously defined to the system on their own behalf in line with their anthropometric values. The soccer players wore the sensors that were defined to them before the matches. During the matches, each soccer player's external load was monitored via their own GPS systems. The external load data of the soccer players were monitored with Fitogether brand (Hangang-daero 95, Yongsan-gu, Seoul, 04378, Republic of Korea) wearable technology product. After the won and lost matches, the data of the players were transferred to the computer environment and classified within themselves.

Statistical Analysis

For data showing normal distribution because of Shapiro-Wilk normality distribution analysis in SPSS (26.0) program. Independent T Test was used. Statistical difference in the analyzed data was accepted for values below ($p<0.05$).

RESULTS

According to the results of the analysis, the external load differences between the won (n=6) and lost (n=7) matches are shown in table 1.

When Table 1. is examined, statistically significant differences were found in total distance traveled, total hsr distance, sprint distance and acceleration data ($p>0.05$), while no statistically significant differences were found in deceleration, acdload and max speed distances between won and lost matches ($p>0.05$).

Table 1. External load parameters in won and lost matches

Variable	Matches	Number of Match	Distance	Sd	t	p
Total Distance	Win	6	10010.90	233.73	42.83	0.05*
	Lost	7	7708.79	355.96	21.65	
Total Hsr Distance (mt)	Win	6	639.26	228.24	23.43	0.05*
	Lost	7	539.74	313.06	14.42	
Sprint (mt)	Win	6	147.33	103.36	11.94	0.05*
	Lost	7	115.09	96.98	10.06	
Acceleration	Win	6	50.47	49.56	8.52	0.05*
	Lost	7	34.65	19.75	14.67	
Deceleration	Win	6	75.67	23.25	16.35	0.919
	Lost	7	74.54	15.80	14.80	
Acdload	Win	6	1874.84	899.45	0.38	0.712
	Lost	7	2008.77	251.88	0.45	
Maks. hız (mt)	Win	6	29.86	2.02	123.23	0.382
	Lost	7	29.55	2.23	110.60	

DISCUSSION

Within a soccer competition that meets the requirements of the period, players perform a large number of high intensity actions. In intermittent high intensity soccer, players move from low intensity tasks to near maximum or maximum intensity tasks in a short period of time on the pitch. Considering the seasonal differences, soccer players cover an average distance of 9-14 kilometers during the match, 600-110 meters of this distance covered by high intensity running (Aquino et al. 2022). In addition, while soccer players perform an average of 1400 actions on the field during the competition, 700 of them are recorded as directional activities, 600 accelerations and 600 decelerations (Dolci et al. 2020). Among these data, running distance defines the volume of the match, while acceleration, deceleration, high-intensity running, and sprint distances are considered as match-defining actions (Akyıldız et al. 2020). These data, which are defined as external load in football, are important for the success factor of the player and protection against injuries. In this study, the external load data of football players in winning and lost matches were examined and the question of the effect of external load on winning matches was sought. According to the findings, while there was a statistical difference in total distance traveled, total hsr distance, sprint distance and acceleration ($p<0.05$), there was no significant difference in acceleration, acd load and maximum speed data.

In soccer, high-intensity movements should be performed at a high level for a long time and at certain intervals. These examinations are also reflected in today's studies. According to the results of the analysis, it was determined that athletes playing football in La Liga traveled a maximum distance of 13.7 km and an average distance of 11.3 km. In another study, it was found that the total distance traveled by professional soccer players playing in the Premier League in England was 10.7 km, 11.3 km in the Championship and 11.6 km in League 1 (Bradley and Noakes 2013; et al. 2007), following the external load values of Brazilian professional soccer players throughout the season 2022. In their study findings, they found that high intensity running, acceleration and total distance travel were higher in winning matches than in losing matches. In a study of 23 matches, Miguel et al. (2022) found that the external load data of soccer players such as total distance, acceleration, high intensity running differed according to positions and home advantage and emphasized that external load training should be determined in this way. Since the physical requirements of soccer are much more diverse than other sports branches, it is possible to reach studies and significant results on this subject in the past years. Rhodes et al. (2021) examined acceleration and deceleration values in England 2nd Football League as one of the studies in this field and statistically significant

results were obtained in favor of the matches won. In addition, Rhodes also revealed that in the 4-3-3 format, wingbacks and center forwards accelerate and decelerate with higher intensity than players playing in other positions. Although there was no statistical difference in the results of the study, the high intensity running distance was higher in the matches in which victory was achieved compared to the other two results. As a similar study in the field, won and lost matches in the Iranian First League were examined, because of the study, Nobari et al. (2021) found that the average speed and sprint distance were higher in won matches than in lost matches. Moalla et al. (2018) found a significant difference in total distance travel, high-speed running distance and sprint distance and obtained similar results to our study. Smpokos et al. (2018), found that total running distance was higher in winning matches than in losing matches.

In a study conducted with soccer players from Ankara Demirspor, Taştan and Özcan (2023) found a statistically significant difference in total running distance and maximum speed of soccer players in competitions as a result of 8-week training. In a study comparing the match performances of professional soccer players with GPS technology (Başaran, 2023), a statistically significant difference was found between the groups in the sprint number and sprint distance parameters as determinants of victory. Güler et al. (2019) examined the changes in total distance and regions in case of victory, draw and defeat in their study on soccer players. Total distance (m) was found to be 108686.27 m in won matches and 10160.77 m in lost matches, and a statistically significant negative difference was found.

Football is a sport with high expectations and a wide range of requirements for success. Recent soccer competitions are faster, more intense, with less recovery time and higher intensity than in the past. Elite level coaches develop their players according to the period. For this reason, to win matches and be successful, it is imperative to follow the literature correctly, follow player development and fulfill the requirements of today's football. With this study, it has been shown in the reviewed literature that external load parameters are metrics that affect match winning in soccer. In line with this information revealed by statistical data, it is recommended that coaches should follow soccer player data with the use of GPS, use GPS data sets not only in training but also in matches, and exchange information by giving more importance to the field of athletic performance.

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THE MOTIVATION OF CROSSFIT PRACTITIONERS FOR COMPETITION

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ABSTRACT. CrossFit is an emerging trend that has captured the attention of many studies in recent years. Despite the high number of research papers covering different aspects of the sport, the motivation of participants in CrossFit competitions remains a topic that is not talked about enough. The purpose of this study is to analyze how competition influences the motivation of CrossFiters. We applied a questionnaire who contains a number of 27 items on a 5-point Likert scale to observe how the participants' motivation influences their view on the competition. The results indicate that all four variables used to define the motivation of competitors (enjoyment to compete, self-perception, challenges, CrossFit community) are significant, while loss of motivation is not a significant factor. Regarding gender, there is a significant difference between the groups in terms of CrossFit community perception ($p< 0.05$). In conclusion, competitive experience plays a crucial role in self-perception, competitive satisfaction, and appreciation of the CrossFit community.

Keywords*: enjoyment, self-perception, challenge, community.*

REZUMAT. *Motivația practicanților de CrossFit pentru competiție*. CrossFit este o activitate sportivă nouă care a captat atenția multor studii în ultimii ani. În ciuda numărului mare de lucrări de cercetare care acoperă diferite aspecte ale sportului, motivația participanților la competițiile de CrossFit rămâne un subiect despre care nu se vorbește suficient. Scopul acestui studiu este de a analiza modul în care competiția influențează motivația practicanților de CrossFit. S-a aplicat un chestionar care conține un număr de 27 de itemi pe o scară Likert de

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5 puncte pentru a observa modul în care motivația participanților le influențează viziunea asupra competiției. Rezultatele indică faptul că toate cele patru variabile utilizate pentru a defini motivația concurenților (plăcerea de a concura, percepția de sine, provocările, comunitatea CrossFit) sunt semnificative, în timp ce pierderea motivației nu este un factor semnificativ. În ceea ce privește genul, există o diferență semnificativă între grupuri în ceea ce privește percepția comunității CrossFit ($p < 0,05$). În concluzie, experiența competitivă joacă un rol crucial în percepția de sine, satisfacția competitivă și aprecierea comunității CrossFit.

Cuvinte cheie: *plăcere, percepția de sine, provocare, comunitate*

INTRODUCTION

CrossFit competitions have become an essential component of the culture and practice of this form of intense training. As this sport has grown in popularity, so has the importance of research that explores the motivation of the participants, to better understand the factors that influence their commitment, persistence and ultimately most importantly - their performance. Different studies talk about the various benefits that intense CrossFit training brings when it comes to physical health, improving six out of ten physical abilities of athletes as follows: cardiovascular and respiratory endurance, stamina, strength, flexibility, balance, strength (Gianzina and Gianzina, 2019; Meyer, Morrison, and Zuniga, 2017; Murawska-Cialowicz, Wojna, and Zuwala-Jagiello, 2015; Bellar et al., 2015). One of the main reasons why CrossFiters participate in competitions is the enjoyment they have during training and the high level of engagement. The diversity and challenging nature of CrossFit workouts encourages active engagement and keeps participants interested, creating a rewarding and engaging experience. For example, the variability in exercise routines has a positive impact on adherence and enjoyment during workouts (Sylvester, Jackson and Beauchamp, 2018; Schlegel, 2020; Meier, Schlie, and Schmidt, 2023; Dawson, 2017). In CrossFit, every workout is different, which provides a constant challenge. The risk of boredom or overfitting is reduced, which maintains the interest and motivation of the participants. Participants are motivated by a desire to continuously improve and surpass themselves, which makes participating in competitions an extremely rewarding experience. In Crossfit, self-efficacy, commitment and personal goal setting are significant elements of personal satisfaction and consequently sports performance (Theodorakis, 1996). The implications of self-efficacy in athletes' performance are very important and the results show that this factor has direct effects on their success (Rogowska et al., 2022; Patterson et al., 2021).

CrossFit competitions are recognized for their intense challenges that test both the physical abilities and mental resilience of participants. They are motivated by a desire to push their limits and prove their skills in a competitive environment. Overcoming these challenges and achieving the goals set in competitions provides deep satisfaction and strengthens the determination to continue training, and in our case the desire to compete. Different studies describe how satisfaction is the materialization of achieving goals through effort (Slavinski et al., 2021; Nikitopoulos, 2020). Subjects who managed to fulfill a greater part of the targets showed a high level of satisfaction. Some studies about the CrossFit program listed 'challenge' as one of the fundamental factors that describe the training time, and also one of the reasons why practitioners choose it, as part of the process that brings them satisfaction and fulfillment (Simpson et al. 2017; Dominski et al., 2021; Marin et al., 2018). Another factor that contributes to the enjoyment of exercising in CrossFit is the competitive and supportive environment. A study emphasized the importance of social support in participation and continuity in physical activities (Lautner et al., 2021). It highlighted the relevance of social aspects for CrossFit participants and emphasized how community and social support contribute to participants' motivation and engagement. CrossFit competitions represent not only a test of physical capabilities, but also an opportunity to experience and strengthen strong social bonds within the CrossFit community (Bycura, Feito, and Prather, 2017; Claudino et al., 2018; Till and Ibrahim, 2024).

Loss of motivation and identification with a sport is a complex phenomenon, which can be influenced by multiple factors. Understanding these negative aspects is important to develop effective strategies to maintain engagement and motivation among CrossFiters. Several studies have analyzed these themes explaining how each case is different; some are related to intrinsic motivation, others to extrinsic motivation, sometimes there is no way back for an athlete who has gone down this path (Ginis, and Bray, 2004; Kellman, 2010; Schwanhausser, et al., 2021).

At the same time, positive psychological aspects can be observed, such as the pleasure of exercising, satisfaction, challenges and reaching your goals. Based on the results, CrossFit training includes both aerobic and anaerobic elements, which improve cardiovascular fitness - which means better heart and lung efficiency during exercise, a better body composition - thus contributing to a more toned and healthy physique, and last but not least, the anaerobic capacity of both men and women, regardless of their sports level. All these benefits have been shown to be factors that lead to high levels of athlete retention and participation in CrossFit training. Since we see so many positive aspects of playing sports, an obvious question arises: what happens if we move to the next step - competition, which means another level of involvement and dedication?

Given everything mentioned above, we will perform an in-depth examination on the relationship between the two variables (competition and motivation of CrossFit athletes), using empirical data to determine if this relationship is significant and will provide a clearer perspective on how this aspect affects the involvement and performance of athletes.

MATERIALS AND METHODS

Procedure

The purpose of this research is to understand the motivation of athletes participating in CrossFit competitions. An electronic questionnaire was developed using a Google-based form to allow for digital administration of the measure. Considering the international appeal of CrossFit, both Romanian and English versions of the survey were available. The survey was distributed via CrossFit gym owners and members of the CrossFit community in Timisoara, Romania. All participants provided informed consent prior to beginning the survey, and the study protocol was approved by the institution's ethics review board.

We applied a questionnaire who contains a number of 27 items on a 5-point Likert scale. The 27 items are classified into 5 categories : Enjoyment of competition (10 questions), Self-perception (7 questions), Challenges (5 questions), CrossFit community (2 questions) and Loss of motivation (2 questions).

For the questionnaire, the Cronbach alpha fidelity coefficient was calculated for the complete version of 27 items. The Cronbach Alpha coefficient of validity of the 27-item scale has a value of 0.915, with a strong percentage of 99.8%, which proves that the scale has a very good level of fidelity. A Cronbach's alpha coefficient greater than 0.800 is considered satisfactory.

A number of 65 athletes from Romania, that are CrossFit practitioners, have participated in this study. All of them have participated in CrossFit competitions. We have added questions that contextualize the scale to the chosen topic. ANOVA, Correlations (Pearson), and Descriptive Statistics were used for data analysis. All statistical analyses were performed using SPSS software, version 22 with a 5% significance level.

Research hypotheses

CrossFit competitions are not only a way to demonstrate physical skills, but also a source of motivation and fulfillment for practitioners. Understanding the reasons why they choose to compete can provide valuable insights into the

factors that contribute to engagement and satisfaction in this sport. Based on the specialized literature and empirical observations, we formulated the following hypotheses, which will be tested in this study:

Hypothesis 1: CrossFit practitioners participate in competitions because it gives them the pleasure of competing in a varied and stimulating environment that maintains a high level of engagement.

Hypothesis 2: Participants in CrossFit competitions are motivated by the personal satisfaction and positive self-perception achieved by reaching and exceeding personal goals.

Hypothesis 3: CrossFit practitioners are attracted to competitions because of the intense challenges they provide, which allows them to demonstrate their capabilities and reach their personal goals.

Hypothesis 4: A major factor motivating participation in CrossFit competitions is belonging to a strong and supportive community that provides social support and encouragement.

Hypothesis 5: There is a segment of CrossFit practitioners who, for various reasons, may end up losing motivation and falling out of the sport, which may lead to less participation or inconsistency in competitions.

Hypothesis 6: Factors such as gender, age or years of competition experience are very important and will determine different results from one individual to another.

RESULTS

The data to be presented were collected using the sociological survey (questionnaire) and aid to describe the data and evaluate the differences between them, understand the relationships and interdependencies between the motivational variables, and then the defined groups and between the genders.

Participants generally report high Enjoyment of competing, with an average close to 4 and a slightly higher median than average (4.10). It has reached maximum value, which suggests that many participants gave high scores for the enjoyment of competing. Self-perception is more variable than Enjoyment of competing, with an average just below 3.5 and a significant standard deviation (.773). The value reached is 4, indicating a significant concentration of scores in this area. We can observe a strong appreciation for the Challenges involved in fitness, with a high mean (3.92) and median (4.00). Standard deviation indicates moderate variation in responses (.841). Scores for the CrossFit Community are lower compared to the other motivation variables, with a mean below 3.

Table 1. Descriptive statistics

		Enjoyment of competing	Self-perception	Challenges	CrossFit community	Loss of motivation
N	Valid	65	65	65	65	65
	Missing	0	0	0	0	0
Mean		3.99	3.45	3.92	2.58	1.59
Median		4.10	3.33	4.00	2.33	1.00
Mode		5	4	5	3	1
Std. Deviation		.767	.773	.841	1.111	.918
Minimum		2	2	2	1	1
Maximum		5	5	5	5	5

Participants show significant variation in their perception of the Cross-Fit Community, as shown by the standard deviation (1.111). Overall, Loss of Motivation is not a significant factor, having a very low mean (1.59) and median (1.00) and situating at minimum value. The standard deviation suggests moderate variation in responses, but with a general trend toward lower scores (.918). The descriptive statistics provided indicate a wide range of motivation levels for each variable studied in CrossFit competitions. Enjoyment of competing, Challenges and Self-perception are significant aspects for participants, while the CrossFit Community appears to be perceived less positively. In addition, concern about Loss of Motivation is generally low among participants. These observations will form a solid foundation for further analysis to gain a deeper understanding of the factors that influence motivation in the context of CrossFit fitness and competition.

Table 2. Correlations of motivational variables

		Enjoyment of competing	Self-perception	Challenges	CrossFit community	Loss of motivation
Enjoyment of competing	Pearson Correlation	1	.769	.907	.269	-.163
	Sig. (2-tailed)		.000	.000	.030	.195
	N	65	65	65	65	65
Self-perception	Pearson Correlation	.769	1	.734	.654	.050
	Sig. (2-tailed)	.000		.000	.000	.693
	N	65	65	65	65	65
Challenges	Pearson Correlation	.907	.734	1	.238	-.155
	Sig. (2-tailed)	.000	.000		.056	.216
	N	65	65	65	65	65
CrossFit Community	Pearson Correlation	.269	.654	.238	1	.228
	Sig. (2-tailed)	.030	.000	.056		.067
	N	65	65	65	65	65
Loss of motivation	Pearson Correlation	-.163	.050	-.155	.228	1
	Sig. (2-tailed)	.195	.693	.216	.067	
	N	65	65	65	65	65

In table 2 we have the results regarding the correlations of the motivation variables. Based on the Pearson correlations plotted above, we can draw some important conclusions about the relationships between different aspects of participants' motivation:

There is a strong positive correlation between the Enjoyment of competing and Self-perception ($r = 0.769$, $p < 0.01$). This suggests that participants who enjoy to compete tend to have a better self-perception. There is a very strong positive correlation between the Enjoyment of competing and the Challenge variable ($r = 0.907$, $p < 0.01$). Participants who find enjoyment in competition also tend to be motivated by existing challenges. Between the Enjoyment of exercise and the CrossFit Community there is a moderate positive correlation ($r = 0.269$, $p < 0.05$). This indicates a positive link between Enjoyment of competing and sense of belonging to the CrossFit Community. Between the Enjoyment of competing and the Loss of Motivation there is a weak negative correlation ($r = -0.163$, $p > 0.05$).

There is a strong positive correlation between Self-perception and Challenges ($r = 0.734$, $p < 0.01$). This tells us that participants with a better self-perception tend to be more motivated by challenges. Between Self-perception and the CrossFit community there is a strong positive correlation ($r = 0.654$, $p < 0.01$) which indicates that a better self-perception is associated with a strong sense of belonging to the CrossFit community. There is a very weak correlation between Self-perception and Loss of Motivation ($r = 0.050$, $p > 0.05$).

Table 3. ANOVA Analysis Motivation – Gender

		N	Mean	Std Deviation	ANOVA
Enjoyment of competing	Masculine	34	4.03	.790	F(1. 63) = 0.224,
	Feminine	31	3.94	.750	p = 0.637
	Total	65	3.99	.767	
Self-perception	Masculine	34	3.57	.762	F(1. 63) = 1.712,
	Feminine	31	3.32	.777	p = 0.195
	Total	65	3.45	.773	
Challenges	Masculine	34	4.00	.877	F(1. 63) = 0.634,
	Feminine	31	3.83	.804	p = 0.429
	Total	65	3.92	.841	
CrossFit community	Masculine	34	2.84	.996	F(1. 63) = 4.219,
	Feminine	31	2.29	1.173	p = 0.044
	Total	65	2.58	1.111	
Loss of motivation	Masculine	34	1.55	.828	F(1. 63) = 0.138,
	Feminine	31	1.63	1.020	p = 0.711
	Total	65	1.59	.918	

There is a weak positive correlation (r = 0.238, p > 0.05) between the Challenges and the CrossFit Community as well as the correlation with the Loss of Motivation which is a weak negative correlation (r = -0.155, p > 0.05). Between the CrossFit Community and the Loss of Motivation there is also a weak positive correlation (r = 0.228, p > 0.05).

