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ORGANISATIONAL CULTURE RESEARCH IN COMPETITIVE SPORT – A SYSTEMATIC REVIEW

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ABSTRACT. Introduction: Defining and measuring organisational culture in the sport sector receives little attention. Nevertheless, it has an impact on the effectiveness and functioning of sport organisations. **Objective:** The aim of this paper is to explore definitions of sport organisational culture and to present its measurement possibilities through international literature. **Methods:** The secondary research will review the international literature on competitive sport between 1999 and 2022, using a systematic sampling according to predefined criteria. **Results:** In addition to general bibliometric data, the results present the frequency of keywords for each definition, the measurement methods used to assess sport culture, and group studies on sport culture according to the literature. **Conclusion:** We discuss the results of the publications presented in the literature and their conclusions, thus contributing to the Hungarian research on sport culture.

Keywords: *sport organisational culture, competitive sport, definition, measurement methods, systematic review*

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INTRODUCTION

The study of organisational culture and the mapping of its elements are popular and widespread activities among public and private sector companies and employees. Nevertheless, studies on a particular area of the competitive sector have concluded that there is no uniformly developed framework for mapping culture. Nor is there a uniform definition in the literature (Primecz, 2006; Toarniczky, 2006; Tariszka, 2017).

The sports sector has many unique characteristics compared to conventional corporate and organisational management. Initially, a voluntary sector based on civic initiative, profit orientation mainly drives the sports sector now. However, the globalisation of sports, the worldwide expansion of sports disciplines and the increase in revenue streams linked to sporting events and athletes have significantly increased the complexity of the sports sector – a complexity that organisations must adapt to.

The Hungarian government has defined sport as a strategic sector. As a result, public funding is available, both directly and indirectly, and applied for a wide range of purposes: infrastructure development, youth education, development of sports professionals and operational expenditure. The government's sports policy has categorised domestic sports clubs and sports disciplines (competitive team sports, flagship sports clubs, flagship sports, catch-up sports, and sports academies) according to their nature, social importance and economic potential, which provide the basis for the availability and volume of government support. However, the impact of increased cash inflows on international success remains limited and sporadic in certain sports. One reason may be the lack of attention to sporting organisation culture. The literature agrees that organisational culture significantly affects organisational effectiveness (Eskiler, Geri, Sertbas & Calik, 2016; Samur, 2021) and sports performance (Popkochev & Tsvetkov, 2021).

The number of studies on sports organisational culture is far below the number in the public and competitive sectors. Nor are the frameworks and definitions used to analyse culture in the sporting arena uniform, as evidenced by Wagstaff and Burton-Wylie's (2018) systematic review, which appeals to sport culture researchers to think about discourse and debate sport culture. The present study utilised quantitative and qualitative analysis methods to map organisational culture in the sporting environment.

MEASURING ORGANISATIONAL CULTURE – A LITERATURE REVIEW

The CVF (Competing Values Framework) model developed by Cameron and Quinn (1999) is the most widely used culture assessment method among quantitative measurement methods. The model distinguished four types of culture – clan, hierarchy, market, and adhocracy. Clan culture is characterised by internal cohesion, shared values, cooperation, and collective views. As the name implies, an ad hoc approach characterises adhocracy culture, which is flexible and discretionary and allows for risk-taking, creativity and innovation. The focus is on competition in terms of market culture, but it does not ignore stability, control and objectives. An internal focus – combined with centralised decision-making, stability and control – characterises hierarchy culture, mainly through formalised and rigid structures that achieve formulated guidelines. To assess the CVF model, Cameron and Quinn (1999, 2006) developed the OCAI questionnaire, which distinguishes six dimensions. The original methodology of the OCAI questionnaire was to measure on a positive ipsative scale, but many sport-related studies use a Likert scale. Kása (2020) discusses the problems, advantages and disadvantages of the two measurement methods.

The DOCS (Denison Organisational Culture Survey) questionnaire developed by Denison (2006) measures sports organisational culture based on four cultural traits (adaptability, involvement, mission, and consistency). Each is further subdivided into 3-3 dimensions so that the model distinguishes 12 dimensions.

Among the qualitative methods, sports organisational culture studies widely use Schein's (2010) three-level theoretical model. Invisible, unconscious, deep culture, "basic assumptions" such as ideas about the meaning of life comprise the bottom level. The lowest level provides the characteristics of the higher levels. The middle includes tangible and consciously used "espoused beliefs and values", including virtues, ideals, values, sins, and vices. This level has a so-called mediating role because it transmits and makes aware of the messages expressed to society. "Cultural artefacts – tangible and visible (e.g., monuments, language, social stratification) – occupy the top level. As such, they are the easiest and simplest to distinguish, but only on the surface level. Understanding culture entails understanding deeper levels (Schein, 2010).

Martin and Meyerson's (1988) three-perspective approach to culture appears repeatedly in sport culture studies. Following a literature search, the authors created three different groupings to classify each typology of cultural interpretation. The integration perspective is a limitation of the concept and methodology of culture, as it only includes what is shared and common.

It devalues unshared variables and marginalises other views and cultural identities. The differentiation perspective focuses on cultural manifestations whose interpretations are controversial. Compared to the integrationist perspective, it attributes less influence to the large impact leaders have on shaping culture. It accepts the existence of subcultural conflicts, power issues and differences in attitudes. This perspective challenges the assumption that only one culture can exist in an organisation. The fragmentation approach focuses on ambiguity where culture is not clearly consistent or inconsistent. It describes organisational life as unpredictable and constantly changing as experience is gained.

OBJECTIVE

This study aims to review the literature on sports organisational culture systematically. There is no consensus in the literature on the concept of organisational culture. Several systematic studies have attempted to map and categorise organisational culture concepts (Maitland, Hills & Rhind, 2015; Wagstaff & Burton-Wylie, 2018). This study explores the diversity of sports organisational culture definitions and examines methodological approaches to sports culture.

MATERIAL AND METHODS

The secondary research involved a literature review using a systematic data collection approach to examine organisational culture in competitive sports according to pre-defined criteria. The online databases used to collect and review scientific journals were Web of Science, Google Scholar, and EBSCO. The selection criteria were literature available in English and/or Hungarian with the terms “organisational culture” and “sport” in the title and/or abstract. Literature published and peer-reviewed between 1999 and 2022 was selected. Subsequently, the study reviewed abstracts and excluded any article that did not meet the content of the objective (e.g. analysis of sports organisations involved in recreational sports activities). Publications that contained no relevant content in the detailed analysis were also excluded. Publications that appeared more than once in the list were filtered out. The study processed 27 articles from the Web of Science database, ten from the EBSCO database and one from Google Scholar, for a total sample size of 38.

Table 1. Search results for articles on sports organisational culture in online database search engines

	Web of Science		EBSCO	Google Scholar	Total
Organisational culture + sport	1 285		447	18 100	19 832
Relevant	27		10	1	38

Source: Own editing

RESULTS

General and bibliometric data

Concerning the temporal distribution of the literature (N=38) on the organisational culture of sports organisations that met the selection criteria, most publications (42.1%) were published between 2019 and 2022, with only three papers published between 1999 and 2010, indicating that the study of the culture of sports organisations is still an area of research.

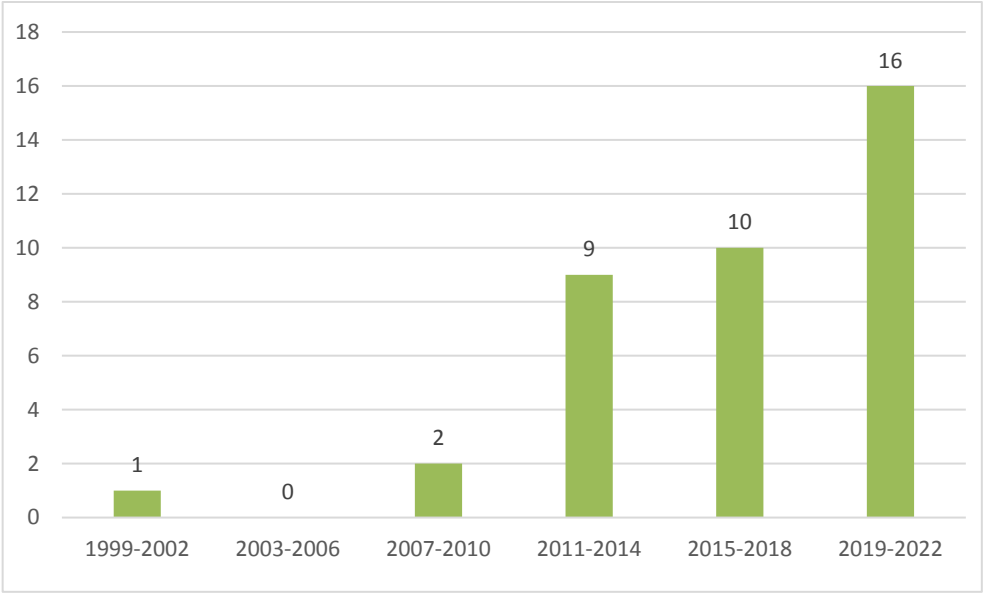

Figure 1. Distribution of publications of studies on sports organisational culture
Source: Own analysis

The publications appeared in various journals, depending on the focus of the sports culture. In total, the selected literature was published in 28 different journals, with the most (four) in the peer-reviewed Journal of Sport Management, which mainly published studies on the diagnosis of culture and organisational effectiveness (Colyer, 2000; Choi, Seo, Scott & Martin, 2010; Mitrovic, Simovic & Raicevic, 2019). Papers addressing culture and ethical issues (Solberg & Ringer, 2011; Riivari & Heikkinen, 2022) have been published in journals dealing with ethical issues (Ethics & Behaviour).