Table 3 shows significant differences between groups for five dependent variables: enjoyment of competing, self-perception, challenges, CrossFit community, and loss of motivation. While there are no statistically significant differences between groups on enjoyment of competing, self-perception, challenges, or loss of motivation, there is a significant difference between groups on the perception of the CrossFit community (p< 0.05). To find out what it is, we will analyze the table below.

Table 4. Tukey Test

		N	Mean	Std Deviation	ANOVA
CrossFit community	1	17	2.82	1.008	F(3.61) = 0.616, p = 0.608
	2	30	2.50	1.253	
	3	16	2.56	.994	
	4	2	1.83	.236	
	Total	65	2.58	1.111	
Enjoyment of competing	1	17	4.00	.809	F(3. 61) = 1.045, p = 0.379
	2	30	3.95	.800	
	3	16	4.14	.669	
	4	2	3.15	.212	
	Total	65	3.99	.767	
Self-perception	1	17	3.63	.766	F(3. 61) = 1.285 p = 0,288
	2	30	3.34	.814	
	3	16	3.55	.702	
	4	2	2.67	.157	
	Total	65	3.45	.773	
Challenges	1	17	4.05	.731	F(3. 61) = 1.342 p = 0.269
	2	30	3.88	.938	
	3	16	4.00	.745	
	4	2	2.83	.236	
	Total	65	3.92	.841	
Loss of motivation	1	17	1.67	1.124	F(3. 61) = 0.158 p = 0.924
	2	30	1.59	.896	
	3	16	1.48	.760	
	4	2	1.83	1.179	
	Total	65	1.59	.918	

Tukey's post hoc test confirms this difference, indicating that men (M = 2.84, SD = 0.996) and women (M = 2.29, SD = 1.173) have different perceptions of the CrossFit community, with men having a better perception. This could mean that the communities they belong to are better defined and therefore better perceived, or that they are better integrated than women.

Table 5. ANOVA Analysis Motivation – Age groups

		N	Mean	Std Deviation	ANOVA
Enjoyment of competing	1 - 5	49	3.97	.797	F(3. 61) = 0.531, p = 0.663
	6 - 10	14	3.97	.689	
	11+	1	4.30	.	
	Total	65	3.99	.767	
Self-perception	1 - 5	49	3.45	.797	F(3. 61) = 0.332, p = 0.802
	6 - 10	14	3.36	.744	
	11+	1	4.00	.	
	Total	65	3.45	.773	
Challenges	1 - 5	49	3.94	.839	F(3. 61) = 0.713, p = 0.548
	6 - 10	14	3.76	.874	
	11+	1	4.50	.	
	Total	65	3.92	.841	
CrossFit community	1 - 5	49	2.63	1.121	F(3. 61) = 2.137, p = 0.105
	6 - 10	14	2.38	.923	
	11+	1	4.67	.	
	Total	65	2.58	1.111	
Loss of motivation	1 - 5	49	1.59	.999	F(3. 61) = 0.201, p = 0.895
	6 - 10	14	1.62	.652	
	11+	1	2.00	.	
	Total	65	1.59	.918	

Table 5 shows that there is no significant difference between the age groups regarding the 5 analyzed variables. The average values are relatively close. This suggests that motivation is consistent, so age does not significantly influence the variables.

These results indicate that there are no significant differences between age groups for enjoyment of competing, self-perception, challenges, and loss of motivation. Regarding the CrossFit community, there is a trend towards marginal significance ($p = 0.105$), but not strong enough to be considered conventionally significant ($p < 0.05$).

DISCUSSIONS

If we compare the results to the proposed hypotheses, we notice that the Enjoyment of competition, self-perception and challenges are closely related. This suggests that participants who enjoy competing more and have a better self-perception are also more motivated by challenges. The overall mean of enjoyment of competing is 3.99 with a standard deviation of 0.767, indicating relatively high enjoyment. The greatest enjoyment of competition is seen among younger participants, and this enjoyment declines slightly with age. Different studies reported also high levels of the enjoyment in exercise, challenge and community for CrossFit practitioners (Fisher et al., 2016; Pickett et al., 2016).

Similar to CrossFit training community, the CrossFit competition created a community in which the sense of belonging it is important characteristic (Pickett et al., 2016). Also, there is a correlation between intrinsic motivation and sense of community (Blenkarn, 2018). The feeling of belonging to the community varies significantly, being lower for participants with less experience (standard deviation of 1.111.) Community plays a crucial role in maintaining motivation and satisfaction. It is essential to create an environment of support and camaraderie among competitors.

Given the positive correlations with self-perception and enjoyment of competition, fostering a strong sense of community can help improve overall motivation. Different studies suggested that competing at the adult age provide space for older people to begin sport in later life, can provided also goals which can structured their future training and how the competition enabled them to compare themselves with others (Dionigi, Baker, and Horton, 2011). CrossFit offer this possibility too.

Positive self-perception can positively influence sports performance (Jiménez-Díaz, Morera-Castro and Araya-Vargas, 2018). In CrossFit, the self perception's importance increases with age and years of experience, these are the groups of people that should be targeted by coaches who should encourage positive self-evaluation.

Older and more experienced participants in CrossFit competitions tend to feel the impact of the challenges and perceive their importance more intensely. The competitions should be challenging enough to maintain interest, but not so difficult as to discourage them (Vogl, 2024). Providing mental and emotional support can help participants cope better with challenges and maintain long-term commitment. However, the years of experience seem to bring with them a self-confidence that compensates for other shortcomings.

A slight general increase in the impact of these motivational factors is observed for older competitors. As with anything, it takes an increase of motivation to keep doing it, especially when we're talking about physically demanding activities like CrossFit competitions.

CONCLUSIONS

The proposed hypotheses are confirmed. According to them, all four variables used to define the motivation of competitors are significant, while the loss of motivation is not a significant factor. Competition experience was found to play a crucial role in self-perception, competition satisfaction and appreciation of the CrossFit community. The more experienced tend to have a better self-perception and to be more satisfied with competitions and the CrossFit community. Age has a significant impact on perceptions and motivation. Younger participants report greater enjoyment of practicing, while older and more experienced participants report higher levels of self-perception and satisfaction in competitions, but perceived challenges may vary.

Overall, gender differences are minimal, but there are slight trends showing that women, in certain age groups and experience levels, have lower self-perceptions and may perceive the challenges and CrossFit community differently compared to men. The loss of motivation is relatively constant between groups, hardly significant, but tends to be slightly higher as competitors get older. This suggests that specific interventions may be needed to maintain motivation in this experienced group.

Self-perception plays a more important role for participants with more experience and for those in more advanced age groups. Thus, we see how as age and years of experience increase, there is a slight transition in the set of values that underlie the motivation of competitors: if at first the pleasure of practicing comes first, along with self-perception and then the perceived challenges, in time, the level and importance of enjoyment of exercise decreases. On the other side, the importance of self-perception, perceived challenges, and community belonging increases. We can call this process competitor maturation.

STUDY LIMITATIONS

In carrying out the analysis of this data set and the conclusions drawn, it is important to acknowledge and mention the limitations of the study. These limitations help contextualize the results and highlight areas where further research is needed.

Imbalance between genders and years of experience: Some age categories and years of experience have very few participants, which may skew the results and make meaningful analysis of these subgroups difficult. With so many overlapping filters, it was obvious that we were going to have big differences and that some categories were going to be underrepresented. After all, the questionnaire was applied without knowing how much experience the respondents had.

Possible response biases: The data are based on self-report, which may involve response biases, such as the desire to present a positive self-image or influence by other subjective factors. We also need to consider context influence: participants may be influenced by the context in which they filled out the questionnaires (for example, in a competitive or relaxed atmosphere), which may affect their responses.

Consequently, we have the Subjective Nature of the Variables: Variables such as "enjoyment of exercise", "self-perception" and "challenges" are measured based on the subjective perceptions of the participants, which can vary significantly from person to person.

Another factor is that the study has a cross-sectional design, capturing data at a single point in time. This means that causality cannot be established and long-term changes in participants' perceptions and motivation cannot be observed.

Last but not least, lack of an in-depth analysis of covariates: Other potentially relevant variables (eg training level, lifestyle, psychological factors) that could influence the results were not included.

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OPTIMIZATION OF BALANCE AND FLEXIBILITY THROUGH THE RATIONALIZATION OF METHODS IN THE EDUCATIONAL PROCESS FOR PRIMARY SCHOOL STUDENTS (AGES 6-10)

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ABSTRACT. Introduction: In physical education lessons, the proper rationalization of methods targeting psychomotor components will lead to improved coordination, perception, and analysis of body movements and the movements of its various parts in their interaction. A rationalized training system applied in teaching can prevent the phenomenon of insufficient or excessive exercise, promoting the standardized performance of exercises, which plays an important role in students' physical and mental health. **Objective:** The general objective of this study is the rationalization of specific methods aimed at optimizing balance and flexibility in the instructional process for students aged 6-10 years. **Methods:** The Flamingo Test was used to determine lower body balance, and the Sit and Reach Test was used to measure flexibility. **Results:** The results of this study revealed significant differences in balance and flexibility performance among students in grades 1-4, both by gender and overall. The Mann-Whitney and Wilcoxon tests were used to evaluate these differences. For balance on one leg, p-values ranged from 0.003 to 0.75, indicating significant differences in some classes, particularly in grades 1 and 2. Flexibility, measured through jumping tests, showed significant differences in grade 2 (p=0.011) and grade 1 (p=0.032). These findings suggest the need for personalized interventions in balance and flexibility training to optimize physical development at these ages. **Conclusions:** Proper structuring of exercises, based on a detailed assessment

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of each student's individual needs, facilitates improvements in balance and flexibility. This is reflected in both student performance and physical activities, having a positive impact on the overall educational process.

Keywords: *Balance, Flexibility, students, psychomotor skills*

REZUMAT. Optimizarea echilibrului şi flexibilităţii prin raţionalizarea metodelor în procesul educaţional la elevii din ciclul primar (vârsta 6-10 ani). **Introducere:** În lecţiile de educaţie fizică, o raţionalizare adecvată a metodelor care vizează componentele psihomotorii va duce la îmbunătăţirea coordonării, percepţiei şi analizei mişcărilor corpului şi ale diverselor sale părţi în interacţiunea lor. Un sistem de antrenament raţionalizat aplicat în predare poate preveni fenomenul de exerciţiu insuficient sau excesiv, promovând realizarea standardizată a exerciţiilor, aspect ce joacă un rol important în sănătatea fizică şi mentală a elevilor. **Obiectiv:** Obiectivul general al acestui studiu este raţionalizarea metodelor specifice orientate către optimizarea echilibrului şi a flexibilităţii în procesul instructiv-educativ pentru elevii cu vârste cuprinse între 6-10 ani. **Metode:** Testul Flamingo a fost utilizat pentru a determina echilibrul membrelor inferioare, iar testul Sit şi Reach a fost folosit pentru măsurarea flexibilităţii. **Rezultate:** Rezultatele acestui studiu au evidenţiat diferenţe semnificative în performanţa echilibrului şi a flexibilităţii în rândul elevilor din clasele I-IV, atât pe gen, cât şi în ansamblu. Testele Mann-Whitney şi Wilcoxon au fost utilizate pentru a evalua aceste diferenţe. Pentru echilibrul pe un picior, valorile p au variat între 0,003 şi 0,75, indicând diferenţe semnificative în unele clase, în special în clasele I şi II. Flexibilitatea, măsurată prin teste de săritură, a arătat diferenţe semnificative în clasa a II-a (p=0,011) şi clasa I (p=0,032). Aceste constatări sugerează necesitatea unor intervenţii personalizate în antrenamentele de echilibru şi flexibilitate pentru optimizarea dezvoltării fizice la aceste vârste. **Concluzii:** Structurarea adecvată a exerciţiilor, pe baza unei evaluări detaliate a nevoilor individuale ale fiecărui elev, facilitează îmbunătăţiri ale echilibrului şi flexibilităţii. Aceasta se reflectă atât în performanţele elevilor, cât şi în activităţile fizice, având un impact pozitiv asupra procesului educativ în ansamblu.

Cuvinte-cheie: *Echilibru, Flexibilitate, elevi, abilităţi psihomotorii*

INTRODUCTION

1. Rationalization of Means for Optimizing Balance in the Instructional Process for Primary School Students (Ages 6-10)

Faigenbaum et al. (2002) confirm that the duration of effort can be a safe and effective conditioning parameter for children. Moreover, by regularly focusing on the development of muscle strength, an improvement in body composition can be observed. An increasing number of boys and girls are participating in programs aimed at developing muscular strength, power, and endurance in physical education

classes and after-school programs. All movements involve mobilizing the body's energy resources to achieve both mental effort (attention, memory, imagination) and muscular effort. The field of physical education and sports builds its specificity only in relation to physical effort as an adaptive complex that produces multiple effects on the human being. According to Lazăr (2020), understanding effort is important in the conduct of physical education lessons, in the choice of exercises, volume, and intensity. Effort tests evaluate the cardiorespiratory response to a given effort, allowing the functional assessment of the individual.

The body's response to effort varies depending on age, gender, nutritional status, ambient temperature, body position, and work capacity. Mas & Riera (2018) demonstrated that movement can improve the cognitive development of structures related to attention, memory, perception, language, and thinking, which will help in interpreting concepts such as space, time, and speed. Furthermore, the systematization of body development facilitates the emergence of motor and cognitive skills and also leads to an expansion in the acquisition of emotional and affective content.

The dosing of effort, program objectives, methods and means used, as well as involvement in other physical activities that must be considered, will lead to long-term improvement in motor qualities. It is recommended that students be offered programs for developing conditional, intermediate, and coordinative capacities to optimize psychomotor components.

Keating (2003) highlighted that, in addition to debates regarding the effectiveness of evaluating physical abilities in young people, it is equally important to acknowledge the existence of other test batteries. Moseichuk et al. (2020) identify coordination abilities as innate to the formation of motor function, which determines their compliance with ergonomic requirements for performing motor tasks. Additionally, certain kinematic and dynamic parameters allow for the selection of the best ways to solve motor problems, while minimizing energy sources.

In physical education lessons, the correct rationalization of means for acting on psychomotor components will determine improvements in the level of coordination, perception, and analysis of the movements of one's own body and its various parts in their interaction. Furthermore, Skitnevskiy et al. (2018) supported that during effort, students improve their coordination of movements, muscle strength, action speed, flexibility, fatigue tolerance, the vestibular system's ability to adapt to acceleration tasks, static and dynamic balance, attention, memory, emotional stability, determination, and courage.

The rationalized training system applied in teaching can avoid the phenomenon of insufficient or excessive exercise, promoting the standardized performance of exercises, which plays an important role in both the physical and mental health of students.

2. Study Objectives

2.1. General-Objective

The general objective of this study is the rationalization of specific methods aimed at optimizing balance and flexibility in the instructional process for children aged 6-10.

2.2.Specific-Objectives

The specific objectives pursued in the current study are:

1. Analysis of current evaluation methodologies for balance and flexibility.
2. Implementation of a specific methods program to optimize balance.
3. Implementation of a specific methods program to optimize flexibility.

3. Research Instruments

In this stage of the study, the subjects from grades 1-4 underwent two tests to determine the development of balance and flexibility. The test batteries applied were:

a) The Flamingo Test– to assess the balance of the lower body,

b) The Sit and Reach Test – to assess flexibility.

4. Research Methodology and Implementation of Intervention Strategies

THEMES, PURPOSE AND OBJECTIVES FOR A-I-II-III-IV-A CLASS. FLEXIBILITY DEVELOPMENT (PASSIVE /ACTIVE STRETCHING)

Table 1. Research methodology and implementation of intervention strategies for developing flexibility

		CLASS 1	**CLASS 2**	**CLASS 3**	**CLASS 4**
EX.1	**OBJECTIVES**	- Holding the knee to the chest for 10 seconds. - Keeping the knee extended on the supporting leg.	Maintaining the position on each foot for 10 seconds without bending the knee.	-Holding the position for 10 seconds without bending the knee. -Gradual lowering of the hands from the slat as much as mobility allows, with the knees stretched.	- Holding the position on each foot for 10 seconds. -Maintaining the lower limbs at an angle of 90°.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
	PURPOSE	- Development of the musculature of the lumbar area - Development of the musculature of the posterior part of the thigh (biceps-femoral) -Developing the elasticity of the inguinal ligament - Stretching of the femoral right muscle - Stretching of the large buttock muscle	- Development of the musculature of the lumbar area -Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, etc.) - Stretching of large, medium, small fezier muscle -Mobility at the level of the coxo-femoral joint.	- Development of the musculature of the lumbar area - Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, semi-mebranous) - Stretching of large, medium, small fezier muscle - Mobility at the level of the coxo-femoral joint.	-Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, etc.). - Stretching of the large, medium, small fezier muscle. - Mobility at the level of the coxo-femoral joint.
	DESCRIP-TION OF THE EXERCISE	From the dorsal decubitus, the hands grab the right knee, the other lower limb is with the knee stretched out and the heel on the ground with holding for 10 seconds on bent knee. Runs on each lower limb 3 times.	From sitting with the right left leg bent with the sole glued to the inner part of the thigh, the other lower limb stretched out with the foot in the flexion, the, have the task of maintaining the position on each lower limb for 10 seconds.	From sitting with the lower limbs and the back glued to the fixed scale, they will execute bending of the trunk by grasping the slat and holding in position with the knees stretched. The descent from the slat into the lath will be achieved gradually.	From dorsal lying down with the lower limbs at an angle of 90°, the legs in flexion, (the heel pushes the opposite leg towards the ground), the knees stretched, the arms near the body. It will execute holding on each foot for 10 seconds.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
EX. 2	**OBJECTIVES**	Holding the position on each lower limb for 10 seconds without bending the knees.	Keep the knee partner lying on the lower leg elevated and on the ground for 10 seconds.	-Holding the position for 10 seconds without bending the knee. -To manage to grab hands.	- Twisting the trunk on the bent knee. -Holding the position for 10 seconds alternately on each foot.
	PURPOSE	- Development of the musculature of the lobar area Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, etc.) - Stretching of large, medium, small fezier muscle	-Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, ischiogambieri, etc.) - Stretching of large, medium, small fezier muscle - Development of the coxo-femoral joint muscle	- Development of the musculature of the lumbar area - Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, semi-mebranous) -Stretching of the large, middle, small fezier muscle - Mobility at the level of the coxo-femoral joint -Mobility at the shoulder joint.	- Stretching of the tensor muscles of the broad fascia - Stretching of large, medium, small fezier muscle - Mobility at the level of the coxo-femoral joint. - Development of the back muscles
		From standing with the legs spread out more than the shoulder level the trunk performs	The exercise is carried out with the partner. The first pupil is in the dorsal decubitus position with	On pairs of sitting facing each other with their feet close, sole in the sole with the partner, knees	From sitting with the right lower limb stretched forward, the foot in flexion, the other

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
	DESCRIP-TION OF THE EXERCISE	a forward bend, the students have the task of maintaining for 10 seconds the position on each leg.	a lower limb on the ground with the knee stretched, the arms near the body and the other lower limb is raised vertically with the help of the partner. The other partner is positioned between the lower limbs of his colleague. The pupil has the task of lifting the lower limb to the maximum point of mobility, holding one hand the knee outstretched and the other pressing on the tip of the foot (the foot being in flexion). The pupil who is in the dorsal decubitus position has the task of maintaining without the help of the partner the knee stretched on the passive foot and the raised tip. During this time, the person who is on the ground must be in a relaxed position.	stretched, arms extended forward, the two have the task of bending the trunk forward, the two have the task of bending the trunk forward, to grab hands with his colleague and help each other maintain the position with the bent torso and chest as close to the thighs as possible.	execute a pass over the support leg with the sole on the ground and the bent knee. The trunk makes a twist outward (on the bent leg), the left hand on the ground, and the other pushes the knee inward. This exercise is performed 3 times on each lower limb.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
			It will hold for 10 seconds on each leg and will later change with his colleague. This exercise will be repeated 3 times.		
EX. 3	**OBJECTIVES**	Keeping your hands on your ankles for 10 seconds without bending your knees.	- Holding the position for 10-15 seconds. -Collaboration between the two partners.	Holding the position for 10 seconds with the torso bent.	-Holding the position for 10 seconds with your knees stretched and keeping your hands at the ankle level - Maintaining the position with the chest as close to the thigh level as possible.
	PURPOSE	- Development of the musculature of the lobar area -Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, etc.) - Stretching of large, medium, small fezier muscle	-Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, ischiogambieri, etc.) - Stretching of large, medium, small fezier muscle - Development of the coxo-femoral joint muscle Development of the lumbar muscle	-Development of the flexibility of the lower limbs Flexibility of the back muscles -Flexibility of the shoulder joint	- Stretching of the tensor muscles of the broad fascia -Stretching of the large, middle, small fezier muscle - Mobility at the level of the coxo-femoral joint.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
			-Elasticity of the gracilis muscle, tailor - Elasticity of the inguinal ligament.		- Development of the back muscles
	DESCRIP-TION OF THE EXERCISE	From sitting with their legs close and bending the trunk, students have the task of maintaining the position for 10 seconds.	The exercise is carried out with the partner. From sitting, legs spread out, knees stretched, feet in flexion. One of the two students has the task of grabbing the partner's hands and helping the executor to perform the bending of the trunk to the maximum point of his mobility through a extension of the trunk. This exercise is done alternately.	In pairs one before the other at a distance of 1 m, the legs spread out more than the shoulder level. Students place their hands on the shoulders of the partner and execute a bending of the trunk simultaneously with pressure on the shoulder joint. This exercise will be repeated 3 times with holding for 10 seconds.	2 By 2, one of the students is in the sitting position with the lower limbs stretched out, the feet in flexion and the back of each student will be a pupil to help him in the execution of the movement of bending the trunk with the holding of the hands at the ankle level and maintain the correct position, the, with your back straight. It has the task of progressively pushing the torso of the partner forward to the limit of mobility. This exercise is performed 2 times for 20 seconds per student.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
EX. 4	**OBJECTIVES**	Keep the sitting position with your feet close for 10 seconds without bending your knees.		Holding the position for 10 seconds with the torso bent.	
	PURPOSE	- Development of the musculature of the lobar area -Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semitendinos, etc.) - Stretching of large, medium, small fezier muscle - Development of the coxo-femoral joint muscle		-Development of the flexibility of the lower limbs. -Flexibility of the back muscles	
	DESCRIP-TION OF THE EXERCISE	From sitting with their feet close, the students are tasked with performing the bending of the torso with keeping their hands on their ankles until the moment the chest touches the thighs.		In pairs the back to the back, the legs spread more than the shoulder level, the arms around the body. Students perform a bending of the trunk at the same time as grasping the hands between the lower limbs.	

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
				This exercise will be repeated 3 times with holding for 10 seconds.	
EX.5	**OBJECTIVES**			- Holding the position for 10 seconds on the executing foot. -To reach with your hands at the top of your foot.	
	PURPOSE			Development of the posterior thigh muscle (biceps-femoral, gastrocnemian, semi-tendinos, semi-mebranous). -Flexibility of the musculature of the lumbar area.	
	DESCRIP-TION OF THE EXERCISE			Individually, in support on one knee, the other lower limb stretched forward with the knee stretched out and the foot in flexion. It will hold the position for 10 seconds. It will run alternately on both lower limbs and repeat the exercise 3 times.	

In the intervention plan for developing flexibility in primary school classes (grades I-IV), a structured algorithm was used based on the principles of progression, individualization, and adaptation to the age and motor development level of the students. The algorithm was designed to ensure the correct sequence of exercises, starting with simple positioning and coordination exercises and progressing to more complex exercises that involve the simultaneous development of muscular strength and joint flexibility.

Basic Principles

Progression: The exercises were structured from simpler to more complex to allow students to gradually adapt to the imposed requirements and avoid muscle and joint overexertion.

Adaptability to the students' age: The exercises were designed to fit the specific motor needs of each age group, taking into account the natural development of motor skills in primary school classes.

Individual pace: The intervention plan allowed each student to progress at their own pace, ensuring a flexible framework in which each method (exercise) could be adapted based on individual mobility and strength.

Biomechanical efficiency: Each exercise was designed to develop flexibility, strength, and coordination by maintaining biomechanically correct postures, minimizing the risk of injury.

The intervention plan was structured so that each exercise would meet the specific needs of each class, aiming for the simultaneous development of flexibility and muscular strength through a phased approach adapted to the age and physical preparation level of the students.

The rationalization of the proposed physical exercises had as its primary objective the development of each student's maximum potential through progressive and differentiated adaptation of the methods used according to the specific characteristics of each class (1-4).

This approach allowed for the alignment of physical development objectives with the capabilities and developmental level of each age group, ensuring harmonious and effective growth in muscular development and joint flexibility. Thus, the rationalization of the means for each class was designed according to the motor abilities of the children, long-term objectives, and the requirements for harmonious muscular development, successfully creating an effective intervention plan tailored to the needs of each developmental level.

THEMES, PURPOSE AND OBJECTIVES FOR A-I-II-III-IV-A CLASS. DEVELOPMENT OF STATIC BALANCE

Table 2. Research methodology and implementation of intervention strategies for the development of static balance

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
EX. 1	**OBJECTIVES**	- Maintaining balance throughout the exercise on the support foot - Coordination of upper limbs	- Maintaining balance on the support leg throughout the exercise - Realization of the movement of bending the knee on the support leg.	- Maintaining the position in equilibrium for a duration of 30 seconds on the support leg. -The realization of the two forms of the bird, offered with two hands from the bottom and rolled with one hand on the ground without the appearance of imbalance on the support leg.	-Realization of the transmission of the ball from man to man at the same time as touching the ground on the executing foot - Develop concentration during and after ball transmission to avoid multiple imbalances throughout the exercise.
	PURPOSE	-Development of static balance -Concentration development	-Development of balance -Concentration development	-Development of balance -Concentration development	-Development of balance -Concentration development
		Students are placed on 3 columns in support on the leg tight, the first student in each column having two balls. At the sound signal the first student transmits the balls simultaneous	Students are grouped 4 to two gymnastics benches with the shoulder tight and straight on the direction in support on the left leg. To the right of the bank are placed next to each subject a copet. The task of the exercise is to	Students are placed 2 facing each other at a distance of 2m, in support on the right foot with a handball. The pupil in possession of the ball has the task of bending the trunk simultaneously with the bending of the knee on the supporting leg making the	The collective is placed on the length of the gymnastic bench, one behind the other, in support on the left leg, the other knee being raised. The first student will hold the ball at the chest level with two hands and at the sound signal it

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
	DESCRIP-TION OF THE EXERCISE	ly to the side by extending the arms from man to man until the last student and after the last student received the balls will transmit them back through the same way, students remaining throughout the exercise in support on the left foot. After the first series they will change the support leg. This exercise will be repeated 2 times.	achieve with the executing foot the touch of the cover simultaneously with the bending of the knee on the support leg, returning to the initial position with the knee raised maintaining the balance on the foot on the bench. They will perform 2 times the movement of descent on the right foot and 2 times on the foot clench with the support on the opposite foot, the mats being moved to the opposite side.	ball rolling with the opposite hand of the partner, the other student will wait for the ball all in support on the right foot. The person who receives the ball has the task of lifting the ball off the ground by the movement of bending the trunk and knee on the support leg following the lift to balance and maintain knee raised on opposite foot.	has the task of achieving the tip of the foot on the ground of the executing lower limb while bending the knee on support leg and raising arms with the ball in hand up. The second pupil behind him is tasked with receiving the ball from the first student when he is performing the ground touch on the executing lower limb. This exercise will be completed the moment the ball reaches the last student. They are tasked to maintain their balance on the support leg after each ball transmission until the object reaches the last in the column. After completing the exercise they turn face to face in the opposite direction realizing the transmission of the ball from the last student to the first

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
					changing and the support leg. ***The student who for 30 seconds had more than 3 imbalances on the gymnastic bench will receive additional tasks, tasks that help to improve the static balance.***
EX. 2	**OBJECTIVES**	- Maintaining balance throughout the exercise on the support foot -Coordination of the upper limbs with the executing lower limb	- Maintaining balance on the support leg throughout the exercise - Keeping the knee stretched on the support leg	- Maintaining the position in equilibrium for a duration of 30 seconds on the support leg. -Coordination of partners in the exchange of materials for a duration of 30 seconds without the occurrence of multiple imbalances on the support foot.	Developing concentration to avoid multiple imbalances during the exercise.
	PURPOSE	Development of static balance	-Development of static balance -Concentration development	Development of static balance	-Development of static balance -Development of concentration and attention

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
	DESCRIP-TION OF THE EXERCISE	Students are placed on 3 columns in support on the leg tight, with the right arm stretched sideways and the other raised. At the first sound signal they have the task of bending the trunk at the same time as bending the knee on the support leg with touching the ground. At the second sound signal have the task of returning to the original position. Repeat the exercise 2 times on each leg.	Students are grouped 2 face to face with each other at a distance of 1m in support on the left foot. Before the right foot each subject has a cover. They have the task of changing the mats between them by pushing forward towards the partner with the right foot, following to pull the opposite quilt towards them, obliquely returning the inner to the final position with the knee raised, the right, repeating without stopping 3 times these movements with the executing foot.	The students are placed 2 facing each other at a distance of 1m, in support on the left foot with a ridge before the right foot. On the signal of the teacher the two students push into the same quilt without fully leaning on it, towards his partner, then maintaining the position of balance in support on the left foot, the, the other lower limb being with the knee raised. After the thrust of the bucket they have the task of bringing the opposite dome to the right, from the place where it was originally positioned by pulling it to the right foot, subsequently achieving a balanced position throughout the exercise. After each movement performed, the students have the task of keeping the knee high on the right	Students are grouped 2 times before each other with a bobath ball. The student in possession of the ball will be in support 30 seconds on the standing foot and 30 seconds on the right foot. The other partner after the teacher's signal has the task to execute with both hands, alternately pushing the ball in different directions to force him to unbalance. After the exercise, the roles will change. ***The student who for 30 seconds had more than 3 imbalances will receive additional loads, tasks that help to improve the static balance, strength in the lower limbs, and, development of abdominal muscles and development of flexibility.***

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
				lower limb, permanently maintaining balance on the left foot. They are tasked to perform the exercise in support for 30 seconds on a lower limb without the occurrence of multiple imbalances during execution.	
EX. 3	**OBJECTIVES**	- Maintaining balance throughout the exercise on the support foot -Coordination of the upper limbs with the lower ones	To execute the movement of lowering the lower limb from the back simultaneously with the passing of the ball with two hands from below, ensuring the maintenance of body stability on the foot on the bench and synchronized coordination of movements during the ball bird.	- Maintaining the position in balance with the knee raised after each touch of the mat. - Spreading the mats on the previous, postero-lateral and postero-medial direction with the foot without the occurrence of imbalances on the support leg.	To be able to maintain their balance after the exercise task is performed.
	PURPOSE	-Development of static balance -Development of attention	-Development of balance -Development of concentrated attention - Segmental coordination	-Concentration development -Development of static balance	Development of static balance

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
	DESCRIP-TION OF THE EXERCISE	The collective is placed in a circle at an arm length in support on the right leg. The second student in the band will be positioned in a circle. At the teacher's sleepy the students will raise the circle from the ground by performing the simultaneous bending of the trunk and knee on the supporting leg by passing over them, they will also place the circle of the next participant on the ground by the same way of execution. Each student is tasked to execute the same principle of execution 3 times.	Students are grouped 4 to two gym benches facing each other in support on the left foot at a distance of 1.5m with a handball. The task of the exercise is to carry out the passing of the ball offered from below with two hands to the partner positioned facing him following that after the bird to perform a bend of the knee on the leg tight, the, the other leg of the lower limb performing a touch of the soil without fully allocating the weight on it, returning to the final position vigorously pushing into the foot on the bench. Alternatively work, each subject having the same task after the bird. They will perform 2 times the movement of	The students are seated inside the 3 horns oriented in the trunk in support on the left foot. On the signal of the teacher they have the task of performing with the executing foot the thrust of the thighs on the previous 3 directions, postero-lateral and postero-medial, maintaining balance with the other lower limb with the knee raised after each movement executed on each direction. After pushing the mats, they have the task of bringing them to their original position (in the triangle) without placing the executing foot on the ground or completely leaning on the mats.	The students are placed on the length of the gymnastic bench, one behind the other, in support on the left leg, the other knee being raised, the arms stretched sideways. At the indications of the teacher, the students have the task of performing with the lower right limb touching the ground with the tip of the foot by moving the cross back together with bending the knee on the support leg (left) returning in final position with knee raised.

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
			descent on the right foot and 2 times on the foot they gather with the support on the opposite foot 8 touches of soil each later will change the groups on the gymnastics bench.		
EX. 4	**OBJECTIVES**	- Improve balance control on the support leg -Developing coordination and response to dynamic changes - Improve collaboration and manipulation technique			
	PURPOSE	-Development of static balance -Development of concentrated attention			
	DESCRIP-TION OF THE EXERCISE	The students are placed 2 facing each other in support on the left leg, arms extended forward and a circle on both sides. Each of them has the task			

		CLASS 1	CLASS 2	CLASS 3	CLASS 4
		of controlling the object through the push-pull movement forcing the partner to lose control over the balance on the support leg for 20 seconds. After that time of work they will change the support leg performing the same task without making contact with the ground on the free foot.			

Algorithmization of the intervention plan for the development of static balance in primary classes I-IV has taken into account principles for developing static balance in students from grades I-IV. The plan was structured based on specific objectives, each adapted to the physical and cognitive development level of the children. Therefore, I implemented a set of exercises that gradually addressed the complexity of the requirements, emphasizing the maintenance of balance on the supporting leg, coordination of the limbs, and concentration.

Basic principles of the intervention plan

Graduality: Exercises have been designed to progress from simple to complex exercises, allowing students to develop their skills in a controlled and effective way.

Adaptability: Each exercise has been tailored to meet the individual needs of students, given their varying physical abilities.

Collaboration: Many of the exercises were structured to encourage intercollegial interaction, which not only improved motor skills but also developed their social skills.

The implementation of this intervention plan for the development of static balance in primary classes I-IV not only facilitated the improvement of physical abilities, but also contributed to the formation of algorithmic approaches, ensuring a coherent progression of exercises, adapted to the needs of each group of students.

The rationalization of exercises aimed at developing static balance was carried out in order to maximize the potential of each class of students, adapting the activities to their specific needs and skills. Each class had clear goals, defined on the basis of students' motor and cognitive capabilities, which allowed for a personalized and effective approach. They were also performed through a detailed analysis of each class, taking into account the specificity of age, the level of physical development and the ability to concentrate students. This approach allowed not only the development of static balance, but also the formation of motor skills essential for future physical activities.

RESULTS

In the study, we assessed the performance of I-IV students in 2 tests that contain 2 different samples, differentiated by the codes that appear in the table below. So we have the test:

1. FLAMINGO test
2.SIT AND REACH test

1. Results obtained in Class I – Girls - Boys

Table 3. Characteristics and characterization of variables between GE and GC girls and boys in Class1

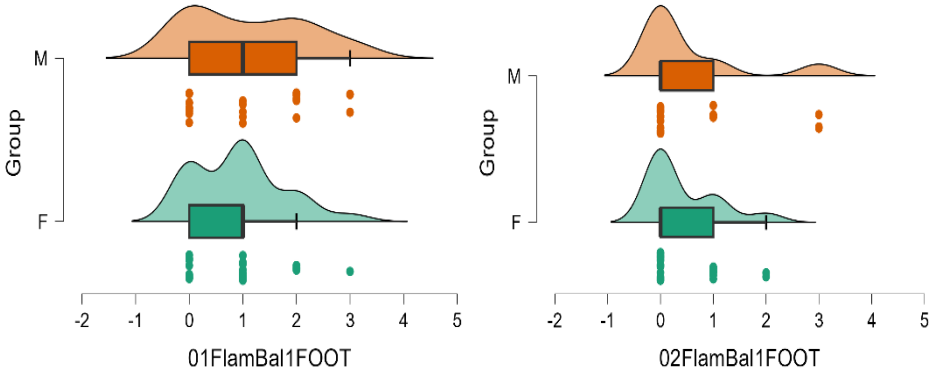
CHARACTERISTIC	Class 1	Class 1	Class 1	Mann-Whithey
	all	F	B	
VARIABLE	mean (standard deviation)	mean (standard deviation)	mean (standard deviation)	p-value
01FlamBal1FOOT	0.9 (1)	0.9 (0.7)	1 (1.3)	0.606
02FlamBal1FOOT	0.1 (0.3)	0.1 (0.4)	0.1 (0.3)	0.853
p-value (Wilcoxon)		0.003	0.064	
01SARFLEXIBILITY	5.6 (5.1)	5.4 (5.8)	5.8 (4.2)	0.629
02SARFLEXIBILITY	8.8 (4.5)	9.5 (5.1)	7.8 (3.6)	0.286
p-value (Wilcoxon)		0.032	0.682	

Table 4. District of Median and Quartile for Class 1 Student Group Variables

CHARACTERISTIC VARIABLE	median [Q1 - Q3]	median [Q1 - Q3]	median [Q1 - Q3]
01FlamBal1FOOT	1 [0 - 1]	1 [0.3 - 1]	0 [0 - 2]
02FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 0]
p-value (Wilcoxon)			
01SARFLEXIBILITY	6 [1 - 8]	5 [1.3 - 6.8]	7 [2 - 9.5]
02SARFLEXIBILITY	9 [7 - 11]	9 [7 - 10.8]	8 [5.5 - 10.5]
p-value (Wilcoxon)			

1.1. Results from the FLAMINGO balance test (01FlamBal1FOOT – 02FlamBal1FOOT)

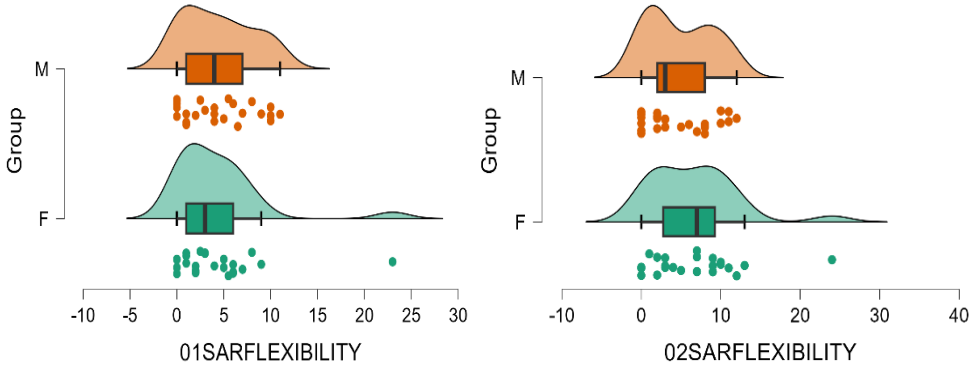
The Wilcoxon test values (p) indicate the statistical significance of the observed differences between the two groups: In the first test session, the difference between girls and boys is significant (p = 0.003), which suggests the existence of notable differences in performance in the girls' group; compared to that of boys, the difference being statistically insignificant (p = 0.064), indicating an increase in value from the girls and boys group and in the third test session. We cannot confirm the same for the Mann-Withney value the differences are insignificant in both groups (p=0.606) and (p=853) respectively.



Graph 1. Distribution of FlamBal1FOOT variable (FLAMINGO BALANCE TEST) at time 1 and 2 by group membership. (GE = experimental group, GC = control group).

1.2. SIT AND REACH test results for flexibility measurement (01SARFLEXIBILITY – 02SARFLEXIBILITY)

In the study, we also assessed the flexibility development test for both girls and boys, using two distinct sets of Mann-Withney and Wilcoxon measurements for. The Wilcoxon test indicated a significant p-value of 0.032 in the girls' group in terms of differences between groups, while for the boys' group value p=0.682, suggesting that the differences are not statistically significant. The results for the Mann-Witney value indicate that there are no statistically significant differences between girls and boys in terms of flexibility (p > 0.05 for both measurements). However, there are variations in the level of flexibility reported between the two groups.