More than half of the papers (52.6%) were written by three or more authors, 28.9% were written by two authors, while only 18.4% were written by a single author.

Most of the literature sampled (28 papers; 73.7%) is practice oriented. The practice-oriented literature included publications analysing the sports culture of sports organisations/associations using a method. A total of ten publications included in the sample were theory-oriented (e.g., systematic reviews) (26.3%). More than half of the practice-oriented literature (20 publications; 71.4%) used a culture model to explore the culture of sports organisations. Furthermore, 53.6% of the practice-focused articles were qualitative, 35.7% were quantitative, and 10.7% used both quantitative and qualitative methodologies.

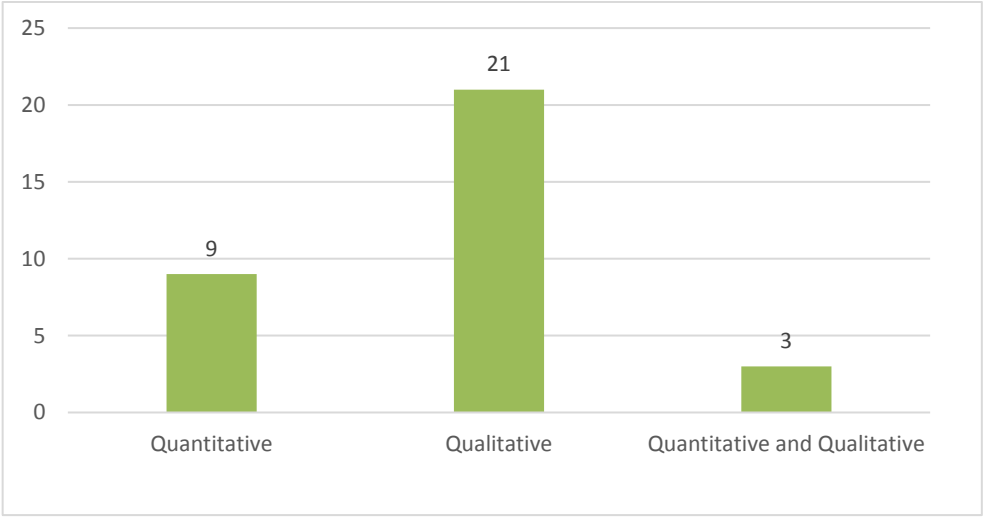

Figure 2. Distribution of the methodology used in sports organisational culture studies

Source: Own editing

There is no universally accepted definition of articles on organisational culture and sport. To simplify organisational culture, we can quote Marvin Bower (1966) who defined it as "the way we do things around here". Of course, more varied and complex formulations have emerged. The keywords in the definitions are emphasized by organisational researchers in the subfield they are researching. For example, in the study of culture and organisational ethics, Riivari and Heikkinen (2022) used the definition "Ethical organisational culture can be defined as the virtues of an organisation", while in a study of culture and effectiveness, Williams and co-authors (1993) used the definition of Williams et al. (2015) in their study: "Organisational culture is defined as relatively stable beliefs, attitudes and values shared among organisational members". In total, 21 definitions of organisational culture were recorded after the literature review, demonstrating the diversity in the way culture is formulated. Edgar Schein defined organisational culture as: "Organisational culture is the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaption and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 1991 p.246).

Once the step was completed, the keywords used in each definition were selected to obtain an idea of which keywords appear most frequently in the definitions. The table below clarifies the meaning of the main keywords.

Table 2. The meanings of the keywords that appear most often in the definitions of organisational culture used in sports organisational culture studies

Keyword	Definition	Author(s)/year
Value	*"Values are related to what is perceived as morally good or bad"*	Frese, 2015, p.2
Belief	*"Cultural beliefs are beliefs that are learned and shared across groups of people"*	Weller, 2005, p.579
Norm	How people are thinking (shared reality) and behaving	Shteynberg et al., 2009

Source: Own editing

Many organisational culture definitions include the term "value"; the terms "norm" (N=9) and "belief" (N=12) also appear frequently in the various definitions.

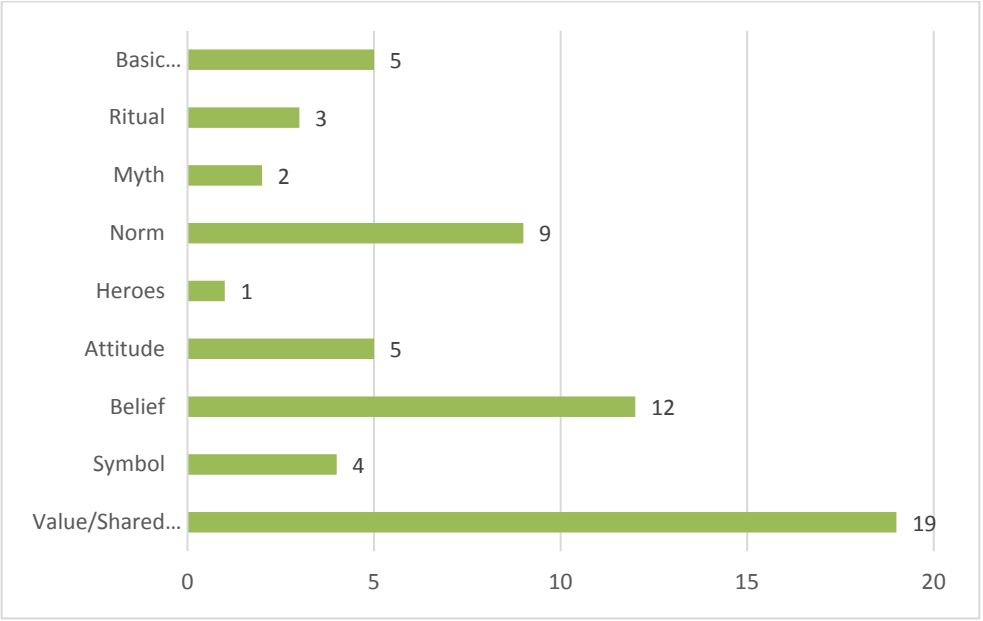

Figure 3. Distribution of keywords for definitions used in sports organisational culture studies

Source: Own editing

Possibilities for measuring organisational culture in sport

After the literature review using a systematic approach, studies on sports organisational culture were grouped into five distinct themes (see Figure 4).

Articles dealing with the characteristics of sports organisational culture, including strengths and weaknesses, were grouped under the heading "culture characteristics". Seven included a culture model (N=20), representing 35% of the publications. Concerning the models used, the articles mainly employed the CVF model developed by Cameron and Quinn (1999) and the closely related OCAI questionnaire. Three publications deviated from this methodology, with one using a self-designed questionnaire to sample (Samur, 2021), another using the culture view created by Spillmann (2016) to characterise the sports organisation (Skille & Chroni, 2018), and a third using Martin and Meyerson's (1988) three-perspective approach. The third group primarily studied sports leaders, sports managers, paid employees and, less frequently, coaches and athletes. In the 'culture and effectiveness/leadership' grouping, we selected

literature exploring links or differences in the relationship between culture and the effectiveness of an organisation or organisations. In addition, the grouping also included publications that related the communication style of senior or middle managers in sports organisations to culture. A total of seven literature papers were included, representing 35% of the articles. Of the models used, the CVF model/OCAI questionnaire (Cameron & Quinn, 1999) was dominant, with five of seven articles using the model, while two studies used the DOCS (Denison, 2006) model and questionnaire. In the "culture and ethical issues" group, we collected literature focusing on culture and illegal performance enhancers (Solberg & Ringer, 2011) and culture and ethical behaviour within organisations (Riivari & Heikkinen, 2022). Two articles found in the literature addressed this topic (10%). The first used the CEV questionnaire survey, which is associated with Kaptein (2007), while the second analysed American baseball league culture using the cultural value and behavioural norm descriptors developed by Schein (2004). Our penultimate thematic grouping is called "culture and performance", and the literature here (N=3) focuses predominantly on team culture (15%). Essentially, studies in this thematic group seek to answer how culture influences the on-field performance of athletes of a given sports club or sports organisation. Two different models appear in the literature, with two articles (Cole & Martin, 2018; Junggren, Elbæk & Stambulova, 2018) employing the culture segmentation methodology defined by Schein (2010) and one article (McDougall, Ronkainen & Richardson, 2020a) favouring the three-perspective approach of Martin and Meyerson (1988). The last group – "culture and PR" – comprises one article (N=1; 5%) investigating the influence of sports organisation culture in marketing via the "culture cycle" model (Curtin & Gaither, 2007).

It is worth noting that the literature search yielded several publications that lacked a culture measurement model. These include papers on culture change (N=4), in which the authors address the questions of when culture change should be implemented, how it can be done, and the advantages and disadvantages of the culture change process. The literature on culture change is still in its infancy, as evidenced by Cruickshank and colleagues (2012), who describe a lack of literature and then provide a discussion paper (2013) to initiate a discourse on the topic before offering recommendations for the development of a possible culture change model (Cruickshank, Collins & Minten, 2015). The literature on talent management is also worth highlighting (N=3).

When distinguishing the target population assessed in each article by geographical location for Balkan, Central European and Asian sports organisations, the present study found that clan culture dominated the publications in which the OCAI questionnaire was used.