Graph 2. Distribution of SARFLEXIBILITY variable (SIT AND REACH) at time 1 and 2 by group membership. (GE = experimental group, GC = control group).

1.3. Results obtained in Class II – Girls - Boys.

Table 5. Characteristics and characterisation of variables between GE and GC girls and boys in Class 2

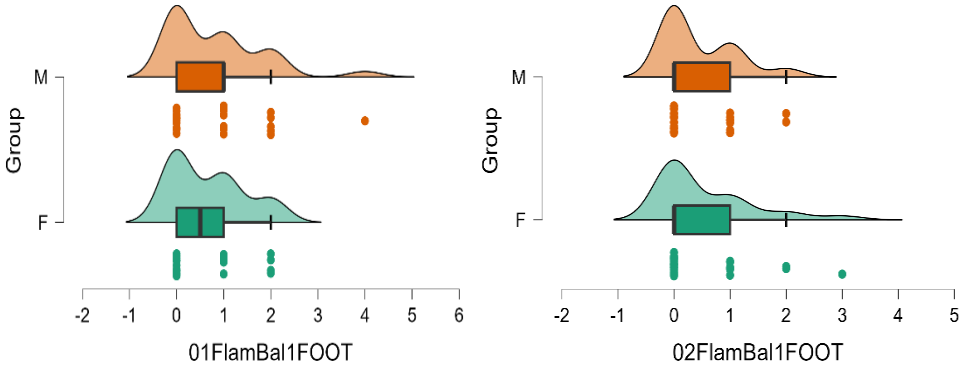
CHARACTERISTIC	Class 2	Class 2	Class 2	Mann-Whithey
	all	F	B	
VARIABLE	mean (standard deviation)	mean (standard deviation)	mean (standard deviation)	p-value
01FlamBal1FOOT	0.6 (1)	0.4 (0.8)	0.7 (1.1)	0.75
02FlamBal1FOOT	0.1 (0.3)	0.1 (0.3)	0.1 (0.4)	0.86
p-value (Wilcoxon)		0.004	<.001	
01SARFLEXIBILITY	3.5 (5)	5.6 (6.1)	1.6 (2.9)	0.037
02SARFLEXIBILITY	4.8 (5.2)	7.3 (6.5)	2.6 (2.6)	0.011
p-value (Wilcoxon)		0.007	0.014	

Table 6. District of Median and Quartile for Class 2 Student Group Variables

CARACTERISTIC VARIABLE	median [Q1 - Q3]	median [Q1 - Q3]	median [Q1 - Q3]
01FlamBal1FOOT	0 [0 - 1]	0 [0 - 0.3]	0 [0 - 1]
02FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 0]
p-value (Wilcoxon)			
01SARFLEXIBILITY	1.5 [0 - 4.8]	3 [1.8 - 8.5]	0 [0 - 1.8]
02SARFLEXIBILITY	3 [1 - 8]	8 [1.8 - 10]	2 [1 - 3]
p-value (Wilcoxon)			

1.4 Results from the FLAMINGO balance test (01FlamBal1FOOT – 02FlamBal1FOOT)

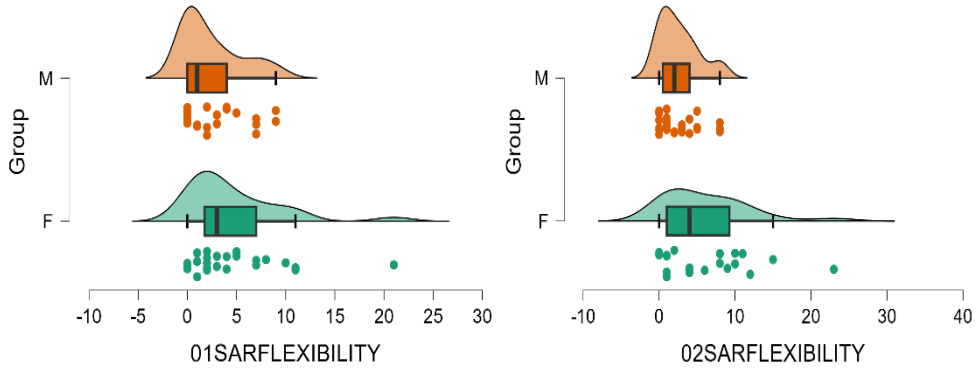
The p-values obtained from the Wilcoxon test indicate the statistical significance of the observed differences between the groups: For the two groups tested (GE-GC), the p-value being 0.004 and <.001, respectively, which suggests a statistically significant difference between girls and boys. These results demonstrate important variations in the performance of girls and boys in the indicators assessed, finding later that Mann-Withney values are above the materiality threshold of 0.05, (p=0.75 - p=0.86).



Graph 3. Distribution of FlamBal1FOOT variable (FLAMINGO BALANCE TEST) at time 1 and 2 by group membership. (GE = experimental group, GC = control group).

1.5. SIT AND REACH test results for flexibility measurement (01SARFLEXIBILITY – 02SARFLEXIBILITY)

The statistical analysis was performed using the Wilcoxon test to determine the significance of observed differences between groups. P-values from the Mann-Withney variable (0.037 and 0.011) indicate that there are significant differences in the flexibility performance of girls and boys for both tests. The Wilcoxon test results confirm these differences with p-values of 0.007 and 0.014, emphasize the statistical significance of the results.



Graph 4. Distribution of SARFLEXIBILITY variable (SIT AND REACH) at time 1 and 2 by group membership. (GE = experimental group, GC = control group).

2. Results obtained in Class III – Girls - Boys

Table 7. Characteristics and characterisation of variables between GE and GC girls and boys in Class 3

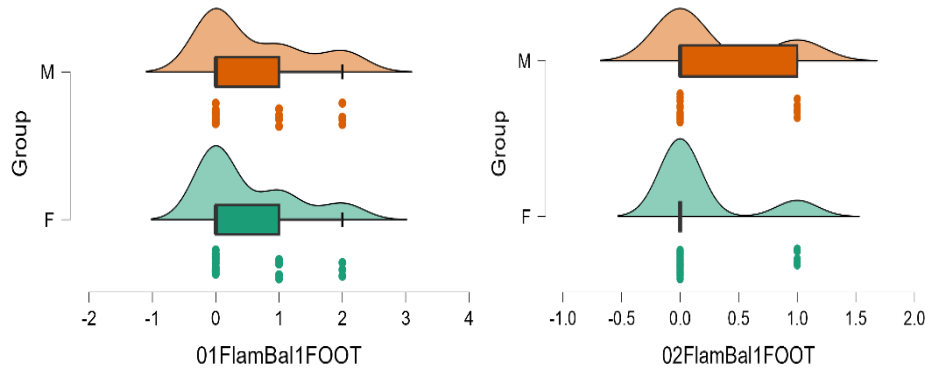
CHARACTERISTIC	Class 3	Class 3	Class 3	Mann-Whithey
	all	F	B	
VARIABLE	mean (standard deviation)	mean (standard deviation)	mean (standard deviation)	p-value
01FlamBal1FOOT	0.2 (0.4)	0.1 (0.4)	0.3 (0.5)	0.678
02FlamBal1FOOT	0.1 (0.3)	0.1 (0.3)	0.2 (0.4)	0.352
p-value (Wilcoxon)		<.001	0.002	
01SARFLEXIBILITY	5.3 (6.3)	7.3 (7.1)	2.4 (3.2)	0.1
02SARFLEXIBILITY	8 (6.2)	9.2 (7.3)	6.3 (3.7)	0.422
p-value (Wilcoxon)		0.078	0.004	

Table 8. Characteristics and characterisation of variables between GE and GC girls and boys in Class 3

CHARACTERISTIC VARIABLE	median [Q1 - Q3]	median [Q1 - Q3]	median [Q1 - Q3]
01FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 0.8]
02FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 0]
p-value (Wilcoxon)			
01SARFLEXIBILITY	3 [0 - 9]	4 [2 - 11.5]	1.5 [0 - 3]
02SARFLEXIBILITY	6 [3 - 10]	7 [3 - 12.5]	6 [3.3 - 7.8]
p-value (Wilcoxon)			

2.1. Results from the FLAMINGO balance test (01FlamBal1FOOT – 02FlamBal1FOOT)

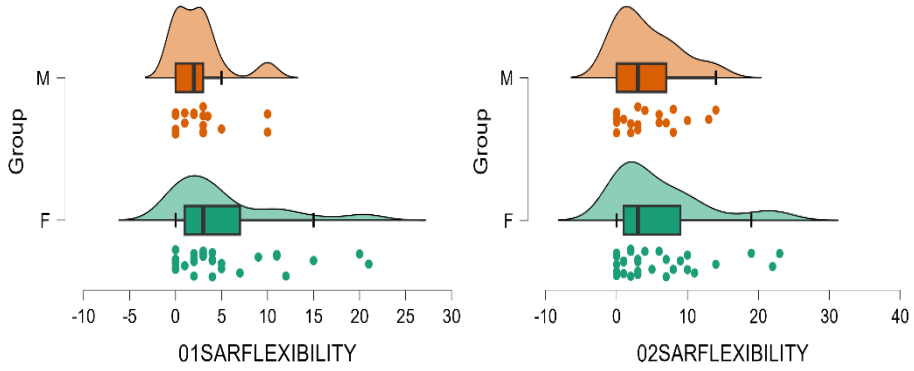
Statistical analyses suggest that there are statistically significant differences between girls and boys of class 3 according to the Wilcoxon test that demonstrate the differences in values for the two genders being at a materiality threshold of < 0.05 (p-value=<.001-GIRLS) respectively (p-value=0.002-BOYS). Subsequently, the p-values obtained from the Mann-Withney test for the test indicator suggest a statistically insignificant difference between girls and boys. These results demonstrate important variations in the performance of girls and boys in the indicators assessed, finding later that Mann-Withney values are above the materiality threshold of 0.05, (p=0.678 and p=0.352 respectively).



Graph 5. Distribution of FlamBal1PICIOR variable (FLAMINGO BALANCE TEST) at time 1 and 2 by group membership. (GE = experimental group, GC = control group).

2.1.1. SIT AND REACH test results for flexibility measurement (01SARFLEXIBILITY – 02SARFLEXIBILITY)

Statistical analysis using the Wilcoxon test to compare the performance of girls and boys in the flexibility test reveals non-significant statistical differences, with the Mann-Whitney p-value being above the materiality threshold of 0.05. These results underline the importance of separate data analysis by gender, since the significant differences observed in boys (Wilcoxon p-value = 0.004) following the flexibility test, at a statistical significance threshold of $p < 0.05$, are not reflected in the group of girls, where the significance level exceeds this threshold of 0.05 (0.078 for girls).



Graph 6. Distribution of SARFLEXIBILITY variable (SIT AND REACH) at time 1 and 2 by group membership. (GE = experimental group, GC = control group)

3. Results obtained in Class 4 – Girls – Boys

In this study, we looked at the performance of class 4 students (girls and boys) on two separate tests, differentiated by codes. The purpose of this analysis was to investigate whether there were significant differences in the performance of girls and boys in these tests using non-parametric Wilcoxon and Mann-Withney testing methods.

Table 9. Characterisation and characterisation of variables between GE and GC girls and boys in Class 4

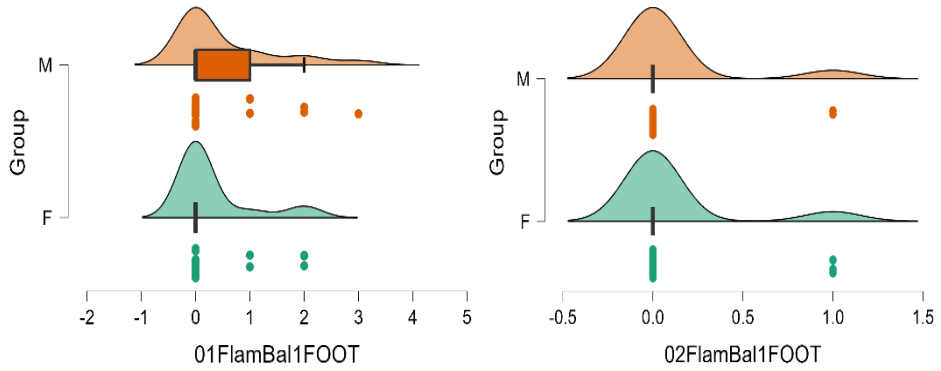
CHARACTERISTIC	Class 4	Class 4	Class 4	Mann-Whithey
	all	F	B	
VARIABLE	mean (standard deviation)	mean (standard deviation)	mean (standard deviation)	p-value
01FlamBal1FOOT	0.4 (0.7)	0.2 (0.6)	0.6 (0.9)	0.399
02FlamBal1FOOT	0 (0)	0 (0)	0 (0)	0.897
p-value (Wilcoxon)		<.001	<.001	
01SARFLEXIBILITY	4.1 (4.4)	3.7 (4)	4.4 (5)	0.11
02SARFLEXIBILITY	5.7 (5.3)	5.6 (5.3)	5.7 (5.7)	0.134
p-value (Wilcoxon)		0.06	0.167	

Table 10. District of Median and Quartile for Class 4 Student Group Variables

CHARACTERISTIC	median [Q1 - Q3]	median [Q1 - Q3]	median [Q1 - Q3]
VARIABLE			
01FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 1]
02FlamBal1FOOT	0 [0 - 0]	0 [0 - 0]	0 [0 - 0]
p-value (Wilcoxon)			
01SARFLEXIBILITY	3 [0.8 - 5]	2 [1 - 5]	3 [1 - 5]
02SARFLEXIBILITY	4.5 [2.8 - 6.5]	4 [3 - 7]	5 [2 - 6]
p-value (Wilcoxon)			

3.1. Results from the FLAMINGO balance test (01FlamBal1PICIOR – 02FlamBal1PICIOR)

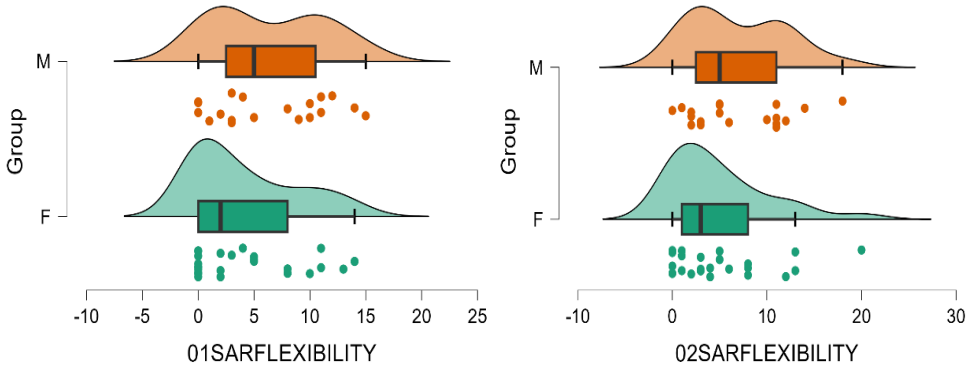
The balance test on one leg suggests the existence of significant differences in performance achieved by girls and boys at a materiality threshold (<.001) Of the Wilcoxon variable concluding that following the Mann-Withney variable there are no statistically significant differences between the groups in terms of the result obtained (p=0.399), respectively (p=0.897) the materiality threshold being over (0.05).



Graph 7. Distribution of FlamBal1FOOT variable (FLAMINGO BALANCE TEST) at time 1 and 2 by group membership. (GE = experimental group, GC = control group)

3.2. SIT AND REACH test results for flexibility measurement (01SARFLEXIBILITY – 02SARFLEXIBILITY)

The comparative analysis of the two tests did not reveal statistically significant differences between girls and boys of class 4. Both for the first and second tests, the p-values obtained from Wilcoxon (girls p-value=0.06 and boys p-value=0.167 respectively) and Mann-Withney (p=0.11 and p=0.134 respectively) suggest that the variations observed on average and the standard deviation do not they are large enough to conclude that there are real differences between the groups. This indicates a similarity in the level of flexibility between girls and boys at this age, according to the measurements made.



Graph 8. Distribution of SARFLEXIBILITY variable (SIT AND REACH) at time 1 and 2 by group membership. (GE = experimental group, GC = control group)

CONCLUSIONS

1. Based on the observed developments, educational interventions through specific physical exercises appear to be effective in improving both flexibility and balance in primary school students. The results indicate the need to adapt the exercises to the specific characteristics of each class and gender, with special attention to girls' flexibility and general balance.

2. The p-values from the Wilcoxon tests highlight a general improvement in performance during successive evaluations, particularly in flexibility tasks, where statistically significant differences are observed in most classes. This demonstrates the effectiveness of the proposed physical activities within the intervention plan, contributing to the improvement of motor skills.

3. Proper structuring of exercises, based on a detailed assessment of each student's individual needs, facilitates the improvement of both balance and flexibility. This is reflected not only in the students' performance but also in the physical activities, having a positive impact on the overall educational process.

4. In general, no significant differences were identified between boys and girls regarding one-leg balance across all classes. The p-values from the Mann-Whitney tests indicate the absence of statistically significant differences between genders (with minor exceptions in Grade 2). This suggests that balance development is comparable between boys and girls at the analyzed ages.

5. Grades 1 and 2 showed tendencies for better results than older grades (3 and 4) in maintaining one-leg balance, possibly indicating a greater importance of developing this skill at younger ages.

6. Girls tend to score higher than boys in terms of flexibility across all grades, but the differences are not always statistically significant (p-values vary), particularly in Grades 2 and

7. The Wilcoxon tests suggest a general improvement in flexibility from the first to the second test, indicating the effectiveness of the intervention program in developing flexibility among children.

Author contributions

In this research, ***Tiberiu Silviu Puta*** made a significant contribution to the implementation of strategies for optimizing psychomotor components. Through an innovative and well-founded approach, he recommended the use of effective methods and tools integrated into the intervention process, which facilitated the improvement of psychomotor skills. His expertise was essential in developing a solid theoretical and practical framework aimed at optimizing psychomotor performance, adapted to the needs of subjects from various age groups and skill levels.

Carla Silvia Băloi (Puta) played an important role in implementing the intervention plan within physical education lessons at the primary school level. She was also actively involved in the data collection process, contributing to the statistical analyses necessary to support the research conclusions.

Simona Petracovschi made a significant contribution to this study through the implementation of the intervention plan and the data collection process. She also participated in conducting the statistical analysis, ensuring the accuracy and relevance of the results. Her efforts were crucial to the success of this research study.

Acknowledgments

I would like to express my deep gratitude to the educational institution and the legal tutors of the students for their constant support in the implementation of the intervention plan. Constructive collaboration and active involvement were key factors in the development of this educational approach, which focuses mainly on the development and well-being of students.

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THE IMPLICATIONS OF STRUCTURED PHYSICAL AND SPORTS ACTIVITY PROGRAMS IN REDUCING AGGRESSIVENESS IN PRISONERS – A SYSTEMATIC REVIEW ANALYSIS

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ABSTRACT. Structured and purposeful physical activity has demonstrated significant effects on personality traits and behaviors among offenders, especially in reducing maladaptive behaviors. The European Prison Rules strongly advocate for all prisoners to have regular access to organized sports and physical education. This systematic review aims to emphasize the role of physical activity in enhancing inmates' ability to control aggression, which in turn boosts their chances of successful social reintegration and lowers the risk of recidivism by improving self-esteem and locus of control. The review included eight relevant studies sourced from scientific platforms, analyzing research published between 2000 and 2023. The studies targeted both adult and young male and female inmates, regardless of their ethnicity, all of whom participated in structured physical education and sports programs within a prison environment. These programs varied in terms of physical activity, focusing on resistance and strength training, and were consistently associated with reduced aggression, improved self-esteem, and other benefits directly related to life in detention. Through the redirection of aggressive impulses and the enhancement of self-esteem and locus of control, physical activity plays a crucial role in preventing and reducing the harmful consequences of aggressive behavior in incarcerated populations.

Keywords: *physical activity, sports, prison, aggression control, self-esteem, locus of control.*

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REZUMAT. ***Implicațiile programelor structurate de activități fizice și sportive în reducerea agresivității deținuților –revizuire sistematică.*** Activitatea fizică structurată și intenționată are efecte semnificative asupra trăsăturilor de personalitate și comportamentelor infractorilor, în special în reducerea comportamentelor inadaptative. Regulile Penitenciare Europene recomandă ca toți deținuții să aibă acces regulat la sporturi organizate și educație fizică. Această revizuire sistematică își propune să evidențieze rolul activității fizice în dezvoltarea capacității deținuților de a-și controla agresivitatea, ceea ce contribuie la creșterea șanselor de reintegrare socială și la reducerea riscului de recidivă prin îmbunătățirea stimei de sine și a locusului de control. Revizuirea a inclus opt studii relevante, selectate de pe platforme științifice, analizând cercetări publicate între 2000 și 2023. Studiile au vizat atât populații adulte, cât și tineri, de sex masculin și feminin, indiferent de etnie, toți participanții fiind deținuți care au participat la programe structurate de educație fizică și sport în mediul penitenciar. Programele de exerciții au variat, concentrându-se pe antrenamente de rezistență și forță, și au fost corelate în mod constant cu reducerea agresivității, îmbunătățirea stimei de sine și alte aspecte legate de viața în detenție. Redirecționarea impulsurilor agresive, împreună cu îmbunătățirea stimei de sine și a locusului controlului, poate fi realizată prin antrenament și practică a abilităților fizice. Astfel, activitatea fizică contribuie semnificativ la prevenirea și reducerea comportamentului agresiv în detenție.

Cuvinte cheie: *activitate fizică, sport, penitenciar, controlul agresivității, stimă de sine, locul controlului.*

INTRODUCTION

The role of sports in correctional institutions has been widely studied, with evidence Physical activity can positively impact the psychological and behavioral outcomes of inmates. This systematic review synthesizes research on the relationship between sports, self-esteem, aggression, and locus of control among inmates. Education can encourage those striving not to reoffend, yet sports receive limited attention in prisons. Structured physical activity significantly contributes to reducing maladaptive behaviors, with aggressive behavior influenced by various psychological, physiological, and situational factors. Specialized interventions are necessary to help inmates develop skills to manage anger, aggression, and self-aggression.

Aggression is interconnected with inmates' self-esteem and locus of control, which shape their behavior and influence levels of aggression and self-esteem. Individuals' interpretations and evaluations of events significantly affect their anxiety and stress levels. While aggressive behaviors are common in prison, redirecting energy towards physical education can diminish these behaviors, aiding inmates' social reintegration.

Education in prison facilitates inmates' return to society and enhances penal effectiveness. Incarceration alters personality, but education can limit the damage inflicted on detainees. Additionally, many inmates have had limited and negative educational experiences; therefore, they should receive special support to address their disadvantaged educational situation. Education can also encourage inmates to avoid reoffending. Despite its potential, sports are undervalued in prison education. Nevertheless, research shows that structured physical activity can significantly help reduce maladaptive behaviors.

The purpose of this systematic review is to highlight the importance of physical activity in enhancing adaptive behaviors among inmates, reducing aggression, and improving self-esteem and locus of control in incarcerated individuals.

The objectives pursued in the systematic review were as follows:

- Through participation in structured physical and sports activity programs, inmates will quantitatively reduce aggressive and self-aggressive behaviors.
- After participating in structured physical and sports activity programs, inmates' self-esteem will increase, and they will develop a more internal locus of control.

MATERIALS AND METHODS

This article was conducted in accordance with the specific criteria for systematic review and meta-analysis (PRISMA, Moher, 2009).

Research Strategy

The research was carried out in January 2024 and involved the analysis of relevant literature from two major databases: PubMed and Web of Science. Additional potentially relevant articles were manually searched on the scholar.google.com platform. The research was conducted based on predefined keywords: "physical education in prison," "inmate aggression," "physical activity and self-esteem," "social reintegration," "prevention of inmate aggression."

The selection of studies was carried out through a 3-step process: title evaluation, abstract evaluation, and full-text evaluation. The selected studies focused on adult and young male and female populations, regardless of ethnicity, and were published between 2000 and 2023.

Eligibility Criteria

The inclusion criteria were as follows:

1. The sample must consist of individuals in detention.

2. The study must report an association between physical activity and muscle mass, muscle strength, and/or physical performance.

3. The study must be fully published in English.

4. The intervention program must last at least 8 weeks, which is the minimum recommended duration for increasing muscle strength and reducing aggression.

The exclusion criteria were as follows:

1. Inadequate data retrieval methods.
2. Incorrect classification of terms related to the prison environment.
3. Studies published in a language other than English.

From the eligible articles, data such as the author, year of publication, study type, sample size, participant characteristics (age, gender, nationality), methodology, parameters, and the definition of physical education in prison were extracted.

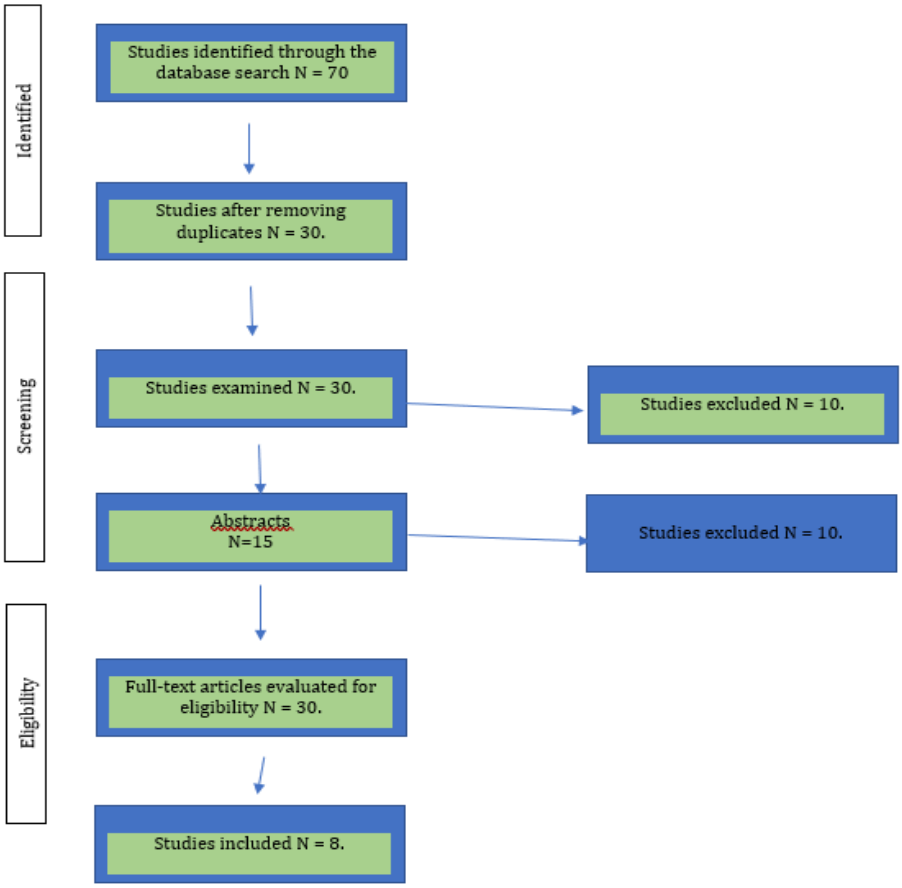

Figure 1. PRISMA diagram for study selection.

RESULTS

As a result of extensive research, 70 studies were found, of which 30 were eliminated due to duplication. Additionally, the titles of the articles were analyzed to highlight the procedures. The abstracts and full texts were assessed based on the exclusion criteria. Consequently, a total of 8 articles remained for analysis. All 4,248 participants in the analyzed studies were inmates who participated in structured physical education and sports programs in the prison environment. The number of weeks of physical training the subjects participated in was 214 weeks. The average age of the studied groups was 34.6 years. The exercise protocols varied; there were training programs focused on resistance and strength training, and their effects were correlated with reduced aggression, increased self-esteem, as well as other aspects specific to prison life.

Table 1. Reviewed Studies

Study	Subjects	Program	Methodology	Results/Conclusions
Psychou, Kokaridas, Koulouris & colab. (2008)	60 male inmates randomly assigned to two groups (control and experimental) from Grevena Correctional Institution (Greece).	The duration of the circuit training program for the exercise group was 12 weeks, with a frequency of 3 training sessions per week, each lasting 60 minutes.	The SF-12 questionnaire on quality of life and the Rosenberg Self-Esteem Scale were administered to both groups before and after the physical exercise intervention.	The results showed significant differences in physical health ($F1,58 = 10.976$, $p < .01$, $\eta p^2 = .16$), mental health ($F1,58 = 125.286$, $p < .001$, $\eta p^2 = .68$), and self-esteem ($F1,58 = 101.250$, $p < .001$, $\eta p^2 = .64$) between pre- and post-intervention measures (a, b, c) only for the experimental participants.
Cashin, Potter& Butler (2008)	747 male and 167 female inmates, forming a cross-sectional random sample of prisoners	Football training sessions occurred weekly, with 2 meetings per week, over a period of 12 months..	The Beck Hopelessness Scale was completed during the interview	An inverse correlation was found at $P < 0.05$ between total weekly exercise time (in minutes) reported in prison and both hopelessness and self-esteem ($r = -0.079$, $n = 838$, $P < 0.02$). As exercise time increased, hopelessness decreased, and self-esteem improved.

Study	Subjects	Program	Methodology	Results/Conclusions
Kimberley, Ozano (2008)	Fifteen female inmates aged 21 to 40 from HMP Drake Hall were interviewed.	Gymnastics activities were conducted at least three times a week.	This was a qualitative study Questions focused on participants' perceived experiences and outcomes related to their involvement in sports and physical activities. The collected data were analyzed using open, axial, and selective coding..	87% of inmates reported a reduction in aggression, while 96% experienced an increase in self-esteem and a decrease in anxiety.
Frey & Delaney (2008)	1770 male inmates.	The study uses a mixed research methodology, combining both qualitative and quantitative data through interviews and survey questionnaires.	interviews and surveys	A significant positive correlation ($r = 0.65$, $p < 0.01$) was found between participation in physical activities and self-reported improvements in mental health. 80% of participants reported feeling less stressed and more mentally balanced.
Frigout, Degrenne, & Delafontaine (2020)	55 men and 20 women.	Sports activity occurred weekly, with 2 meetings per week, over a period of 26 months.	The Dugas observation grid was used in a semi-structured interview, along with Toulouse questionnaires and the Kolmogorov–Smirnov test.	The significance level after Bonferroni correction was set at $p < 0.003$. Effect size values (η^2) of 0.2, 0.5, and 0.8 were considered to represent small, medium, and large differences.
Parker, Meek, & Lewis (2014)	79 participants aged 18 to 21 participated	prison sports "academies."	Observations and self-esteem questionnaires were conducted	The Mann–Whitney U test for independent samples was used. A 57.5% increase in self-esteem was reported

Study	Subjects	Program	Methodology	Results/Conclusions
			pre- and post-test.	for participants between the pretest and posttest, with statistical inference conducted at $p < 0.05$. Inmates who participated in team sports reported a 25% increase in internal locus of control.
Moscoso-Sánchez, De Léséleuc, Rodríguez-Morcillo, Fernández, Pérez-Flores & Muñoz-Sánchez (2017)	135 inmates from three different prisons. 63 staff members, including social workers, psychologists, and educators. .	3 strength training sessions per week, lasting 1 hour each, for a duration of 12 weeks.	A specially designed questionnaire was used to gather perceptions on the expected outcomes of sports practice. It was administered to both inmates and staff, covering physical, psychological, social benefits, and associated risks of sports activities	Chi-square tests were used to evaluate the association between categorical variables. The focus was on the role of sports in the social rehabilitation of inmates, highlighting its potential to foster appropriate self-esteem in over 78% of participants and an internal locus of control in 68.4% of participants.
Jugl, Bender & Lösel (2021)	1,200 male inmates	Three strength training sessions per week, lasting 1 hour, for 34 weeks	Meta-analytic techniques were used to combine data from studies and evaluate the overall effectiveness of sports programs.	The global effect size indicating a small to medium effect of sports programs on reducing aggression, increasing self-esteem, and shifting the locus of control. There was a 58% reduction in the number of aggressions.

DISCUSSIONS

The structured environment and positive reinforcement provided by sports activities contribute to overall psychological well-being. There is a significant reduction in dysfunctional behaviors among inmates through physical education and sports programs. Sports activities play an important role in managing aggression and tension in correctional settings, as physical involvement leads to a substantial decrease in aggressive behavior, channeling energy constructively and promoting a safer prison environment.

Various studies have employed different tests and methods to evaluate the impact of physical activities on inmates' aggression levels. Psychou, Kokaridas, and Koulouris (2008) used repeated measures ANOVA to assess the effects of a circuit training program on aggression, revealing significant reductions in aggressive behaviors in the experimental group compared to controls ($F1,58 = 10.976$, $p < .01$, $\eta p^2 = .16$). Cashin, Potter, and Butler (2008) explored the relationship between time spent in sports and reductions in hopelessness, finding a significant inverse correlation ($r = -0.079$, $p < 0.02$) between exercise duration and aggression levels. Regular physical activity was linked to reduced feelings of despair, which is often associated with aggression, thereby enhancing inmates' mental health. Studies indicate that physical and recreational activities in prisons positively impact self-esteem. Inmates who engage in these activities report improved self-image and increased confidence. The influence of physical activities on self-esteem and locus of control has been evaluated using various psychometric tools. Frey and Delaney (2008) found a significant positive correlation ($r = 0.70$, $p < 0.01$) between participation in physical activities and a shift from external to internal locus of control, suggesting increased responsibility and autonomy among inmates.

The relationship between self-esteem, aggression, and locus of control is complex and interdependent, significantly influenced by participation in sports. Inmates with higher self-esteem and an internal locus of control are less prone to aggressive behaviors. Cashin, Potter, and Butler (2008) demonstrated this correlation, showing that inmates regularly engaged in physical activities not only experienced improved self-esteem but also exhibited better control over aggressive impulses.

These studies suggest that sports can act as a catalyst for positive changes in self-esteem and locus of control, contributing to reduced aggression. This synergy between self-esteem, aggression, and locus of control is crucial for the long-term success of rehabilitation programs in correctional environments, making sports an essential tool for the psychological transformation and social reintegration of inmates.

CONCLUSIONS

Structured physical activities aimed at reducing conflict have proven effective in preventing and decreasing aggression-related harm. Tailored physical training in correctional environments fosters self-control and redirects aggressive impulses. The goal of these physical education and sports programs is to improve inmate behavior, optimize responses to frustration, and enhance chances of social reintegration.

The synergy among the analyzed tests and results highlights that sports activities not only reduce aggression and improve self-esteem but also promote an internal locus of control. These changes are crucial for inmates' rehabilitation and social reintegration, indicating the need for continued and expanded programs in correctional settings. Studies employing rigorous statistical methods demonstrate that sports play a central role in transforming inmates' behaviors and psychological perceptions, contributing to a safer prison environment and better preparation for reintegration.

Significant differences identified in the studies underline the variable impact of physical activities based on sport type, program frequency, duration, and individual participant characteristics. Thus, the systematic review supports international policies in prison education.

The analysis highlights the significant and beneficial effects of sports on self-esteem, aggression, and locus of control among inmates. By promoting physical health, mental well-being, and social skills, sports can be crucial for the rehabilitation and reintegration of inmates. Future research should focus on standardized measures and larger samples to further validate these findings.

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STUDY ON COMPETITIVE ANXIETY IN TABLE TENNIS ATHLETES

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ABSTRACT. The present study aims to explore the levels of competitive anxiety among table tennis athletes, identifying the factors that contribute to it and the impact on performance. **Objectives:** measuring the level of competitive anxiety, identifying the psychological and physical factors that influence the level of competitive anxiety. **Methods**: as a research tool, we used the questionnaire-based survey method, in which the measurement tool used was a standardized questionnaire called SCAT, which measures the characteristics of anxiety in both cognitive and somatic subcomponents. The research sample was composed of 53 adult athletes, who practice table tennis and who participated or are active participants in competitions organized by the Romanian Table Tennis Federation. **Results**: Analyzing the results of the questionnaire, some interesting trends were observed in relation to competition anxiety and its associated physical symptoms among athletes: an increased percentage of athletes reported **low anxiety**, suggesting a high degree of confidence in their abilities to perform in competitions; regarding the differences between men and women, the majority of men (**61.29%**) are in the category of low anxiety, while **50%** of women are in the category of **medium anxiety**; Regarding physical symptoms, according to respondents' feedback, physical symptoms of anxiety are rare. **Conclusions:** The study results suggest that competitive anxiety is a prevalent problem among table tennis athletes with a notable impact on performance. Gender differences in the perception and manifestation of anxiety may require tailored intervention strategies.

Keywords*: anxiety, table tennis, sports performance*

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REZUMAT. ***Studiu privind anxietatea competitivă la sportivi în tenis de masă.*** Studiul de faţă îşi propune să exploreze nivelurile de anxietate competitivă în rândul sportivilor de tenis de masă, identificând factorii care contribuie la aceasta şi impactul asupra performanţei. **Obiective:** măsurarea nivelului de anxietate competitivă, identificarea factorilor psihologici şi fizici care influenţează nivelul de anxietate competitivă. **Metode**: Ca instrument de cercetare s-a utilizat metoda anchetei pe bază de chestionar, în care instrumentul de măsurare utilizat a fost un chestionar standardizat denumit SCAT, care măsoară caracteristicile anxietăţii atât în subcomponentele cognitive, cât şi în cele somatice. Eşantionul cercetării a fost compus din 53 de sportivi adulţi, care practică tenis de masă şi care au participat sau participă activ la competiţii organizate de Federaţia Română de Tenis de Masă. **Rezultate:** Analizând rezultatele chestionarului, s-au observat câteva tendinţe interesante în legătură cu anxietatea competiţională şi simptomele fizice asociate acesteia în rândul sportivilor: un procent crescut dintre sportivi au raportat o **anxietate scăzută**, ceea ce sugerează un grad înalt de încredere în abilităţile lor de a performa în competiţii; în ceea ce priveşte diferenţele dintre bărbaţi şi femei, majoritatea bărbaţilor (**61,29%**) se încadrează în categoria cu **anxietate scăzută**, în timp ce **50%** dintre femei se află în categoria de **anxietate medie**; în privinţa simptomelor fizice, conform feedback-ului respondenţilor, simptomele fizice ale anxietăţii sunt rare. **Concluzii**: Rezultatele studiului sugerează că anxietatea competitivă este o problemă prevalentă în rândul sportivilor de tenis de masă, cu un impact notabil asupra performanţei. Diferenţele de gen în percepţia şi manifestarea anxietăţii ar putea necesita strategii personalizate de intervenţie.

Cuvinte-cheie*: anxietate, tenis de masă, performanţă sportivă*

INTRODUCTION

The way people react to various environmental stressors is different, especially if we refer to the emotional experiences along their lives, like multidimensional state anxiety (Cerin et al., 2000, 2001; Hanton et al., 2008; Mellalieu et al., 2009)

Competitive anxiety and stress management are part of any kind of competitions. Competitive anxiety is a mental state which includes cognitive, somatic and emotional components (Gillham et al., 2014; Mellalieu et al., 2009; Woodman and Hardy, 2001).

There are many different factors such as, gender, life experience, age, skill level (Gan et al., 2009; Radochonski et al., 2011), control of the situation (Jones, 1995) and self-confidence (Gillham et al., 2014; Mellalieu et al., 2009; Wagstaff et al., 2011), which have an impact on competitive anxiety.

In competitive sport, athletes atypically report arousal and other somatic and emotional changes during competition (Gould et al., 1993b). Despite the fact that emotional reactions tend to be uncomfortable or exhausting, they are crucial if we want to obtain an optima response in competitions (Hanton and Jones, 1997; Hanton and Connaughton, 2002).