Several authors highlight the important role of sports organisational culture in promoting talented young people, although this is not closely related to organisational culture (Larsen, Alfermann, Henriksen & Christensen, 2013; Mills, Butt, Maynard & Harwood, 2014). Our sample included three systematic literature reviews. Like the present study, Wagstaff et al. (2018) examined definitions and methodology of sports organisational culture, while Godfrey and co-authors (2020) researched the diversity of culture.

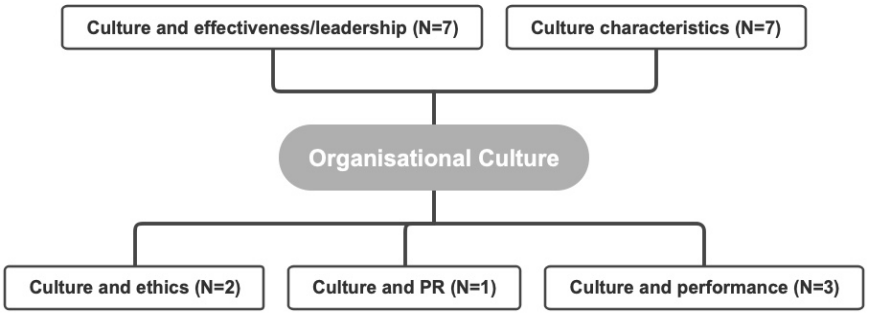

Figure 4. Grouping the literature on sports organisational culture by subject

Source: Own editing

Table 3. Key characteristics of studies on sport organisational culture (in chronological order)

Author(s)/ Year	Title	Content	Participants	Methodology
Colyer, 2000	Organisational culture in selected Western Australian sport organizations	Culture characteristics	Paid employee, Volunteers	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
DongJun, 2009	The Research on the Organisational Culture of Competitive Sport Organization and Its Effect on the Organisational Effectiveness in China	Exploring the relationship between sport organisational culture and organisational effectiveness	Athletes, Coaches	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
Choi, Seo, Scott & Martin, 2010	Validation of the Organisational Culture Assessment Instrument: An Application of the Korean Version	Culture characteristics	Paid employee, Sport managers	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)

Author(s)/ Year	Title	Content	Participants	Methodology
Tojari, Heris & Zarei, 2011	Structural equation modeling analysis of effects of leadership styles and organisational culture on effectiveness in sport organizations	Exploring the relationship between sport organisational culture, leadership, and organisational effectiveness	Sport experts	DOCS-model (Denison, 2006)
Solberg & Ringer, 2011	Performance-Enhancing Drug Use in Baseball: The Impact of Culture	Ethical issues in sport organisational culture	Sport manager	Schein (2004) cultural values and behavioural norms
Cruickshank & Collins, 2012	Culture Change in Elite Sport Performance Teams: Examining and Advancing Effectiveness in the New Era	Culture change	Not relevant	A gap in the literature on culture change
Parent & MacIntosh, 2013	Organisational culture evolution in temporary organizations: The case of the 2010 Olympic Winter Games	Culture development in a sports organisation	Organising committee	Elements of sport organisational culture
Mills & Hoeber, 2013	Exploring Organisational Culture Through Artefacts in a Community Figure Skating Club	Culture characteristics	Athletes	Martin and Meyerson's (1988) three-perspective approach to culture
Larsen, Alfermann, Henriksen & Christensen, 2013	Successful Talent Development in Soccer: The Characteristics of the Environment	The relationship between sport organisational culture and talent development	Not relevant	Not relevant
Cruickshank, Collins & Minten, 2013	Culture Change in a Professional Sports Team: Shaping Envi-ronmental Contexts and Regulating Power A Response to Commentaries	Culture change	Not relevant	Discourse on sport organisational culture
Kalateh & Amoozadeh, 2014	The relationship of organisational culture and entrepreneurship with effectiveness in sport organizations	Examining the relationship between sport organisational culture and organisational effectiveness	Sport directors, sport experts	DOCS-model (Denison, 2006)

Author(s)/ Year	Title	Content	Participants	Methodology
Mills, Butt, Maynard & Harwood, 2014	Toward an Understanding of Optimal Development Environments Within Elite English Soccer Academies	The relationship between sport organisational culture and talent development	Not relevant	Not relevant
Cruickshank, Collins & Minten, 2015	Driving and sustaining culture change in professional sport performance teams: A grounded theory	Culture change	Sport managers	Culture change model development
Maitland, Hills & Rhind, 2015	Organisational culture in sport - A systematic review	Not relevant	Not relevant	Systematic review
Mehmet, 2015	Managers' Perception of Organisational Culture and Organisational Communication	The relationship between sport organisational culture and leadership	Sport managers	OCS questionnaire (Kanun, 1990)
Eskiler, Geri, Sertbas & Calik, 2016	The effects of organisational culture on organisational creativity and innovativeness in the sport business	Examining sport organisational culture and organisational innovation	Paid employee	Dimension 4 of Richard Pascal's organisational culture model
Souza, Galatti, Graca, Folle & Nascimento, 2017	Female basketball athlete development environment: proposed guidelines and success factors	The relationship between sport organisational culture and talent development	Not relevant	Not relevant
Larsen, 2017	Bringing a knife to a gunfight: A coherent consulting philosophy might not be enough to be effective in professional soccer	A sport psychology approach to sport organisational culture	Athletes, Sport managers	Danish sport psychology programme report
Wagstaff & Burton-Wylie, 2018	Organisational culture in sport: A conceptual, definitional and methodological review	Not relevant	Not relevant	Systematic review
Junggren, Elbæk & Stambulova, 2018	Examining coaching practices and philosophy through the lens of organisational culture in a Danish high-performance swimming environment	A sport psychology approach to sport organisational culture	Coaches, Athletes	Schein's (2010) three-level theoretical model

Author(s)/ Year	Title	Content	Participants	Methodology
Cole & Martin, 2018	Developing a winning sport team culture: organisational culture in theory and practice	A sport psychology approach to sport organisational culture	Coaches, Athletes	Schein's (2010) three-level theoretical model
Skille & Chroni, 2018	Norwegian sports federations' organisational culture and national team success	Culture characteristics	Sport managers	Spillmann's (2016) view of culture
Guenter, Dunn & Holt 2019	Talent Identification in Youth Ice Hockey: Exploring Intangible Player Characteristics	The relationship between sport organisational culture and talent development	Not relevant	Not relevant
Chroni, Abrahamsen, Skille & Hemmestad, 2019	Sport Federation Officials' Practices and National Team Coaches' Stress	The relationship between sport organisational culture and stress	Sport managers	Outline practical feasibility and proposals
McDougall & Ronkainen, 2019	Organisational culture is not dead... yet: Response to Wagstaff and Burton-Wylie	Reply to Wagstaff & Burton-Wylie	Not relevant	arguing for the importance of sports organisational culture
Ibrahimi & Miftari, 2019	Managerial culture in sports organizations in Kosovo as a factor in the integration in international sports associations	Culture characteristics	Sport managers, Managers, Paid employee	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
Jeong, Kim & Zhang, 2019	Exploring Relationships among Organisational Culture, Empowerment, and Organisational Citizenship Behavior in the South Korean Professional Sport Industry	Exploring the relationship between sport organisational culture, empowerment, and organisational behaviour	Paid employee	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
Mitrovic, Simovic & Raicevic, 2019	The relationship between leadership styles and organisational culture in sport organizations	Exploring the relationship between sport organisational culture and leadership styles	Sport managers	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
Kitchin, Telford & Howe, 2022	An empirical use of organisational habitus and ethnography to explore how sport cultures are negotiated	Operationalising the concept of organisational habitus	Not relevant	Not relevant

Author(s)/ Year	Title	Content	Participants	Methodology
Feddersen, Morris, Littlewood & Richardson, 2020	The emergence and perpetuation of a destructive culture in an elite sport in the United Kingdom	Destructive culture	Talent development team, Athletes, Coaches, parents, Sport experts, Sport managers	Developing a destructive culture framework
Mcdougall, Ronkainen, Richardson, Littlewood & Nesti, 2020b	Three team and organisational culture myths and their consequences for sport psychology research and practice	A sport psychology approach to sport organisational culture	Not relevant	Keynote speech
Godfrey, Kim, Eluére & Eys, 2020	Diversity in cultural diversity research: a scoping review	Not relevant	Not relevant	Systematic review
Mcdougall, Ronkainen, Richardson, Littlewood & Nesti, 2020a	Organisational Culture Beyond Consensus and Clarity: Narratives from Elite Sport	A sport psychology approach to sport organisational culture	Strategic managers, Athletes, Coaches, Paid employee	Martin and Meyerson's (1988) three-perspective approach to culture
Feddersen, Morris, Littlewood & Richardson, 2021	A Longitudinal Study of Power Relations in a British Olympic Sport Organization	Culture change	Athletes, parents, National Governing Body	Examining power relations during culture change
Samur, 2021	Examination of organi-sational culture varia-bles in sports organi-sations (perspective from Turkey)	Culture characteristics	Sport managers	Self-edited questionnaire
García, 2021	Real Madrid and public relations: applying the circuit of culture to organisational values	The relationship between sport organisational culture and PR	Real Madrid	Culture cycle (Hall, 1997)
Popkochev & Tsvetkov, 2021	Profile of the organisational culture in youth club football (the present situation in Blagoevgrad region)	Culture characteristics	Athletes, Coaches	CVF-model, OCAI questionnaire (Cameron & Quinn, 1999)
Riivari & Heikkinen, 2022	Virtuousness in Sports Organizations: Examination of Ethical Organisational Culture and Its Virtues	Ethical issues in sport organisational culture	Sport managers, Sport experts, Coaches, Paid employee	CEV questionnaire (Kaptein, 2007)

Source: Own editing

CONCLUSION

There have been previous systematic reviews of studies on sports organisational culture (Maitland, Hills & Rhind, 2015; Wagstaff & Burton-Wylie, 2018). Maitland and co-authors (2015) grouped different definitions of organisational culture according to three perspectives (integrative, differentiation, and fragmentation). They also explored the methodologies used to assess culture in each literature. In line with the results of our article, their results showed that the questionnaire method dominated quantitative methods, while the interview was the most predominant qualitative measurement option. Most studies using the questionnaire method used the OCAI questionnaire (Cameron & Quinn, 1999). Wagstaff and co-researcher (2018) reviewed the literature on organisational culture that may be relevant for sports psychologists.

Colyer (2000) investigated the culture of three Western Australian sports organisations with different profiles (disadvantaged, outdoor, racquet sports), and his results showed that sports organisations with different profiles had different culture types and different cultural strengths. Clan culture dominated most sports organisations surveyed via the OCAI questionnaire developed by Cameron and Quinn (1999) (Ibrahimi & Miftari, 2019; Jeong, Kim, & Zhang, 2019; Popkochev & Tsvetkov, 2021), suggesting that these sports organisations emphasize internal cohesion, shared values, cooperation, and collective beliefs. According to Mehmet's (2015) research, there is no significant difference between some subscales of organisational culture and the gender profile of the sports organisations studied.

Several studies agree that organisational culture impacts the effectiveness of a sports organisation (Amoozadeh, 2014; Eskiler, Geri, Sertbas & Calik, 2016; Samur, 2021). In his research, Amoozadeh (2014) used the DOCS model (Denison, 2006) to examine the Directorate General of Sport and Youth in Golestan province from the perspective of organisational culture. His results showed that organisational culture is a predictor of organisational effectiveness. DongJun's (2009) study of Chinese sports organisations found that the prominence of clan culture made the organisation more effective. Moreover, organisational culture positively influences employee responsibility (Jeong, Kim, & Zhang, 2019), creativity, and organisational innovation (Eskiler, Geri, Sertbas & Calik, 2016).

In addition to organisational effectiveness, organisational culture also affects sports performance. Popkochev and Tsvetkov (2021) investigated organisational culture in youth football sports clubs in Belgrade and found that managing culture is essential for improving sports performance efficiency and competitive results. Their results show that the coaches of the best-performing sports teams emerged from hierarchical cultures, while clan culture dominated the worst-performing.

Among the sub-domains of organisational culture, several articles identify the prevailing culture within a team. The literature on team culture mainly examines the impact of culture from a sport psychology perspective. Cole and Martin (2018) found that team culture, including performance culture, is the most important factor for success, adding that team culture needs continuous development, which is mainly the coach's responsibility. According to Cruickshank, Collins and Minten (2015), achieving a final form of team culture is impossible as it is constantly changing. To be successful, professionals and coaches need to understand the different facets of the team culture (Larsen, 2017), and coaches need to fit into the cultural values within the team by sharing similar values (Chroni, Abrahamsen, Skille & Hemmestad, 2019). In the case of professional sports teams, scouts not only look at the talent of the athlete they want to sign but also look at how well the athlete will fit into the team culture of the sports organisation (Guenter, Dunn & Holt, 2019).

There is consensus in much of the literature that leaders influence the culture of a sports organisation. Cole and Martin (2018) argue that sports organisation leaders should reinforce culture across the breadth of the organisation. Sports leaders and coaches in successful organisations need to communicate clear guidelines to strengthen the organisational culture (Souza et al., 2017). Skille and Chrone (2018) examined organisational culture through Norwegian sports leaders. Their results show that sport leaders' commitment to their work (a sense of sacrifice and privilege) and closeness to coaches and athletes influence organisational culture. A study on the relationship between leadership style and culture found that transformational leadership positively influences organisational effectiveness and organisational culture, while transactional leadership diminishes effectiveness and culture (Tojari, Heris & Zarei, 2011). The presence of leadership skills in a hierarchical culture is the most significant in a study of managers and paid employees of sports federations in Kosovo (Ibrahimi & Miftari, 2019).

As evidenced by the research of McDougall and colleagues (2020), academic literature on culture change methodology is still in its infancy, suggesting that sports psychologists need to examine culture more thoroughly and clearly. Cruickshank, Collins and Minten (2013) call on researchers to investigate the processes of culture change further. The authors also emphasise that culture change is context specific and not a general process. In the process of culture change, sports leaders and managers need to create conditions that encourage athletes to see the importance of culture change for themselves to mitigate or perhaps avoid the emergence of subcultures. When approaching culture change from a practical perspective, Cruickshank and Collins (2012) and Cruickshank, Collins and Minten (2015) argue that the best approach is an

initial evaluation, design and impact assessment phase involving internal and external stakeholders. In sports organisations, an adhocracy culture has been shown to be the most effective in culture change (Samur, 2021).

In contrast, Chroni and colleagues (2019) interviewed Norwegian national team sports managers concerning coaching beliefs. They explained that coaches of non-Norwegian origin who come to work in Norway have a difficult time, as other countries often have a more hierarchical model than Norway. In Nordic countries, an open exchange of views is vital. There is no hierarchy; everyone is equal. However, it is significant to note that the scope for regional comparisons in the literature is limited because the methodologies used in the different studies are dissimilar.

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REDUCING GENDER STEREOTYPES AND PROMOTING GENDER EQUALITY IN THE PHYSICAL EDUCATION LESSON – A SYSTEMATIC REVIEW ANALYSIS

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ABSTRACT. Introduction: The teacher has a very important role in making students aware of the importance of physical education and sports classes and has a decisive role in building the fundamental bases of gender equality. For this reason, teachers must support and encourage the reduction of gender stereotypes developed over the years in Romania, as well as implement diversified methods and techniques to homogenize the group from an early age. The purpose of this study is to analyse how gender inequalities were removed in other countries by specialists and what measures were taken by them. Identifying the methods and strategies applicable to the class in order to implement gender equality. **Method:** Using the systematic review method, a number of 420 articles were initially identified. After establishing the inclusion and exclusion criteria, a number of 20 articles were retained for analysis. **Discussions:** Gender differences are found in all fields, but they are more pronounced in physical education lessons. Gender stereotypes in the physical education lesson have a close connection with the attitude of the students, with the strategies and perceptions of the teachers and last but not least, with the prejudices of the parents. **Conclusions:** The following studies regarding gender differences should target the attitudes and conceptions of parents and teachers, but also the way in which they are reflected in the students' actions later in the lessons.

Keywords: *gender, stereotype, physical education.*

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REZUMAT. ***Reducerea stereotipiilor de gen și promovarea egalității de gen în lecția de educație fizică. O analiză sistematică.*** **Introducere:** Profesorul deține un rol foarte important în conștientizarea importanței orelor de educație fizică si sport de către elevi, și are un rol determinant în construirea bazelor fundamentale ale egalității de gen. Din acest motiv, cadrele didactice trebuie să susțină și să încurajeze atât diminuarea stereotipurilor de gen dezvoltate pe parcursul anilor în România, cât și implementarea metodelor și tehnicilor diversificate pentru omogenizarea grupului, încă de la o vârstă mică. **Scopul** acestui studiu este acela de a analiza modul în care inegalitățile de gen au fost înlăturate în alte țări de către specialiști și care au fost măsurile luate de aceștia în identificarea metodelor și strategiilor aplicabile la clasă în vederea implementării egalității de gen. **Metodă:** Folosind metoda revizuirii sistematice, au fost identificate inițial un număr de 420 de articole. În urma stabilirii criteriilor de includere și excludere, un număr de 20 de articole au fost reținute pentru analiză. **Discuții:** Diferențele de gen se regăsesc în toate domeniile, dar ele sunt mai accentuate în lecțiile de educație fizică. Stereotipurile de gen în lecția de educație fizică au o strânsă legătura cu atitudinea elevilor, cu strategiile și percepțiile profesorilor și nu în ultimul rând, cu prejudecățile părinților. **Concluzii:** Studiile următoare care privesc diferențele de gen ar trebui să vizeze atitudinile și concepțiile părinților și profesorilor dar și felul în care acestea se reflectă în acțiunile elevilor mai târziu în lecții.

Cuvinte cheie: *gen, stereotip, educație fizică.*

INTRODUCTION

A teacher's role is to make informed and intelligent decisions about practice to achieve different outcomes with and for the students in their classrooms. For this reason, teachers play a very important role in reducing gender stereotypes and achieving gender equality.

The role of a teacher is to adapt the methods and materials to the students' requirements and to find the most efficient way to help their students learn in the environments in which they teach. They should be aware that their decisions may not achieve the desired results, therefore it is necessary to monitor their decisions over time, evaluating the results and rethinking the strategy, if this measure is necessary.

Physical education is a mandatory discipline in school, it is present in the schooling plan from the small classes to the higher education level, having an increasingly important role in society and in education. Physical education as a discipline was introduced in the curriculum and is a fundamental discipline

when it comes to training children, even more so if it is implemented at an early age, it helps the child to develop cognitive, affective and social skills and abilities that prepare him for everyday life. With the help of physical exercise, the child manages to express himself freely and develop a series of things such as creativity and spontaneity, but also respect, both when it comes to him and in his relationship with others. Due to this reason, it is necessary to experience a varied range of sports and recreational activities implemented constantly, during classes as well as through certain pedagogical activities with the aim of accepting gender equality.