Competitive anxiety has lately become an object of study in sports psychology (Mellalieu et al., 2006; Wadey and Hanton, 2008). Its definition, as we find it in Ong an Chua (2021), is the following: "a trait and/or state-like response to a stressful sport-related situation, which the individual perceives as potentially stressful, resulting in a range of cognitive appraisals, behavioral responses, and physiological arousals".

Generally, there are two types of anxiety: state anxiety and trait anxiety (Kar, 2013). State anxiety involved feeling of apprehension, tension, fear, and increased physiological arousal (Kar, 2013). This is an immediate emotional state response to the specific situation. State anxiety also consists of somatic and cognitive anxiety (Kar, 2013). The characteristics of somatic anxiety are related to physical symptoms like: accelerated heartbeat, muscle weakness and difficulty in breathing. (Martinent et al., 2010). Meanwhile, cognitive anxiety refers to discomfort and mental disturbance for approaching events.

Table tennis, if explored in a culturally diverse surrounding, could be worthy of attention. Due to its complexity and demanding situations, this sport is very demanding for the players - releasing emotional and cognitive reaction. (Hagan Jr. et al, 2017). The speed of the ball requires a short rapid response, that is why table tennis resembles other fast paced and reactive sports with discontinuous tasks. (Raab et al., 2005). All these elements are essential for the players, as they need advanced cues in deciding the appropriate cues and the movement patterns that offer improved performance. (Mann et al., 2007).

In table tennis competitions, players do not fight against the opponents only through physical actions, but also through emotions.

These players try to identify the emotions of their opponents and match histories to improve their own control of the competitive situation. Players usually hide or try to give a false account of their emotions in order to mislead the opponents; they also try to use other tools, like emotional expressions, in influencing various events. (Sève et al., 2005, 2007).

Therefore, any emotional instability may cause habitual technical faults (performance errors) that may affect subsequent match outcomes.

AIM OF THE STUDY

The aim of this research was to determine, by means of an applied questionnaire, the levels of competitive anxiety among table tennis players, identifying the factors contributing to it and its impact on sports performance.

RESEARCH OBJECTIVES

In order to assess competitive anxiety in table tennis players, setting specific objectives is essential. These objectives help structure the research and ensure that the information obtained is relevant and applicable. To conduct the research, we set the following objectives:

- measuring competitive anxiety levels in a representative number of table tennis players using a standardized questionnaire. This objective will allow a comparative analysis of anxiety levels in different groups (men vs. women);
- identifying psychological and physical factors that influence the level of competitive anxiety, such as pressure of results, social expectations, previous competition experience. Understanding these factors can help develop personalized interventions to manage anxiety.

METHODS AND MEANS

Research subjects

The research sample consisted of **53** adult athletes who practice table tennis and who participated or actively participate in competitions organized by the Romanian Table Tennis Federation. The group consisted of athletes aged between **18** and **30** years, providing a representative picture of competitive anxiety in adults. Of the total participants, **22** were female, representing **42%** of the sample, and **31** were male, representing **58%** of the sample. This relative gender balance allows for a relevant comparative analysis between levels of competitive anxiety in both male and female table tennis athletes.

METHODS

To carry out this study, the survey method was used. A standardized questionnaire called the Sports Competition Anxiety Test - SCAT (Martens et al. 1990) was used as a measurement tool used in the research. The SCAT is a

15-item self-report scale that assesses athletes' anxiety levels in both cognitive and somatic subcomponents. The questionnaire analyzes an athlete's response to a series of statements about how they feel in a competitive or performance situation. Of the 15 items, 10 of them measure symptoms associated with anxiety, the other 5 statements are included to reduce inaccurate or false responses to the questionnaire. The collected data were measured using a 3-point Likert scale (1 - rarely; 2 - sometimes; 3 - often).

Questionnaire application procedure

Each of the research subjects was given the questionnaire individually and they were given a privacy space to ensure honest answers, and without time limit, they completed it. For each statement, they had to complete the three-point scale as they felt when competing.

RESULTS

The results presented below show the levels of competitive anxiety among table tennis athletes identified by them as contributing factors to sports performance.

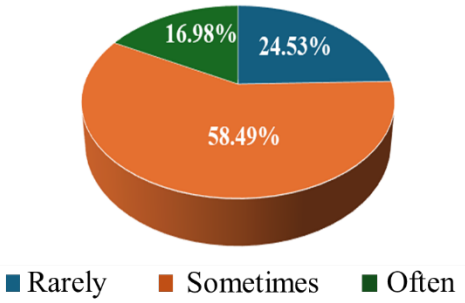

Fig. 1. Feeling anxious before the competition

The graph clearly illustrates the prevalence of feelings of anxiety among the surveyed athletes. Of the 53 participants, most (31 athletes, i.e. 58.49%) chose the option "sometimes", which means that most athletes occasionally experience anxiety before or during competitions. Nearly a quarter of the respondents (24.53%) indicated that they experience anxiety "rarely", suggesting a relatively frequent state of calm before competitions. In contrast, 16.98% of the athletes chose the 'often' option, indicating that they experience anxiety more frequently, with this group being the lowest percentage. Thus, the graph clearly reflects the distribution of feelings of anxiety within this sample.

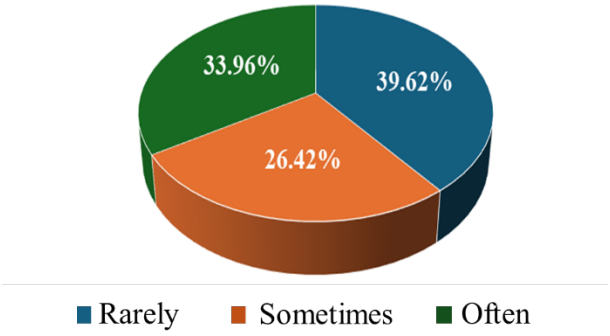

Fig. 2. Performance concerns

As illustrated in the figure, the athletes' responses to the statement about fear of not performing well were quite divergent. From the total of 53 athletes:

• **21 athletes** (39.62%) indicated that they "rarely" fear failure in competitions, suggesting that they have a low level of performance anxiety.

• **14 athletes** (26.42%) reported that they "sometimes" have these fears, showing a moderate level of anxiety.

• **18 athletes** (33.96%) answered that they "often" fear that they will not perform well, indicating a higher level of anxiety about their performance in competitions.

This diversity of responses reflects the fact that the athletes in the sample perceive the pressure to perform well differently, some experiencing the fear of failure more frequently, while others experience it less often.

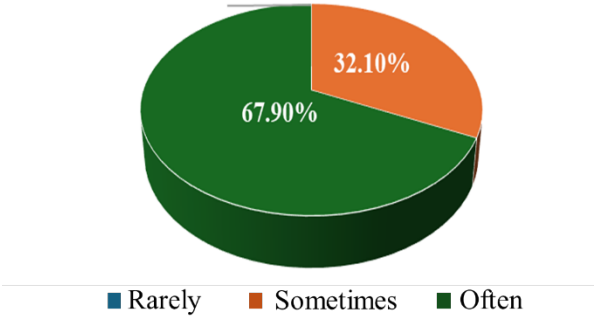

Fig. 3. Athletes' perception of themselves as good athletes

The graph reflects a clear trend of confidence and self-assurance among the athletes interviewed. Of the 53 respondents, **67.90%** often consider themselves **good athletes**, indicating a high level of self-efficacy and confidence in their

own abilities. The remaining **32.10%** mentioned that they **sometimes** have the same opinion about themselves during competitions, which shows moderate self-confidence.

A positive and significant aspect is the fact that **none of the athletes chose the "rarely"** option, suggesting that all research participants have a positive image of their own sports performance. This is a clear sign of a generally high level of confidence and self-assurance, essential for success in competitions.

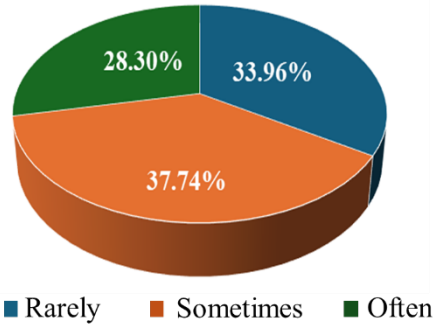

Fig. 4. The frequency of fear of failure

The fear of making mistakes during competition generated quite varied responses among athletes. The most common answer was **"sometimes",** with **37.74%** of athletes indicating that they occasionally experience this fear. In second place, with **33.96%,** are those who mentioned that they **"rarely"** fear mistakes during the competition, which suggests that a significant part of this sample experiences this anxiety only in isolated cases. Finally, **28.30%** of respondents indicated that they are **"often"** afraid of making mistakes, highlighting that a smaller but important proportion feels this insecurity more frequently.

This distribution shows that fear of making mistakes is a relevant anxiety factor for athletes but varies in intensity from person to person.

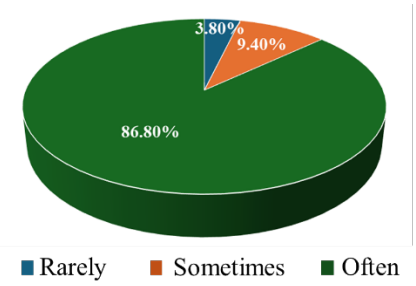

Fig. 5. The importance of setting a goals

The chart highlights the major importance athletes place on goal setting. **86.80%** of respondents believe that goal setting is **"often"** essential to their performance, which underlines the crucial role it plays in motivation and direction in competitions. On the other hand, a very small percentage, only **3.80%,** believe that goal setting is **"rarely"** important, indicating that only a small proportion of athletes underestimate or neglect this element in their training.

This strong prevalence of the view that goals are essential indicates that most athletes believe that setting clear and realistic goals improves their focus and performance.

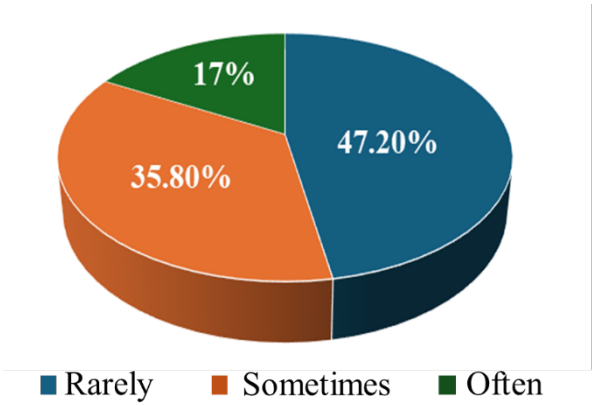

Fig 6. Frequency of feeling nervous before competitions

The results indicate that nervousness, as a phenomenon and a disruptive factor during competitions, is felt differently by athletes. According to the data:

• **47.20%** of respondents state that they **"rarely"** feel nervous, which suggests a low level of anxiety during competitions for this category.

• **35.80%** of athletes indicate that they "sometimes" feel nervous, which suggests that a considerable part of them experience this feeling under certain conditions or circumstances.

• Finally, **17%** of respondents say they **"often"** feel nervous, highlighting a minority who experience this disruptive factor to a significant degree.

Thus, more than half of the athletes **(82.80%)** rarely or sometimes feel nervous, which is a positive sign, indicating that most of the athletes in this sample have the ability to effectively manage negative emotions during competitions.

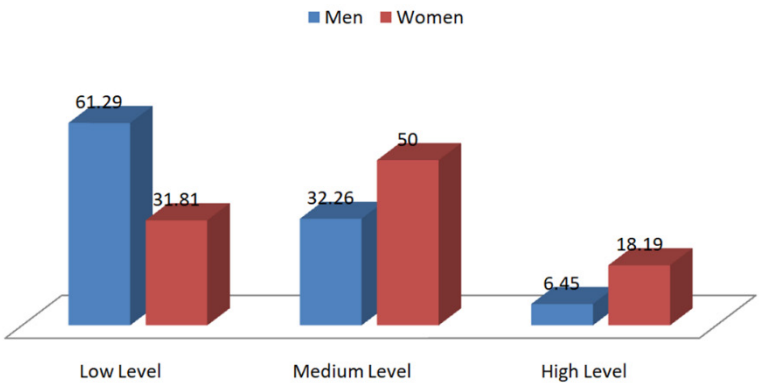

Fig. 7. Percentage comparison between women and men

Comparative analysis of SCAT (Sport Competition Anxiety Test) scores for women and men reveals significant differences in anxiety levels.

DISCUSSIONS

Analyzing the results of the questionnaire, several interesting trends were observed in relation to competition anxiety and its associated physical symptoms among athletes:

- almost **49.05%** of athletes reported low anxiety, suggesting a high degree of confidence in their ability to perform in competitions.
- **61.29%** of men fall into the low anxiety category, indicating a significant prevalence of confidence in their competitive abilities.
- In contrast, only **31.81%** of women are in the same category, highlighting a difference of almost **30%** between the two sexes.

This suggests that men are more likely to experience low levels of anxiety compared to women.

39.63% of the respondents stated that they have average anxiety, which indicates that a considerable part of the athletes feel some pressure, but not to an extent that significantly affects their performance. About **50%** of women fall into the medium anxiety category, which shows a greater tendency for women to feel moderate anxiety during competitions. In contrast, only **32.26%** of men are in this category, suggesting a greater predisposition of women towards an average level of anxiety.

Only **11.32%** of athletes reported high anxiety, highlighting that most do not experience overwhelming fear before competitions.

Research shows that athletes in general feel relatively calm before competitions, but this state of calm is more common among men than women. Nervousness rarely occurs among athletes before a direct competition, which indicates a good ability to manage emotions and stress.

According to respondents' feedback, physical symptoms of anxiety are rare.

An increased heart rate is a more commonly observed symptom, with just over **20%** of athletes reporting that they experience it often, and nearly **40%** saying that they experience it sometimes.

On the other hand, nausea occurs often in only **7.5% of athletes,** suggesting that overall physical symptoms of anxiety are less common.

CONCLUSIONS

Past research has demonstrated the impact that competitive anxiety can have on sporting performance, with a meta-analysis by Woodman and Hardy (2003) indicating a significant adverse effect for cognitive anxiety on sport performance.

Other studies have shown that high anxiety situations cause athletes to engage in excessive error monitoring (Masaki et al., 2017); reduce anticipation timing performance (Duncan et al., 2016); decrease search rate and processing efficiency (Nieuwenhuys et al., 2008); and have a negative effect on shooting accuracy in soccer (Wilson et al., 2009). Competitive anxiety has also been shown in past research to heighten the risk of sport injury (Ford et al., 2017), with a review study indicating that competitive trait anxiety is a risk factor for musculoskeletal injury in athletes (Ong and Chua, 2021).

The study focused on analyzing the anxiety level of table tennis players. The conclusions of our investigation highlighted that anxiety represents a serious problem in sport competition and that if we train our team with mental coaching and psychological evaluation, we can prevent the rise of the anxiety level and also improve sportive results. (Sopa, 2021).

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THE INFLUENCE OF SLEEP ON ATHLETES' BODY RECOVERY AFTER EFFORT

Mihaela BUTNARIU[1]

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ABSTRACT. The recovery of athletes' body after effort is an essential component of sports training, alongside physical, technical, tactical, theoretical, and psychological preparation. Sleep is a natural and crucial means for post-effort recovery, if the quality and quantity requirements are met. The aim of this research is to investigate athletes' perceptions and behaviors related to sleep and rest and how these affect sports performance. The research methods used were literature review, questionnaire survey, statistical-mathematical analysis and graphical representation. By analyzing the responses to a 9-question survey, the study aims to highlight the factors that affect sleep quality and the impact on recovery and overall performance. Specifically, the research seeks to identify correlations between hours of sleep, bedtime and wake-up routines, relaxation techniques and perceptions of sleep's importance in physical recovery. The questionnaire included questions about sleep habits (sleep hours, bedtime, alarm use), perceived sleep quality and common issues (difficulty falling asleep, frequent waking); athletes' perceptions of sleep's influence on sports performance; factors that disrupt sleep and techniques used to improve sleep quality. The student-athletes who responded to our questionnaire do not have sufficient knowledge about sleep hygiene, meaning that coaches should focus more on providing information about athletes' lifestyle, which include the importance of sleep for post-effort recovery, for their health and implicitly for improving sports performance. Athletes must realize that sleep should be a priority in their lifestyle, placing it in the same place with nutrition and training.

Keywords: *effort, performance, recovery, sleep, athletes*

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REZUMAT. ***Influența somnului în refacerea organismului sportivilor după efort.*** Refacerea organismului sportivilor după efort este o componentă importantă a antrenamentului sportiv alături de pregătirea fizică, tehnică, tactică, teoretică și psihologică. Somnul este un mijloc natural esențial pentru refacerea după efort, cu condiția respectării cerințelor legate de calitatea și cantitatea acestuia. Scopul acestei cercetări este de a investiga percepțiile și comportamentele legate de somn și odihnă ale sportivilor, precum și influența acestora asupra performanței sportive. Metodele de cercetare utilizate au fost analiza literaturii de specialitate, ancheta prin chestionar, metoda statistico-matematică și metoda grafică. Prin analizarea răspunsurilor la un chestionar cu 9 întrebări, studiul își propune să evidențieze factorii care afectează calitatea somnului și impactul acestora asupra refacerii și performanței generale. În mod special, cercetarea vizează să identifice corelațiile între orele de somn, obiceiurile de culcare și trezire, tehnicile de relaxare, și percepțiile despre importanța somnului în contextul recuperării fizice. Chestionarul a inclus întrebări despre obiceiurile legate de somn (ore de somn, ora de culcare, folosirea alarmelor); calitatea percepută a somnului și problemele frecvente (dificultăți de adormire, trezire frecventă); percepția sportivilor asupra influenței somnului asupra performanței sportive; factorii care perturbă somnul și tehnicile folosite pentru îmbunătățirea acestuia. Studenții sportivi care au răspuns chestionarului nostru nu au suficiente cunoștințe despre igiena somnului, ceea ce înseamnă că ar trebui să existe o preocupare mai mare din partea antrenorilor în legătură cu transmiterea unor informații referitoare la regimul de viață al sportivilor, care include și importanța somnului pentru refacerea după efort, pentru sănătatea acestora și implicit pentru creșterea performanțelor sportive. Sportivii trebuie să conștientizeze faptul că somnul trebuie să reprezinte o prioritate în regimul lor de viață, punându-l pe același loc cu alimentația și cu antrenamentele.

Cuvinte-cheie: *efort, performanță, refacere, somn, sportive*

INTRODUCTION

Recovery after effort is a basic component of sports training that plays an essential role in optimizing the performance of athletes and increasing sport longevity. The recovery is addressed to healthy athletes, physically and mentally tired after work and training. When the training and competition effort are in the normal physiological limits of the body, natural recovery through rest is sufficient, but when the number of training sessions and / or competitions is high, the volume and intensity of the training are increased, it is compulsory to intervene with means of the guided restoration. Otherwise, athletes will accumulate fatigue, possibly reaching a state of overload, or, more seriously, over-training,

characterized by a long-lasting functional imbalance arising from repeated physical and psychological stresses, resulting in lower sports performance (Butnariu, 2018).

Recovering the body after effort is an essential part of sports training, to which field specialists must pay attention in order to achieve high performance in sports.

To recover the body after effort, athletes can use various methods of natural or guided recovery, such as passive rest (sleep), active rest, recovery nutrition, hydrotherapy, sauna, cryosauna, cryotherapy, massage, acupuncture, natural and artificial oxygenation, negative aeroionization, electrostimulation, psychotherapy, etc.

In human history, sleep was considered an inactive state when our mind and body simply shut down, disconnected from the external world. However, in recent decades, with the advancement of new technologies that allow researchers to measure brain activity (known as brain waves or EEG recordings), scientists have discovered that sleep is a dynamic state with its own intriguing processes (Gregg, 2009).

Sleep is a normal, periodic and reversible phase, driven by the body's vital need for periodic rest. It is not a time of relaxation for the brain; the brain remains highly active during sleep. Neurons can continue to process memories while the person sleeps (Ciobanu, 2005). Sleep has various functions: organizing thoughts, memory consolidation, stress reduction, muscle relaxation, regulating hormonal activity, lowering heart and respiratory rates, decreasing body temperature, boosting the immune system and tissue regeneration (Chiru, Chiru & Morariu, 2012).