Stereotypes were constructed and preserved to maintain the patriarchal power structure, generating in people the mental representations corresponding to each gender. This has given rise to the unequal distribution of the cultural, economic and political capital of the society in which we are immersed.

These mental representations that constitute personal identity when not constructed by the subject themselves, are imposed by established power and developed through stereotypical representations of the masculine and feminine (Illera Arino, 2016).

Gender is a cultural and social construct that defines what it means to be a woman and what it means to be a man. This is used to highlight social constructions of what it means to be a man, what it means to be a woman and the differences between them. It is understood that gender differences do not correspond only to biological differences, but are determined by the social, cultural and historical contexts through which the processes of primary and secondary socialization develop (Illera Arino, 2016).

The construction of personal identity is a complex process in which personal, relational and cultural factors intervene, these factors interrelate and operate at every moment, at the same time. In order to make the explanation of the analyzed theme more fluid, I consider it essential, before entering the analysis, to clarify the following terms that we frequently use in daily life, however, in the educational field, these words must be explained because they have different meanings. The concepts I will cover are the following: sex, gender, mixed school, physical education and gender (Illera Arino, 2016).

Physical education and gender

According to the studies we evaluated, sex is understood as the differences that exist in relation to the genital organs and their function in human reproduction, determined by the genetic, hormonal, physiological and functional characteristics by which human beings are biologically differentiated. In the middle of the 19th century, differences were noticeable between the sports activity predominant in the education of boys and the restricted framework of

girls. Later, with the incorporation of the movements and schools of gymnastics (Swedish, French, English and German), the first participation of women in physical activity was introduced; in particular, the Swedish methodology based on individual and analytical exercises was adopted (Illera Arino, 2016).

Mixed education is understood as that common education of boys and girls, which apparently develops neutral and universal contents, but which in reality are stereotyped and dominant, guided by a dominant male model, without taking into account individual or collective differences (Illera Arino, 2016).

The purpose of this study is to analyze how gender inequalities were removed in other countries by specialists and what measures were taken by them. Identifying the methods and strategies applicable to the class in order to implement gender equality.

MATERIALS AND METHODS

Method: Using the systematic review method, a number of 420 articles were initially identified. After establishing the inclusion and exclusion criteria, a number of 20 articles were retained for analysis.

This study represents a systematic literature review based on previous research and new research trends as well as developments and open issues of this topic.

THE RESEARCH PROCESSES

Starting from the fundamental research question, an advanced search algorithm was established to list articles/books of interest for clearer search efficiency: (differences) AND (gender) AND (physical education). And then for a more precise search we used another algorithm: (gender) AND (gender differences) AND (students) AND (physical education) AND (physical education and sports teachers) AND (gender equality) AND (the best practices) AND (attitudes). Databases searched in this study included Pubmed, SPORTDiscus, JSTOR Arts & Sciences, ProQuest, SAGE, Taylor & Francis Online, and Web of Science.

Inclusion and exclusion criteria

Articles on the following topics were included:

Systematic literature reviews (RSL), meta-analyses (MA), experimental and quasi-experimental studies

Data collection

Initially, all articles were reviewed to determine whether titles, abstracts, and keywords met our inclusion criteria. Through initial screening, 420 articles were identified as relevant to this review, and the authors performed a preliminary coding of the selected articles. During the coding process, 197 articles were identified as not meeting the inclusion criteria.

After a re-evaluation of all of them, as well as after reading the abstract and the whole study, a total of 20 studies and articles were analyzed (see figure 1).

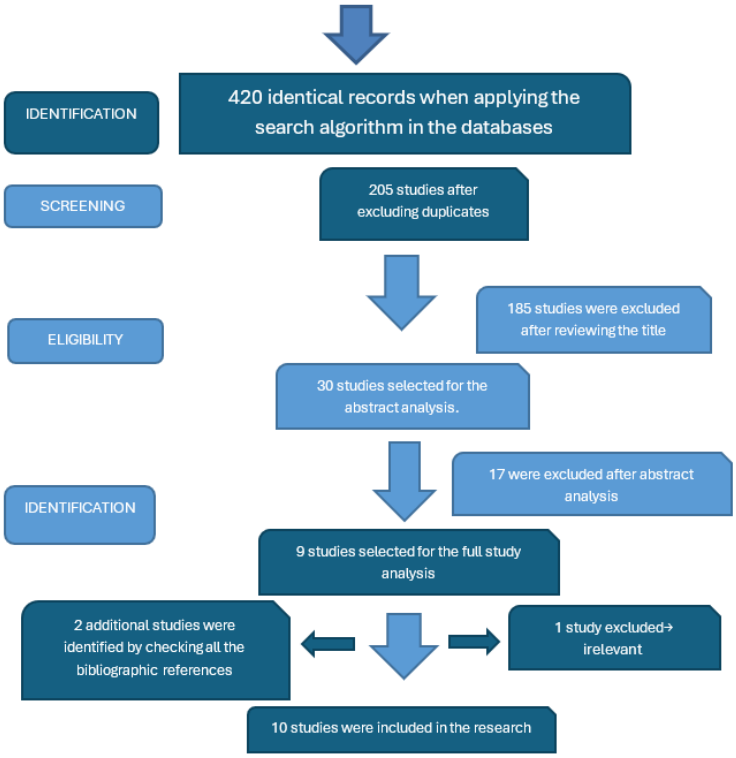

Figure 1. Diagram illustrating the literature search and selection process.

RESULTS

Table 1 provides an overview of all the studies included in the research, with reference to the main findings from the literature of studies on gender differences in physical education lessons.

Table 1. The main findings of studies regarding gender differences in physical education lessons

Article, authors	Sample (profile, n, sex, age)	Research design	Research method	The main findings
Ávalos-Ramos & Vega-Ramírez (2020)	675 Spanish students	Exploratory	cross-sectional study	In the present study, gender differences in gymnastics skills were examined. The results show a very low tendency of technical achievement of specific skills. The assessed elements are classified in the category of basic elements and can be performed from a young age, the development of gymnastic skills remains minimal. The author Davis (22) stated that skills are developed inadequately or almost not at all due to the lack of preparation of students and due to the lack of understanding of gymnastics as an educational field of knowledge, as well as due to the lack of preparation of physical education teachers in teaching gymnastics in its various forms.
Clayton & Humberstone (2007)	young people under the age of 18 years	Exploratory	Case study	This paper examines the implications and effects of a compulsory module on 'sex, difference and leisure' taught to a group of physical education students. The data presented reveal a number of pedagogical issues arising as identity issues, not least the need for teachers to critique masculine identities and to find a way in conveying information unchallenged.
Eccles & Harold (2008)	3,000 children in 12 different school	Qualitative	Question-naire	Due to the growing field of sport psychology, there is a growing concern and interest in gender and performance differences and participation in different sports. Over the past decade Eccles and her colleagues have discovered a theoretical model that examines the motivational factors underlying children's choices. They concluded that gender differences emerge from a very early age and that they are a consequence of gender role socialisation rather than natural differences.
Gutierrez & Garcıa-Lopez (2012)	boys (n= 31) and girls (n = 43) in four age groups	Exploratory	Quasi-experi-mental	The results confirmed the existence of stereotypical forms of participation in invasion games. The boys focused on handling the ball and achieving the goal, while the girls displayed more off-the-task (spectator-player) behaviours.

Lewis, Kamon & Hodgson (1986)		Qualitative	Literature analysis	Physiological and morphological gender differences become evident in different types and different training regimes. Boys and girls develop similar strength gains when training according to the same programme. Data from different research suggests that there are no substantial differences in cardiovascular and peripheral adaptations to aerobic training. The data support that aerobic exercise will be beneficial for both boys and girls when it comes to increasing lean body mass.
Verscheure & Amade-Escot (2007)	Sixteen students (six girls and ten boys) and two teachers	Exploratory	Experi-mental	A number of studies show that girls do not have equal opportunities when it comes to access to sports activities. This paper aims to understand how teachers and students address gender during physical education and sport classes. Students show different levels of understanding and performance during sports games.
Vilhjalmsson & Kristjansdottir (2003)	3270 students	Exploratory	Question-naire	In the present study, findings were made about girls' enrolment in sports clubs and how these low enrolments were favored by girls' low participation rate in physical education classes. Other variables are awareness of physical exercise and the benefits of sports training in social shaping and health promotion.
Elijah, Rintaugu & Ngetich (2012)	30 males and 20 females	Qualitative	Question-naire	An important variable in sport and physical education is motivation, which determines involvement and engagement in physical education lessons. The study was carried out on a group of physical education students, who perceived their physical health to be good and were physically and mentally present in class. The main factors that might decrease the number of participants in the class are lack of motivation, lack of time and injuries.
González-García, Martínez -Martínez & Pelegrín (2022)	357 Spanish athletes	Qualitative	Question-naire	The article aimed to find out whether there are differences in parenting styles and whether parents act according to gender. The results showed that girls are more protected by male parents, while boys who play sports reported more authoritarian mothers. Intervention plans are recommended for parents depending on the needs of their children.
Pikos & Straub (2019)	11 thousand observed games	Explorator y	Case study	In performance sport there are wide differences, analyzing these differences the result showed that boys have better results than girls and this is due to physical capacity.

The deductive phase of the analysis was the starting point, namely the categorization and coding of the data into categories. The second step was the inductive approach and this was aimed at open coding and again at identifying categories. Finally, all the collected data were analysed, described and interpreted.

DISCUSSION

Gender differences are found in all fields, but they are more pronounced in physical education lessons. Gender stereotypes in the physical education lesson have a close connection with the attitude of the students, with the strategies and perceptions of the teachers and last but not least with the prejudices of the parents. After the evaluation of the studies, we can say that we noticed three big factors that influence gender inequalities and stereotypes in the physical education lesson, as they were mentioned previously: the students, the teachers and the prejudices of the parents.

According to the studies reviewed, boys report being more motor than girls but findings by (Ávalos-Ramos & Vega-Ramírez, 2020) reinforce possible gender differences in the development of basic skills, with boys demonstrating better motor skills and dexterity, including quickness and jumping, and girls having better flexibility, agility and balance, qualities that are most likely to develop at the age of 5-6 and are attributed to girls, in a similar way, hence the gender differences in the sports branch of gymnastics and not only.

Another study by (Clayton & Humberstone, 2007) identified how a male-dominated culture can create insensitivity, embarrassment and discomfort for girls in particular. The ratio of boys to girls varied across class times, but all groups were dominated by boys, and the lecture group as a whole was predominantly male. In addition, most of the male students were members of the university's sports teams and therefore part of an athletic and especially football subcultural fraternity, from which we can conclude that boys can put pressure on the shoulders of their female colleagues by to them the freedom to express themselves both in sports and in other fields.

A number of studies show that boys are more physically active in physical education lessons, have greater determination in games and greater enjoyment of the mark. They perform better than girls in team games. Experimental studies have shown that with a correct approach and a well-defined methodology we can diminish these differences, as these stereotypes are largely directly related to the educational instructional process carried out during the learning process (Gutierrez & García-Lopez, 2012).

Another study clearly determines the passive attitude of girls in sports games and the meaning that students attribute to a situation depends on the status and role they play in the context in which the action takes place, and this meaning influences their game behavior. Therefore, behavior is highly dependent on the distribution of roles and power relations during the game. This leads us to suggest that the formation of groups, whether according to gender, friendship or performance criteria, determines gaming behavior and probably gaming performance (Gutierrez & Garcıa-Lopez, 2012). In order to combat these socially accepted inequalities, teachers should schedule tasks in which role equality is favored, they are a key piece in achieving any change in the educational project, for this reason, it is vitally important that they are prepared to develop co-educational strategies, making students see that it is education and cultural conditions that influence correct attitudes related to gender equality.

A study by (González-García et al., 2022) aimed to find out whether there are differences in parenting styles and whether parents act according to gender. The results showed that girls are more protected by male parents, while boys who play sports reported more authoritarian mothers. Intervention plans are recommended for parents depending on the needs of their children.

CONCLUSIONS

This study emphasizes the importance of the following aspects:

1. Mixed classes within the lesson
2. Assigning roles in physical education classes
3. Adaptation of school programs
4. The existence of teacher training courses
5. Debates with parents in which they are presented with the importance of supporting their daughters in choosing a sport declared "masculine."

The following studies regarding gender differences should target the attitudes and conceptions of parents and teachers, but also the way in which they are reflected in the students' actions later in the lessons.

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BENEFICIAL ASPECTS OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE TRAINING PROCESS OF PHYSICAL EDUCATION AND SPORT SPECIALISTS

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ABSTRACT. This article addresses the issue of both the need for information and communication technologies (ICT) in the process of training specialists in the field of physical education and sport, as well as their beneficial aspects within the given process. The analysis of bibliographic sources on the issue addressed allows us to ascertain the role of information and communication technologies from the point of view of the professional training of the profile specialist. The use of technologies in the instructive-educational process contributes to the development for students of the skills required by modern society, focusing the educational process on the student, who in turn becomes the subject of the educational process. Information and communication technologies provide instant access to information, which is why its presence in the teaching process is so important. The implementation of technologies also creates differentiated instructional pathways to meet the unique needs of students as individual learners. The personnel involved in the didactic process must possess, in addition to the theoretical and practical knowledge related to the discipline studied, also skills in the use of information technologies. At the current stage, the use of information and communication technologies by teachers and students has become a priority. Focusing on information and communication technologies in the teaching-learning-evaluation process becomes a pressing necessity in the conditions of the contemporary information society.

Keywords: *Benefit, computer, digital competence, physical education, professional training, sport, student, information and communication technologies.*

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REZUMAT. ***Aspecte benefice ale tehnologiilor informaționale și de comunicare în procesul de pregătire a specialiștilor de educație fizică și sport.*** Articolul dat abordează problema atât a necesității tehnologiilor informaționale și de comunicare (TIC) în procesul de pregătire a specialiștilor în domeniul educației fizice și sportului, cât și aspectele benefice ale acestora în cadrul procesului dat. Analiza surselor bibliografice la problema abordată, permite să constatăm rolul tehnologiilor informaționale și de comunicare din punctul de vedere al pregătirii profesionale al specialistului de profil. Utilizarea tehnologiilor în procesul instructiv-educativ, contribuie la dezvoltarea pentru studenți, a abilităților impuse de societatea modernă, focalizând procesul educațional asupra studentului, care la rândul său devine subiectul procesului de învățământ. Tehnologiile informaționale și de comunicare oferă acces instantaneu la informație, motiv pentru care prezența acesteia în procesul didactic este atât de importantă. Implementarea tehnologiilor creează, de asemenea, căi de instruire diferențiate pentru a satisface nevoile unice ale studenților ca instruiți individuali. Personalul implicat în procesul didactic trebuie să posede, pe lângă cunoștințele teoretice și practice aferente disciplinei studiate, și abilitați de utilizare a tehnologiilor informaționale. La etapa actuală, utilizarea tehnologiilor informației și comunicațiilor de către profesori și studenți a devenit o prioritate. Axarea pe tehnologiile informaționale și de comunicare în procesul de predare-învățare-evaluare, devine o necesitate stringentă în condițiile societății informaționale contemporane.

Cuvinte cheie: *Beneficiu, calculator, competență digitală, educație fizică, pregătire profesională, sport, student, tehnologii informaționale și de comunicare.*

INTRODUCTION

Initially viewed as a support for the conduct of business activity, information technology plays an increasingly important role in the life of all organizations, due to the rapid changes in the market and the expansion of global connections. IT comprises an assembly of computing equipment and software applications used together to store, process, manipulate and transmit data.

The information society is based on multifunctional communication and is in a permanent expansion of technological possibilities, including not only telecommunications, but also other spheres of society, such as the economy, trade, media coverage and virtualization and, last but not least, education.

In competence-centered education, special attention is drawn to interactive pedagogy, integrated through modern educational technologies, including new information and communication technologies.

According to the Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning (2006/962/EC), digital competence has been recognized as one of the eight key competences for lifelong learning. Digital competence involves the safe and critical use of Information Society Technologies (IST) for work, leisure and communication.

The key competences provide a frame of reference in support of the efforts made at national and European level to achieve the objectives they define. This framework is primarily addressed to policy makers, education and training service providers, employers and learners.

It is observed that the educational process is prioritized in the reference framework, a fact beneficial for the good development of society.

Digital competence is embodied in the confident and critical use of the full range of information and communication technologies for information, communication and problem solving in all areas of life.

At the same time, the concept of digital competence is interpreted from the point of view of several aspects, it includes dimensions that represent the convergence of several fields that evolve very quickly, as new digital technologies appear. Being digitally competent today means more than being able to use the latest digital technologies (phones, tablets, etc.) or computer software – it's about having the skills to search for relevant information, to critically and creatively analyze web services, to be able to communicate with others, using a variety of digital tools and applications, to understand/perceive media as a digital habitat, to protect digital identity and to respect ethical norms of conduct in network.

The problem of computer application in training was deeply and multilaterally researched in several countries, and the proposed solutions were determined by the respective stage of education development in the given country, as well as by the degree of computerization of the society at the time of the investigation (Burlacu, 2015).

In the field of physical education and sport, information technologies aim to help teachers/students/coaches and provide them with the necessary support in the teaching-learning-evaluation process.

Several specialists (Oboroceanu, 2016; Risneac, Milici & Rata, 2004; Volcu & Volcu, 2019), consider the application of IT means such as audiovisual ones, in the instructive-educational process, as a method that can contribute to solving the tasks of practical lessons, bringing the teaching staff closer to non-standard means and at the same time having a positive influence on the actual work.

The importance of video recordings is also recognized by Gorsgeorge, quoted by Ciocoiu (2009) who believes that they facilitate the analysis of collective actions, and even recommends that teachers and athletes use video feed-back during the training process.

In the opinion of Balan (2012), the modernization of pedagogical education currently includes two converging trends: the transformation of the learner into a subject of his own development and the approximation of professional knowledge to scientific knowledge.

It is indubitable that the use of information technologies in physical education and sport obviously improves the efficiency of the field.

The consequences of the development of information technologies spread like an echo in different structures of society, bringing changes in education not only at the level of skills in particular, but they agree in the connection of pedagogical models, currently based on the symbiosis of the traditional and the digital environment. The digital habitat imposes paradigms in education that combine the training of the necessary skills in the 21st century and the daily pedagogical activity, which becomes optimal with reference to learning and education, generating new experiments and didactic methods. In recent times, information technologies have constantly focused on training with the help of numerous applications, electronic platforms and virtual educational environments. The pedagogical concordance offered by ICT to the training process coincides with the requirements and expectations of the growing generation to facilitate the formation of transversal skills, necessary in modern society. In the 21st century, pedagogy has acquired the meaning of skills pedagogy and challenges the teacher to develop his professional mastery by applying digital skills.