Sleep is essential for athletes' recovery after the physical and mental effort made in training and competitions. Quality sleep aids in physical recovery, enhances concentration abilities and optimizes cognitive functions, all of these being vital for achieving maximum performance in both training and competition.

Sleep is especially important for athletes, contributing to tissue regeneration and muscle recovery; improving coordination and motor memory; reducing mental stress and anxiety; maintaining immune system health; lowering the risk of injuries; optimizing metabolism and energy levels etc.

For athletes, Drăgan (2002) recommends at least 8 hours of sleep per day, as it is the only natural way to recover the nervous system and eliminate fatigue. Sleep duration should increase during competition periods. The ideal hours are from 10-11 PM until 7-8 AM. It is also recommended that athletes rest, even without sleeping, for 1-2 hours after lunch.

For athletes, sleep is essential for recovery and performance. Yet, up to two-thirds of athletes report poor sleep quality (Vorster et al., 2024). Considering the paramount role of sleep health in the training, recovery, performance, and overall well-being of professional athletes, the unique challenges faced by

professional athletes that negatively impact sleep health, and the high prevalence of sleep problems and disorders among professional athletes, there is a clear need for accessible, tailored, and efective strategies and interventions to enhance sleep health in professional athletes (Cook & Charest, 2023). Monitoring athletes' subjectively perceived sleep and recovery is of great importance, especially during special sports events, to identify deviations as early as possible to then apply objective measures to examine sleep parameters and sleep architecture in more detail (Kiel et al., 2022). Regular sleepers had greater sleep efficiency, less variability in sleep efficiency and total sleep time, but similar total sleep time compared with irregular sleepers. Bedtime, sleep onset and sleep offset times influence sleep efficiency and total sleep time in athletes. While sleep behaviours only explained 22% of the variance in sleep efficiency, at the elite level, small changes may have large consequences for performance outcomes. As such, coaches and staff can assist their athletes by providing training schedules that allow for both regularity and sufficiency of time in bed where possible (Halson et al., 2022).

Based on current knowledge, restorative sleep may be considered the cornerstone of athletes' successful recovery. Previous studies have shown that sleeping problems have become common in professional athletes. This descriptive study compared the sleep between youth elite amateur athletes and professional athletes. Our results demonstrate that younger athletes have received more sleep counselling and experience less sleeping problems. Although there may be various factors affecting sleep, our findings indicate that early sleep counselling may play an important role in prevention of sleep problems in athletes. Therefore, sleep counselling should be recommended to be part of athletes' overall training process aiming at success (Penttilä et al., 2022). Sleep has fundamental physiological and cognitive functions that are crucial for athletes. However, athletes are particularly susceptible to sleep inadequacies such a poor-quality sleep and short sleep. In recent years, athletes, coaches, and support teams have exponentially increased their knowledge about sleep and recovery and its importance to athletic performance (Charest & Grandner, 2024).

To achieve outstanding sports results in any discipline, a large number of training sessions are required, often including two sessions per day. Under these conditions, insufficient sleep can lead to a decline in athletic performance because the body is unable to recover fully from the physical and mental effort exerted during training. Sleep deprivation among athletes leads to slower reaction times, reduced strategic thinking, and diminished decision-making abilities. It also impairs their capacity to efficiently perform multiple complex physical tasks. Additionally, sleep is crucial for muscle regeneration, especially considering the micro-injuries that occur after physical exertion. In this situation, if sleep is adequate in terms of quantity and quality, the risk of injuries decreases significantly.

We should not overlook the quality of sleep either, as athletes need to consolidate and perfect the motor skills and abilities they have acquired, continuously adapting to new techniques and game strategies. The most effective sleep is nighttime sleep, as daytime sleep is not as restful.

The undeniable benefits of enhanced sleep quality resulting from physical exercise have been well-established. However, analyzing the intricate relationship between recovery levels and sleep quality necessitates a thorough investigation. This exploration is essential to develop a comprehensive of how sleep influences recovery, particularly concerning training loads, in the context of young athletes. Physical recovery is a pivotal and rejuvenating aspect for athletes, highlighting the importance of examining its interplay with sleep (Da Costa, 2023).

If athletes habitually obtain ~ 7 h of sleep per night, a general recommendation may be to increase sleep duration up to 2 h over 3–49 nights. Also, supplementing sleep during the day with a nap (20–90 min) can be implemented when necessary. In addition to improving the sleep duration, naps can improve performance outcomes after a regular night and restore performance decrements to baseline levels after a night with partial sleep restriction. For strategies such as sleep hygiene, mindfulness, or limiting the use of electronic devices before bedtime, it is plausible that such interventions can positively impact performance outcomes if they can improve sleep quality and/or duration (Cunha et al., 2023).

Practitioners, including coaches, sports scientists, and healthcare professionals, are encouraged to consider incorporating structured napping into athletes' training regimens, especially during periods of high physical demand or in preparation for competitions. This study not only highlights the importance of sleep duration in athletic training but also underscores the need for a holistic approach to athlete health and performance enhancement. By integrating napping strategies tailored to individual athletes' needs, practitioners can contribute to the improvement of respiratory parameters, thereby potentially enhancing overall athletic capacity and performance (Kurtoğlu et al., 2024).

PURPOSE OF THE STUDY

The aim of this study is to investigate the role of sleep and rest in the physical and mental recovery process of athletes, assessing how these factors influence athletic performance and overall health. The study seeks to determine how aware athletes are of the impact of sleep on their performance and to identify potential practices that contribute to better sleep quality.

MATERIAL & METHODS

The research methods used were the analysis of specialized literature, questionnaire survey, statistical-mathematical method, graphical method and tabular method.

To achieve the objective of the study, a questionnaire consisting of 9 multiple-choice questions was developed, being designed to cover the key aspects related to sleep duration and quality, sleep habits, the use of relaxation techniques and perceptions regarding the importance of sleep in recovery after training. The questionnaires were distributed to 100 students from the Sports and Motor Performance Study Program within the Faculty of Sciences, Physical Education and Informatics at National University of Science and Technology Polyethnica Bucharest. For the analysis and interpretation of the results, 92 questionnaires were used, as 8 had incomplete answers. The collected data were statistically analyzed, using correlation tests to identify relationships between variables, as well as frequency tests to determine the prevalence of certain behaviours and perceptions.

RESULTS

For interpreting the results, we analyzed the questionnaire and correlated the responses from several questions.

Table 1. Questions 1, 2, and 3 of the questionnaire

1.How important do you consider rest and sleep are for your athletic performance?	**Number of responses**	**2.What are the main reasons your sleep is disrupted?**	**Number of responses**	**3.What actions do you take to improve the quality of your sleep? (Check all that apply).**	**Number of responses**
a. Not important at all	0	a.Stress/anxiety	36	a.I avoid alcohol and caffeine before bed	64
b.Slightly important	0	b.Late training sessions	9	b.I make sure the bedroom is dark	39
c.Important	4	c.Use of electronic devices before bed	40	c.I avoid intense workouts a few	8
d.Very important	32	d.Other reasons (please specify)	7	d.I follow a consistent sleep	41
e.Extremely important	56	-	-	e.Other actions (please specify)	12

For question 1, the responses range from "a" (the least expected answer) to "e" (the favorable answer), with Figure 1 showing a clear increase in the number of "very important" and "extremely important" responses, confirming the expectation that athletes consider rest and sleep essential. Analyzing question 2, it is concluded that the main reasons for sleep disruption are "using electronic devices before bed" and "stress" (Table 1). For question 3, although the favorable answer is "e" – other actions, where I expected the activities undertaken to improve sleep would be related to stress and the use of electronic devices before bed, the most common responses were "avoiding alcohol and caffeine before bed" and "maintaining a consistent sleep routine."

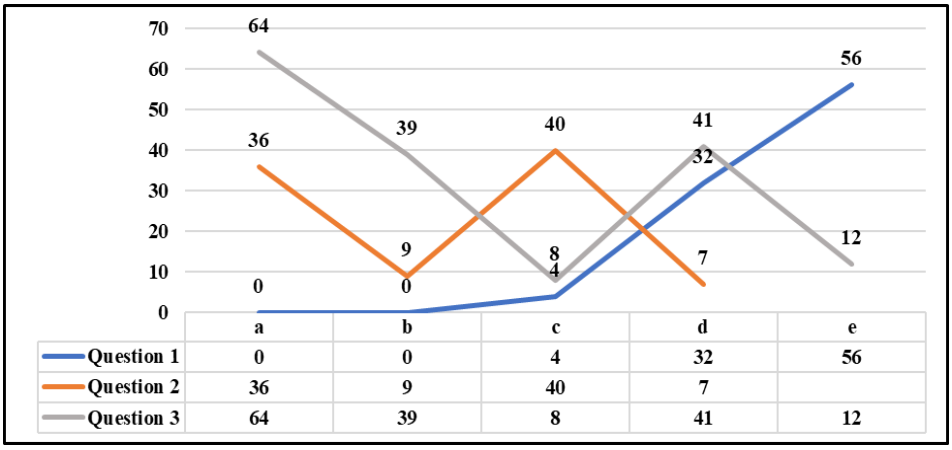

Figure 1. Graphical representation of the responses to questions 1, 2 and 3

Similarly, questions 4, 5, and 6 were coupled to determine the amount of sleep, i.e., the number of hours slept per night, and its quality (Table 2).

For question 4, although the favorable answer was "more than 8 hours," after analyzing the questionnaire, it was found that the most common responses were "7-8 hours" and "6-7 hours." The analysis of question 5 reveals that student athletes frequently feel sleepy and tired during the day. For question 6, we found out that student athletes sometimes feel rested and refreshed after sleep (Figure 2).

Questions 5 and 6 were included with the purpose of checking the attention and seriousness with which the questionnaire was completed. Considering that the answers to these two questions are very similar, this indicates that the respondents were attentive and answered correctly.

Table 2. Questions 4, 5, and 6 of the questionnaire

4. How many hours of sleep do you get on average per night?	Number of responses	5. Do you often feel sleepy or tired during the day?	Number of responses	6. How often do you feel rested and refreshed after sleep?	Number of responses
a. Less than 5 hours	0	a.Never	2	a.Never	4
b.5-6 hours	4	b.Rarely	24	b.Rarely	48
c.6-7 hours	28	c. Frequently	64	c.Sometimes	32
d.7-8 hours	44	d. Every day	2	d.Often	8
e. More than 8 hours	16	-	-	e. Very often	0

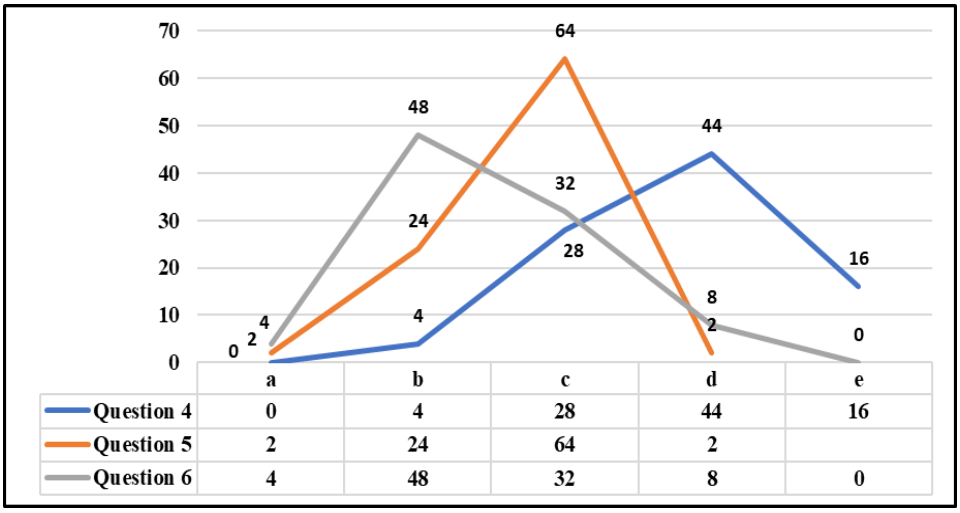

Figure 2. – Graphical representation of the responses to questions 4, 5 and 6

Attempting to establish a correlation between questions 7, 8, and 9, we found that those who go to bed later have more difficulties falling asleep or having restful sleep (Table 3). Athletes who fall asleep after 12:00 AM may experience sleep difficulties more frequently, indicating a potential link between bedtime and sleep quality. Additionally, those who go to bed late tend to have lower performance, being affected by the lack of sleep (Figure 3).

Table 3. Questions 7, 8, and 9 of the questionnaire

7. What time do you usually go to bed during the week?	**Number of responses**	**8. Do you have difficulty falling asleep or staying asleep during the night?**	**Number of responses**	**9. Have you noticed a connection between insufficient sleep and reduced athletic performance?**	**Number of responses**
a.Before 10:00 PM	0	a.Never	4	a.Yes, very often	28
b.Between 10:00 PM and 11:00 PM	48	b.Rarely	48	b.Yes, occasionally	52
c.Between 11:00 PM and 12:00 AM	41	c.Sometimes	32	c.No, almost never	5
d.After 12:00 AM	3	d.Often	8	d. I'm not sure	7
		e.Very often	0		

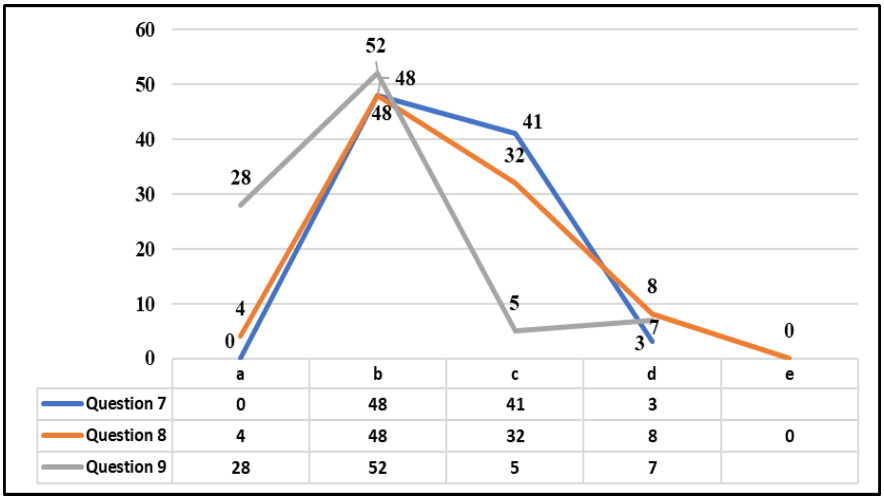

Figure 3. Graphical representation of the responses to questions 7, 8 and 9

DISCUSSION

Sleep is essential in terms of recovery, health, and peak performance by influencing physical, psychological, and cognitive functioning, whereas mindfulness-based techniques have been shown to improve sleep quality (Klier, Seiler & Wagner, 2021).

Acute sleep loss appears to have a negative impact on next day exercise performance. The magnitude of the effect may be greater when individuals experience either sleep deprivation or late restriction, and when performance tasks are conducted in the PM. Individuals can anticipate a ~ 0.4% decline in performance for every hour spent awake following acute sleep loss. Thus, incorporating lifestyle behaviours/strategies that limit the likelihood of experiencing sleep loss must be emphasised. However, if acute sleep loss is anticipated and unavoidable, individuals should, where possible, endeavour to mimic early-restriction sleep patterns rather than deprivation or late restriction and prioritise exercise to the morning in an effort to maintain performance (Craven et al., 2022).

Evaluating sleep quality among athletes is critical due to the adverse effects of sleep deprivation, including reduced capacity to think and react quickly, reduced communication skills, and reduced athletic performance. Examining the role of chronotype in athletic performance provides insight to optimize training, performance, and recovery (Grace et al., 2023). Technological advances in sleep monitoring have seen an explosion of devices used to gather important sleep metrics. These devices range from instrumented 'smart pyjamas' through to at-home polysomnography devices. Alongside these developments in sleep technologies, there have been concomitant increases in sleep monitoring in athletic populations, both in the research and in practical settings. The increase in sleep monitoring in sport is likely due to the increased knowledge of the importance of sleep in the recovery process and performance of an athlete, as well as the well-reported challenges that athletes can face with their sleep (Driller et al., 2023).

Pradzynska, Rylands & Canham (2023) concluded the findings of the scoping review suggest there are opportunities for coaches and practitioners to implements interventions that would reduce the effect of sleep deprivation on athletes prior and post competition. Coaches and practitioners should consider the timing of travel and allow for a climatization period prior to competition, this may have a positive impact on an athletes sleep patterns. While devising a psychological intervention strategy for athletes to cope with pre-competitions nerves may aid with sleep patterns and have a positive effect on performance. During times of heavy training load coaches may wish to consider prescribing training earlier in the day and avoid late night training session as this will help with sleep and aid recovery.

CONCLUSIONS

Athletes need to be aware that sleep should be a priority in their lifestyle, placing it on the same level as nutrition and training.

The student athletes who responded to our questionnaire do not have sufficient knowledge about sleep hygiene, which means that coaches should be more concerned with providing information regarding athletes' lifestyles, including the importance of sleep for recovery after effort, for their health and ultimately for improving athletic performance.

If athletes consider sleep is very important for performance, but report that it is frequently disrupted by factors such as stress or late training sessions, it is possible that they are aware of the importance of sleep but lack the necessary strategies to reduce the impact of disruptive factors.

The correlations made between the 9 questions of the questionnaire highlight the importance of a regular sleep schedule and quality sleep for maintaining athletic performance. Insufficient or poor-quality sleep can lead to fatigue and decreased performance and analyzing these connections can help develop personalized recommendations for improving sleep quality. Athletes could be encouraged to adopt healthier sleep habits, such as establishing an appropriate bedtime and engaging in practices that improve sleep quality, such as reducing stress before bed or avoiding screen exposure. Additionally, the correlations made can provide an overview of the factors that influence athletes' sleep quality and the measures they take to improve it, which can be useful for developing strategies to enhance athletic performance and reduce the risk of injuries.

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IMPROVING BASKETBALL SKILLS THROUGH COORDINATION EXERCISES IN PAIR FOR MIDDLE SCHOOL STUDENTS

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ABSTRACT. This paper aims to present effective methods for teaching exercises during physical education and sports lessons by performing exercises in pairs. The presence of a partner and/or opponent not only adds a competitive element but also simulates adaptation to unpredictable changes, thus creating conditions similar to those encountered in a real basketball game and providing more realistic feedback on the applicability of technical procedures in basketball. **Materials and Methods:** The subjects included in the study were represented by two fifth-grade classes (one experimental class and one control class) from "Ion Agârbiceanu" Secondary School in Cluj-Napoca. Initial tests were applied to both groups involved in the research, then the experimental group was subjected to a variety of pair exercises, followed by the same tests being applied to both groups again at the end. **Results:** The results obtained from the two tests applied to both groups in the research show a more visible progress in the experimental group, especially in the second test, where a very large difference can be seen. In the experimental group, 18 out of 20 students improved their shooting percentage, while in the control group, only 5 achieved this. **Conclusions:** Based on the results obtained, we can confidently state that applying pair-specific basketball exercises improved the execution of procedures and technical elements.