OBJECTIVE AND HYPOTHESIS

Through this paper, we aim to effectively contribute to the professional training of physical education and sport specialists by promoting the use of information and communication technologies in the instructional-educational process, both by academic staff and students/master students, so that they are competitive on the labor market.

In this research, we started from the hypothesis that the implementation of information and communication technologies in the training process of physical education and sport specialists will significantly improve their professional development and, as a result, they will become able to face the challenges of the field.

The purpose of the research is to highlight the benefits of using information and communication technologies in the process of training specialists in the field of physical education and sport.

MATERIALS AND METHODS

We used the following research methods: theoretical analysis, statistical-mathematical method, graphic method, survey method, interview, observation.

Data collection was carried out by developing a questionnaire and filling it in by the students. Participants were asked to provide an answer for each item. For this, the respondents were given general instructions on how to complete the questionnaire, as well as the use of the data provided by them.

At the same time, an analysis of some statistical documents was carried out, such as: Access and use by the population of information and communication technology; strategic: the 2030 Sustainable Development Agenda adopted at the UN Summit, which represents an action plan for People, Planet and prosperity.

RESULTS AND DISCUSSIONS

The widespread acceptance of information technologies in education has an important effect, first of all, on the representation and assimilation of didactic content; technology is gradually changing the way of learning and transmitting information. Today's generation of learners is being trained in the digital habitat and as they progress through the training process, they tend to use interactive, collaborative learning content with limitless opportunities. Precisely for that reason, teachers must include in the teaching-learning-evaluation activities the technologies that will allow them to design educational content and computer-assisted learning scenarios.

In order to carry out an analysis on the topic, I conducted a study on some statistical data and a sociological survey, where the following results were obtained:

When asked about the necessity of using information technologies in the training process of future physical education and sport specialists, 57.5% gave a categorically positive answer and only 2.5% denied, and 40% of respondents were indifferent, considering it difficult to answer this question (Figure 1). A part of society believes that information technologies do not really have a place in physical education and sport, due to the specificity of this, which requires a healthy way of life by practicing physical exercises and proper nutrition.

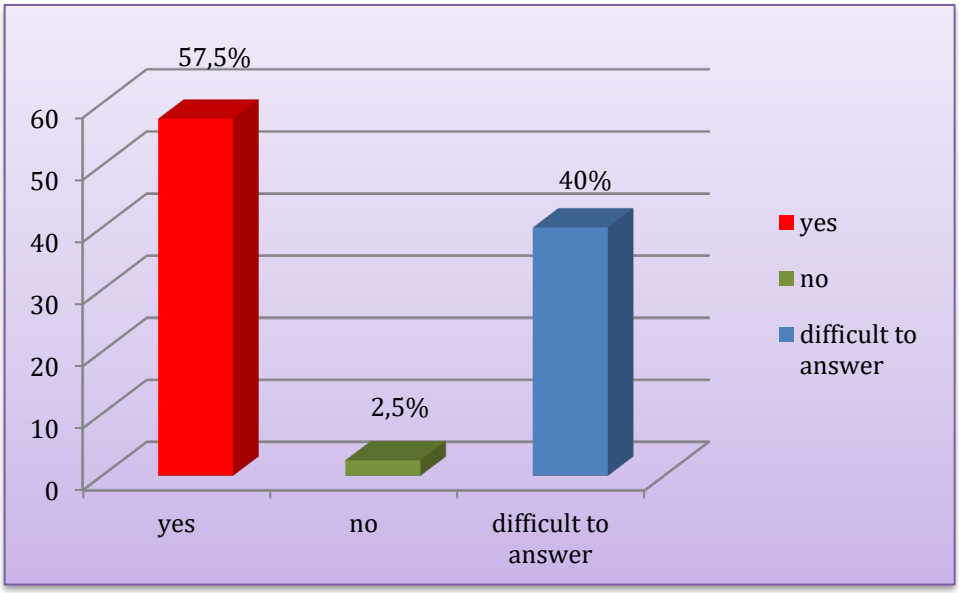

Figure 1. The percentage distribution of the answers regarding the need to use IT in the training of profile specialists (yes, no, difficult to answer)

The change in the education system aims at increasing the efficiency of learning activities, developing skills and individual study, which is an educational and scientific research activity, aimed at developing the necessary skills and is carried out with the methodical guidance of the teacher, but without his direct participation (Volcu & Volcu, 2023). Their achievement depends on the degree of preparation of the teacher in the use of the computer, the style of the teacher, the number of students, their interest, knowledge and abilities, the institutional climate and the quality of the programs used, the time the software is integrated into the lesson, the synchronization of the explanations with the sequences used, the evaluation methods, the developed worksheets, etc.

According to the data of the National Bureau of Statistics of the Republic of Moldova (2018), in 2017 over half of the households in the Republic of Moldova had computers (52.3%), being connected and using the Internet (50.7%), with an increase in the last four years of both indicators by more than 10 p.p. In the urban environment, 2 out of 3 households have computers (65.7%), exceeding by about 24 p.p the share of those in the rural environment (41.6%), the increase of the indicator in 2017 compared to 2013 being approximately the same in both environments (about 10 p.).

In the context of the 2030 Agenda for Sustainable Development (2015), information technologies and information are the main tools for achieving the objectives and reaching the targets of sustainable development.

Among the indicators for measuring access to ICT, proposed at the international level, the indicator of the proportion of pupils/students who have access to the Internet in school is also mentioned. There are no official data regarding access to the Internet in educational institutions by pupils/students, however sociological studies show that the majority of pupils/students have access to the Internet in institutions, about 2/3 of pupils/students confirm that they accessed the Internet during the year at school, college, university (free).

In the context of the above, 90% of the respondents know how to use the computer, and 10% considered it difficult to answer this question, which highlights the fact that some of the respondents encounter difficulties in using the computer (Figure 2).

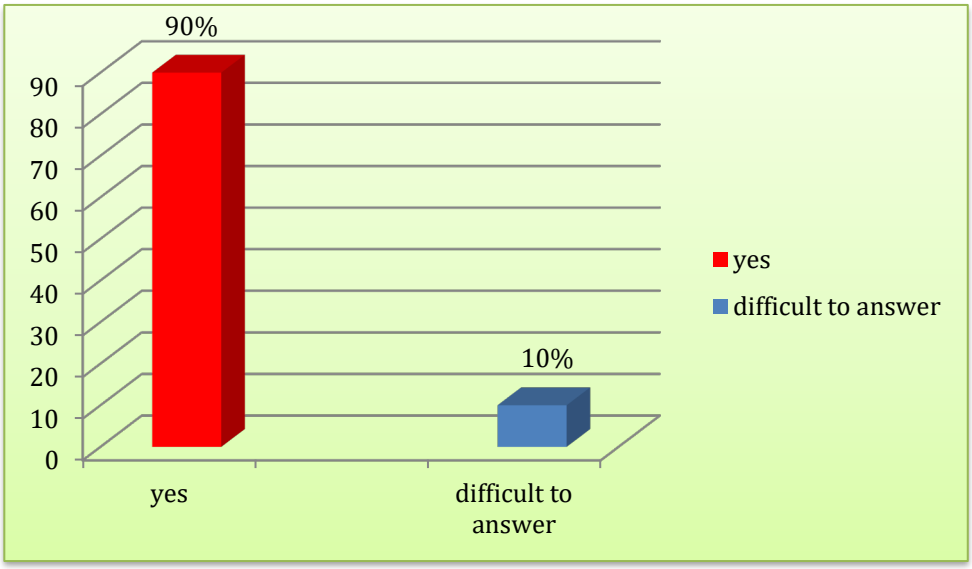

Figure 2. Percentage distribution of answers regarding computer knowledge (yes, no, difficult to answer)

The random use of the computer, without a specific purpose, at an inappropriate moment during the lesson leads to boredom, monotony, the inefficiency of learning due to the non-participation of some students in the

lesson, the failure to achieve the objectives of the lesson and can produce repulsion towards this modern means of teaching-learning- evaluation. Excessive use of the computer can lead to the loss of practical skills, calculation and reality investigation, to the deterioration of human relationships. The excessive individualization of learning leads to the denial of the student-teacher dialogue and to the isolation of the act of learning in its psychosocial context. The subject is segmented and atomized too much, and the mental activity of the students is diminished, it being directed step by step.

Taking into account these negative aspects, we cannot exclude the fact that the integration of ICT in the study process, according to some authors (Constantin & Dinica, 2006; Stan, 2012; Volcu & Volcu, 2019), also brings numerous advantages: Stimulation of innovative, adaptable learning capacity to conditions of rapid social change; Consolidation of scientific investigation skills; Awareness of the fact that the concepts learned will later find their usefulness; Increasing the yield of coherent acquisition of knowledge through the immediate assessment of student answers; Strengthening students' motivation in the learning process; Stimulation of logical thinking and imagination; Introducing a cognitive, efficient and independent style; Installation of the climate of self-surpassing, competitiveness; Mobilization of psychomotor functions in computer use; Development of visual culture; Formation of useful practical skills; Ensuring a permanent feed-back, the teacher having the possibility to redesign the activity according to the previous sequence; Facilities for rapid processing of data, making calculations, displaying results, making graphs and tables; Ensures the choice and use of appropriate strategies for solving various applications; It develops thinking so that, starting from a general way of solving a problem, the student finds the answer for a concrete problem by himself; It ensures the preparation of students for a society based on the concept of permanent education (lifelong education); It determines a positive attitude of students towards the educational discipline in which the computer is used and towards the moral, cultural and spiritual values of the society; It helps students with special needs to integrate into society and the educational process.