Keywords: *procedure, pair, improvement*

REZUMAT. ***Îmbunătățirea jocului de baschet prin intermediul exercițiilor de coordonare in perechi la elevii de gimnaziu.*** Lucrarea îşi propune să prezinte modalităţi eficiente de predare a exercițiilor în cadrul lecţiilor de

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educaţie fizică şi sport, prin efectuarea exerciţiilor în perechi. Prezenta unui partener şi/sau adversar, nu doar adaugă un element de competitivitate, dar şi simulează adaptarea la schimbări imprevizibile, creând astfel condiţii asemănătoare întâlnite într-un joc de real de baschet, şi oferind astfel, un feedback mai real al nivelului de aplicabilitate a procedeelor tehnice în jocul de baschet. **Materiale şi metode**: Subiecţii incluşi în studiu au fost reprezentaţi de două clase de a V-a (o clasă experiment şi una de control) de la Şcoala Gimnazială ‘‘Ion Agârbiceanu”, din Cluj-Napoca. S-au aplicat teste iniţiale ambelor grupe aflate în cercetare, apoi grupa experiment au fost supusă la o varietate de exerciţii în perechi, urmând ca la final să se aplice din nou aceleaşi teste ambelor grupe. **Rezultate:** rezultatele obţinute la cele două teste aplicate ambelor grupe aflate în cercetare arată un progres mai vizibil la grupa experiment, în special la al doilea test, unde se vede o diferenţă foarte mare. La grupa experiment, 18 din 20 de elevi şi-au îmbunătăţit procentajul la aruncări, în timp ce la grupa de control, doar 5 au reuşit acest lucru. **Concluzii**: pe baza rezultatelor obţinute, putem afirma cu certitudine că prin aplicarea exerciţiilor în perechi, specifice jocului de baschet, s-a îmbunătăţit execuţia procedeelor şi a elementelor tehnice.

***Cuvinte-cheie**: procedeu, pereche, îmbunătăţire*

INTRODUCTION

The present work addresses physical education teachers who wish to introduce different methods than those commonly found in most thematic basketball books, specifically the execution of exercises in pairs. We believe that through this method, the class will be more creative, more enjoyable, promote teamwork, collaboration, and, why not, strengthen the relationship among students.

Coordination is defined as a complex form of expressing new movements and quickly adapting to varied situations, according to the specifics of each sport or other basic and applicative motor skills (Dragnea, 1996).

The same terms it defined as the capacity of the human body to perform motor acts and actions, under varied and unusual conditions, with maximum efficiency and minimal energy expenditure by the performer (Cârstea, 1997).

Coordinative capacities are also defined as a complex of predominantly psychomotor qualities that imply the ability to quickly learn new movements, adapt quickly and efficiently to varied conditions specific to different types of activities, by restructuring the existing motor fund (Bota, 1993).

Nicu Alexe (1993) distinguishes in sports practice general coordination motor qualities – developed as a result of polyvalent training and which manifest in various life, work, and sports situations – and specific coordination qualities for a certain event or sports discipline, structured and referred to as coordination accompanied by the term capacity.

Emphasizing the importance of coordination in life, Weinek J. Considers general coordination capacity as a result of "polyvalent motor learning that manifests in various areas of daily life and sports and is aimed at rational and intensive fulfilment of motor tasks of all kinds", while specific coordination capacity is characterized by "the possibility of varying gesture combinations of sports techniques" (Weinek, 1997).

Zatiorski (1968), cited by Bompa (2001), proposed the following classification criteria for coordination:

- by the degree of difficulty, motor skills are of low complexity, which includes cyclic movements, and high complexity skills, which include acyclic skills;
- by execution precision, a skill can be performed with difficulty, slowly and without fluidity when it is not well mastered, or it can be performed with precision, amplitude, speed, and harmony when it is well mastered;
- by the duration of accommodating a skill, which depends on complexity, the level of mastered motor skills, and the predispositions of the subjects. An athlete who master a large number of motor skills and has good coordination shortens the acquisition time of other skills and has a high capacity for adaptation to unpredictable situations.

Epuran (2005) presents the following scheme regarding the forms of manifestation of coordinative capacity and its components:

General Coordinative Capacity: a. adaptation and transformation capacity; b. leading capacity; c. learning capacity.

Coordinative Capacity: a. fine dexterity; b. balance; c. c. movement elasticity; d. combination capacity; e. movement creativity; f. other coordinative capacities.

The game of basketball has significant influences on psychological qualities, including the "fighting power", where willpower is channeled towards achieving victory. This sport contributes to the development of thinking, a "practical thinking". The activity in the game accustoms the student to analyze situations, compare them, and draw practical conclusions with maximum speed (Predescu, 2001, p 29). Thus, we consider that the technical complexes in physical education lessons with basketball themes, performed in pairs, greatly contribute to obtaining these qualities among students.

HYPOTHESIS

The research hypothesis we started from is that by using paired exercises, adapted to the age and skill level of students, performance in basketball can be improved during physical education lessons.

MATERIALS AND METHODS

The subjects and the research location

The subjects of the research were represented by two 5th grade classes (20 subjects each class), with class V. a serving as the experimental group and class V. B. as the control group, from the "Ion Agârbiceanu" Gymnasium School in Cluj-Napoca. The school has a very good material base necessary for learning and practicing this sport, which allowed us to conduct the study under good conditions.

Table 1. Subjects of the experimental class

Nr	Subjects	Grade	Gender	Age	Have you ever practiced any sport, if so, which one?
1	A. C.	V A	M	11	Yes. Tennis.
2	A. D.	V A	F	12	Yes. Volleyball.
3	B. A.	V A	F	11	No
4	B. E.	V A	M	12	No.
5	D. E.	V A	F	11	Yes. Basketball.
6	D. I.	V A	F	11	Yes. Football.
7	E. H.	V A	F	12	No.
8	F. G.	V A	M	11	No.
9	G. A.	V A	M	11	No.
10	G. E.	V A	M	12	No.
11	I. A.	V A	M	11	Yes. Football.
12	I. S.	V A	F	12	Yes. Volleyball.
13	P. A.	V A	F	11	Yes. Swimming.
14	P. A.	V A	M	12	Yes. Volleyball.
15	P. I.	V A	F	11	No.
16	P. R.	V A	F	12	No.
17	S. C.	V A	F	11	Yes. Wrestling.
18	S. I.	V A	F	12	Yes. Swimming.
19	S. H.	V A	M	11	Yes. Handball.
20	U. M.	V A	M	12	Yes. Basketball.

Table 2. Subjects of the control class

Nr	Subjects	Grade	Gender	Age	Have you ever practiced any sport, if so, which one?
1.	A. C.	V B	M	11	Yes. Rugby.
2.	A. C.	V B	F	12	Yes. Gymnastics.
3.	B. A.	V B	F	11	No
4.	C. C.	V B	M	12	No.
5.	C. D.	V B	F	11	Yes. Athletics.
6.	C. D.	V B	F	12	Yes. Badminton.
7.	F. A.	V B	F	11	No.
8.	F. A.	V B	M	12	No.
9.	G. S.	V B	M	11	No.
10.	G. B.	V B	M	11	No.
11.	H. R.	V B	M	12	Yes. Football.
12.	H. A.	V B	F	11	Yes. Football.
13.	K. C.	V B	F	12	Yes. Volleyball.
14.	K. E.	V B	M	11	Yes. Tennis.
15.	O. A.	V B	F	11	No.
16.	O. G.	V B	F	12	No.
17.	P. A.	V B	F	11	Yes. Football.
18.	P. C.	V B	F	12	Yes. Handball.
19.	P. T.	V B	M	11	Yes. Basketball.
20.	R. A.	V B	M	11	Yes. Football.

The stages of research

Stage 1: March 7, 2024: administering initial tests to both research groups (both the experimental and control classes).

Stage 2: March 15, 2024 – April 15, 2024: implementing a lot of basketball exercises (in pairs) only with the experimental group.

Stage 3: April 24, 2024: re-administering tests (same as the initial tests for both research groups).

The tests applied

Test 1 – Description of the exercise: completing and applied route that includes 4 bounce passes with the wall, 4 direct passes to the wall, dribbling with crossovers, dribbling and shooting from one foot (layup – he must score), retrieving own ball, dribbling through cones, high-speed dribbling and shooting from mid-range while jumping (must score).

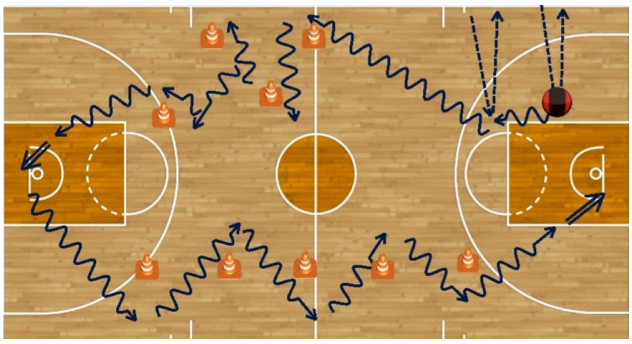


Figure 1. First test

Test 2 – Description of the exercise: each student will make a total of 15 min-range shots. Each successful shot will be scored with 0.5 points. If a shot is made using incorrect technique, even if it goes into the basket, it will not be scored. Shots will be taken from 3 different positions, each at a distance of 4 meters. The basketball balls will be retrieved by a rebounder. If the execution is very correct executed, the subject will receive 1 point.

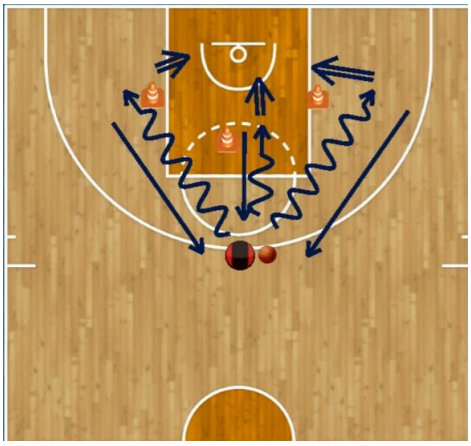


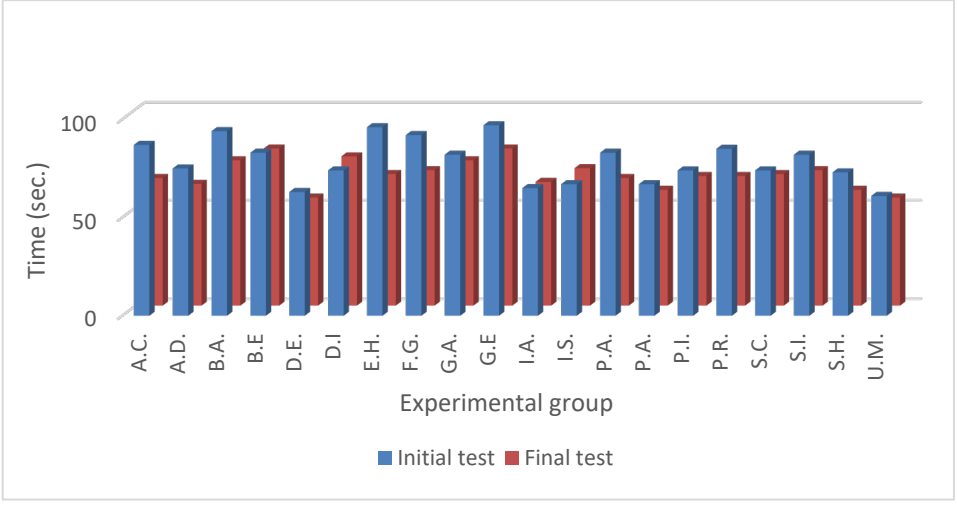
Figure 2. Second test

RESULTS

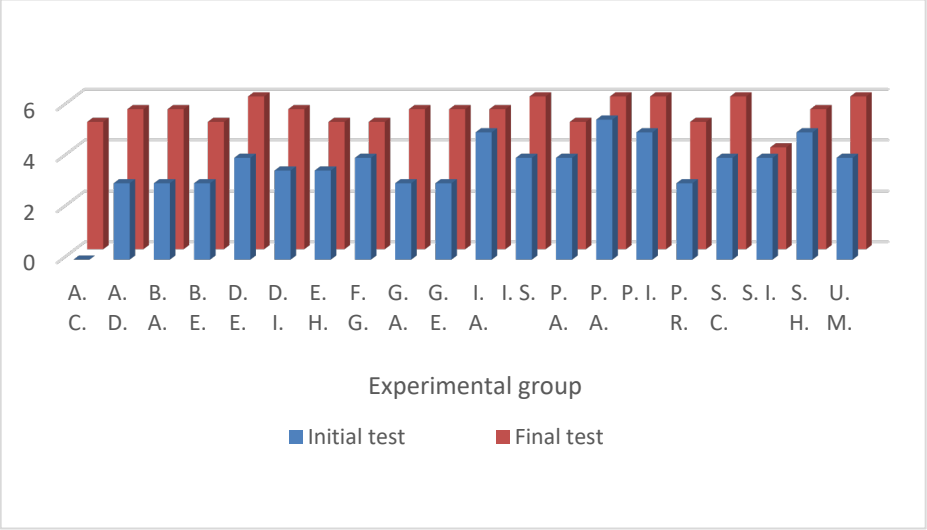
Next, we will present the results obtained by the groups (both the experimental and the control group) on both the initial and final tests.

Table 2. The results of the experimental group

Experimental group		Test 1 (sec)		Test 2 (points)	
Nr.	***Subject***	***Initial test***	***Final test***	***Initial test***	***Final test***
1	A. C.	87	65	4.0	5.0
2	A. D.	75	62	3.0	5.5
3	B. A.	94	74	3.0	5.5
4	B. E.	83	80	3.0	5.0
5	D. E.	63	55	4.0	6.0
6	D. I.	74	76	3.5	5.5
7	E. H.	96	67	3.5	5.0
8	F. G.	92	69	4.0	5.0
9	G. A.	82	74	3.0	5.5
10	G. E.	97	80	3.0	5.5
11	I. A.	65	63	5.0	5.5
12	I. S.	67	70	4.0	6.0
13	P. A.	83	65	4.0	5.0
14	P. A.	67	59	5.5	6.0
15	P. I.	74	66	5.0	6.0
16	P. R.	85	66	3.0	5.0
17	S. C.	74	67	4.0	6.0
18	S. I.	82	69	4.0	4.0
19	S. H.	73	59	5.0	5.5
20	U. M.	61	55	3.0	6.0



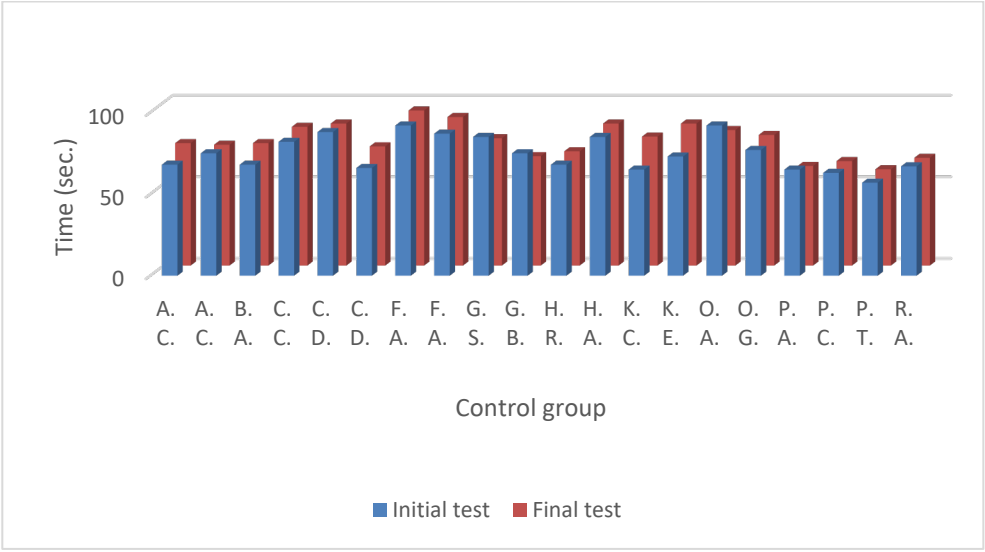
Graph 1. The results of test 1 (experimental group)



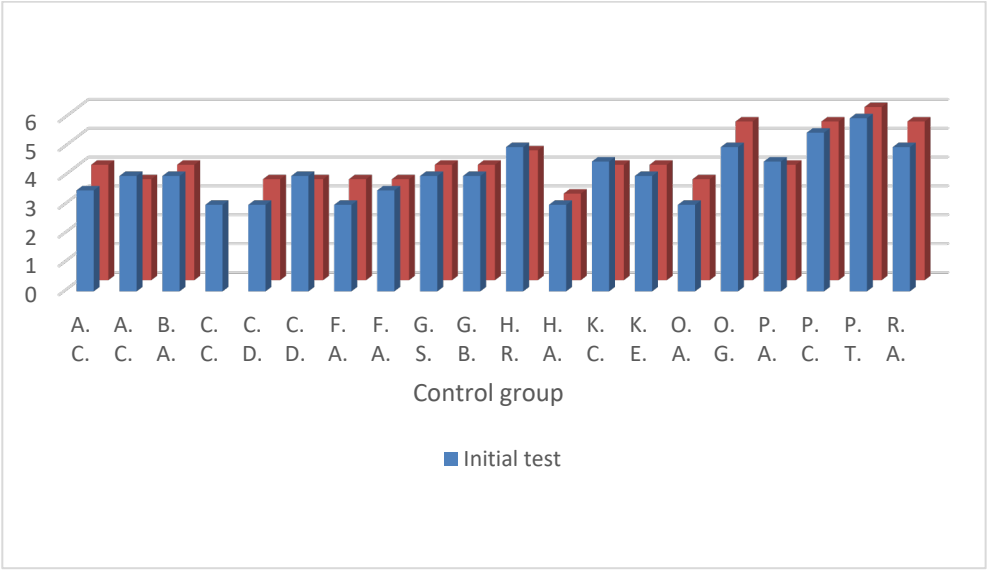
Graph 2. The results of test 2 (experimental group)

Table 3. The results of the control group

Experimental group		Test 1		Test 2	
Nr.	**Subject**	**Initial test (sec)**	**Final test (sec)**	**Initial test (points)**	**Final test (points)**
1.	A. C.	68	75	3.5	4.0
2.	A. C.	75	74	4.0	3.5
3.	B. A.	68	75	4.0	4.0
4.	C. C.	82	85	3.0	3.0
5.	C. D.	88	87	3.0	3.5
6.	C. D.	66	73	4.0	3.5
7.	F. A.	92	95	3.0	3.5
8.	F. A.	87	91	3.5	3.5
9.	G. S.	85	78	4.0	4.0
10.	G. B.	75	67	4.0	4.0
11.	H. R.	68	70	5.0	4.5
12.	H. A.	85	87	3.0	3.0
13.	K. C.	65	79	4.5	4.0
14.	K. E.	73	87	4.0	4.0
15.	O. A.	92	83	3.0	3.5
16.	O. G.	77	80	5.0	5.5
17.	P. A.	65	61	4.5	4.0
18.	P. C.	63	64	5.5	5.5
19.	P. T.	57	59	6.0	6.0
20.	R. A.	67	66	5.0	5.5



Graph 3. The results of test 1 (control group)



Graph 4. The results of test 2 (control group)

DISCUSSION

As observed in Graph 1, from the experimental group, 18 out of 20 students improved their time in the initial evaluation test. The most notable improvement was achieved by one student who completed the course 29 seconds faster. Technical procedures were visibly executed more accurately and with advanced coordination compared to the initial test.

Graph 2 shows that 18 students significantly improved their technical procedures, performing them more accurately and coordinated. Consequently, these students scored higher points in the final test, demonstrating their significant progress compared to the initial assessment. Many students improved their scores by up to 2 points.

Graph 3 illustrates that from the control group, only 7 out of 20 students improved their time in the initial evaluation test. These improvements were not very pronounced, and differences in technical execution and coordination in the final assessment were minor compared to the initial test. The most notable improvement was made by a student who completed the course 7 seconds faster.

As observed in Graph 4, in the control group during the final evaluation test, only 5 out of 20 students improved their time. This improvement was limited and did not reflect significant progress in technical execution compared to the initial test.

CONCLUSIONS

Analyzing the tables and graphs above, it is clear that the experimental group showed significant improvements in both evaluation tests, much larger compared to the control group.

We appreciated the effort and attention shown by both classes of students.

Both experimental and control groups demonstrated dedication and a desire to excel.

Fortunately, the students were highly engaged, and we believe that a primary reason for this is the fact that the exercises were conducted in pairs, a method with which the students were not familiar until then.

The students displayed a positive attitude towards learning and remained committed throughout the activity.

In conclusion, based on the results obtained, we can confidently affirm that the hypothesis has been confirmed, namely that by using paired exercises, adapted to the age and skill level of students, performance in basketball can be improved during physical education lessons.

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