Also, the computer is extremely useful because it simulates complex processes and phenomena that no other didactic means can highlight so well. It allows the realization of experiments that are practically impossible due to the lack of didactic material, the inadequate equipment of the laboratories or the danger to which the participants were exposed.

It is worth noting that one of the areas of interest in the labor market is how employees use computers during working hours.

CONCLUSIONS

Information technologies are of major importance both in the training of physical education and sport specialists, as well as during professional activities, having a multitude of advantages.

The results of the sociological research carried out (Figure 1) highlighted the fact that all categories of respondents confirmed the necessity (57.5%) of using information technologies in the training of physical education and sport specialists.

The use of information technologies is a necessary trend for the evolution of the field of physical education and sport, as well as for the training of profile specialists.

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PHYSICAL FITNESS AND PHYSICAL SELF-PERCEPTION OF CHILDREN IN RELATION TO BMI: AN OBSERVATIONAL STUDY IN SOUTHERN ITALY

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ABSTRACT. **Introduction.** Despite international literature has well recognized the rule of physical education in primary school for the promotion of children's educational process and the mediating effects on cognitive, emotional and social development, in many European countries sedentary lifestyles in children have increased involving all age groups and social classes. Moreover, in Italy the prevalence of children's overweight and obesity is linked to increased physical inactivity and reduced opportunities for physical activity expenditure. The present study aims to assess physical fitness and self-perception in children involved in SBAM Project in Apulia (Southern Italy), according to gender and BMI. The assessment involved four physical fitness tests (SLJ, MBT, 10x4 and 6mWT) and a self-report to assess physical self-perception. A 3x2 ANOVA was carried out to assess the main and interaction effect of gender and BMI on considered variables. **Results** showed (a) better motor performances and self-perception in normal weight children compared to overweight and obese peers, (b) male were stronger and faster than female, and (c) physical self-perception didn't change between obese male and female. Methodological interventions aimed at increasing time spent in motor activity and develop physical fitness are needed in primary school to promote health-oriented physical education.

Keywords*: health promotion; motor development; physical education; children; self-perception.*

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INTRODUCTION

Each experience made by a child through motor activities contributes significantly to the child's educational process. Physical education has a mediating role for motor, cognitive and social development (Bailey, 2006). PA during childhood and adolescence is associated with numerous health benefits for children and adolescents, including the reduction of adiposity, the improvement of cardiovascular efficiency, the reduction of symptoms of depression and anxiety self-perception and improved academic performance (Strong et al., 2005; Eveland-Sayers et al., 2009). Numerous studies confirm that physical activity, in fact, has preventive and protective effects against non-communicable diseases, reduction of adiposity, improvement of cardiovascular efficiency, prevention of metabolic syndrome (Janssen & Le Blanc, 2010; Brambilla et al., 2011).

In many countries, curricular PE, motor activity and sport in childhood fall within the ambit of education policies for correct eating habits and for the fight against overweight and obesity, directing the birth of new organizational and teaching models of the school (Carson & Webstar, 2020; Bailey et al., 2023). Furthermore, reduced opportunities to practice structured daily motor activities and in free time reduce the individual motor repertoire and the preventive and protective effects on systems, organs and apparatuses (Faigenbaum et al., 2018).

Physical fitness is an important indicator of health for children and young people. Indeed: (1) levels of cardiorespiratory efficiency are predominantly associated with abdominal adiposity; (2) cardiorespiratory and muscle efficiency are associated with cardiovascular disease risks; (3) the improvement of muscle efficiency and speed has positive effects on skeletal development; (4) improved cardiorespiratory efficiency has positive effects on depression, anxiety, mood and self-esteem and is also associated with academic achievement (Ortega et al., 2008).

Promotion of children's health through physical education, physical activity and sport is an educational purpose that requires interinstitutional programs. Primary school is an ideal setting for multi-component interventions that contrast sedentary behaviour and promote learning of motor competencies.

According to Garrido-Miguel et al. (2019), in fact, the prevalence of overweight and obesity in European children aged 2 to 13 changed from 20.6% in the period 1999-2006, to 21.3% in the period 2011-2016. The highest prevalence is found in Italy (16.8%) and Malta (14.2%). In childhood, overweight and obesity are public health problems that affect motor development and psychological factors. In Puglia (southern Italy), regardless of gender differences, overweight children are 21.6% and obese people 15.1% (Okkio alla Salute, 2019).

Recently Faigenbaum, Rebullido and McDonald (2018) show that a high percentage of children and adolescents in the world do not reach 60 minutes of daily moderate to intense physical activity (MVPA-Moderate Vigorous Physical Activity), with a consequent reduction in levels of physical efficiency in the developmental age. The motor activity triad in children (Faigenbaum et al., 2018) identifies three distinct but closely related factors: exercise/motor activity deficit disorders, pediatric dynapenia, physical illiteracy. A dangerous circular process is thus generated: subjects with low levels of habitual physical activity will be less inclined to participate in motor activities, even free/unstructured ones, which lead to the achievement of a state of joy and fun; this determines a lower predisposition to motor or sports practice and a progressive reduction of the individual motor repertoire and the consequent levels of individual motor development (Peña et al., 2022).

The increase in overweight and obesity in childhood is a determining factor for the development of physical efficiency. Rauner, Mess and Woll (2013) analyzed the relationship between motor activity levels and overweight and between fitness and overweight, highlighting that obesity is inversely related to physical activity levels and motor performance. Numerous studies also reveal inverse relationships between physical efficiency and overweight and mediating effects in the interrelationship between body mass index (BMI), fitness, physical activity and related psychological factors. Excessive body weight would be the cause or effect of reduced daily physical activity and low levels of fitness. Cattuzzo et al. (2016) confirmed that: motor skill levels are inversely proportional to body weight (27 out of 33 studies), there is a positive association between motor skills and good cardiorespiratory efficiency (12 out of 12 studies) and between motor skills and muscle function -skeletal (7 out of 11 studies).

Fundamental motor skills, in fact, play a key role in the physical literacy curricular project, being functional to motor competencies (Edwards et al., 2017); the development of children's physical efficiency is an essential educational objective of educational interventions, as it solicits positive associations with the self-perception of personal motor skills and abilities (Barnett et al., 2018).

Positive motor experiences contribute to structuring of a positive self-image and to the development of self-perception of one's motor skills, a prerequisite for self-perception and beliefs of physical self-efficacy in different age groups (Feltz & Magyar, 2007; Stodden et al., 2008).

Perceived self-efficacy is linked to the perception of the body self and to the factors that constitute motor competence (Babic et al., 2014; Bardid et al., 2016) concerning the ability to mobilize one's own cognitive, motor, social resources to carry out a wide repertoire of motor skills, in different contexts and in every daily activity (Robinson et al., 2015).

The physical self-perception arises from the global self-perception, which is a hierarchical organization of personal beliefs of action to be performed, with different levels of concreteness and complexity; these beliefs profoundly influence learning and human and social development in different ages (Estevan & Barnett, 2018).

The construct of self-perception has been used in studies according to two meanings: self-efficacy referred to the perceived ability to perform a particular task; self-efficacy refers to the perceived ability to control, prevent or manage potential difficulties that could arise from the performance of a task (Bardid et al., 2016).

Self-perception derives from the experience lived in different contexts and from the way in which these experiences are lived by the individual (Kantzas & Venetsanou, 2020; Estevan & Barnett, 2018). Positive motor experiences in which children successfully experiment with a wide repertoire of activities and executive variants of motor tasks, enrich the individual body experience, i.e., the experiences concretely carried out through the body and movement.

Physical perception of oneself is linked to self-perception and to factors that constitute motor competence (Bardid et al., 2016) concerning ability to mobilize one's cognitive, motor, social resources to perform a wide repertoire of motor skills, in different contexts and in daily activity (Cairney et al., 2019; Robinson et al., 2015).

Recent studies (Khodaverdi et al., 2015; Dapp et al., 2019) highlight how self-perception arises from quality of teaching proposals and is a mediating factor capable of conditioning, accelerating or inhibiting the relationships between cognitive functions, motor, emotional and social and for continuation of motor activity in childhood.

In the light of these evidence, the present study aims to assess differences in physical fitness (strength and speed) and self-perception according to gender and BMI.

OBJECTIVES

In the light of these evidence, the present study aims to assess differences in physical fitness (strength and speed) and self-perception according to gender and BMI in a sample of primary schoolchildren. The attention of researchers has been particularly focused on the evolution (or involution) of physical fitness parameters in normal weight, overweight and obese children.

MATERIAL & METHODS

Participants

The sample involved 900 children (Male, age: 9.23±0.43; Female, age: 9.12±0.36) attending primary schools in Puglia (Italy) recruited by schools that joined the SBAM Project in Apulia (Southern Italy). The project provides four areas of intervention (physical education, active transport, correct eating habits) to promote health and prevent sedentary behavior in 4th and 5th grade primary school children. Sample recruitment was performed via a simple randomization procedure.

Measures

The sample was divided according to gender differences and into three groups according to BMI differences: normal weight (Nw), overweight (Ow) and obese (Ob) (Cole et al., 2000). Data concerning motor development and psychological factors related to motor experience (self-perception) were evaluated and compared. The following motor tests were proposed to all children (Council of Europe-Committee for the Development of Sport, 1988; Cooper Institute, 2004; Ruiz et al., 2011): standing long jump (SLJ) and 1 kg medicine ball throw (MBT 1Kg) to assess strength ability, 10 × 4 shuttle run (10x4), and 6 min walking test (6 min WT) to assess endurance.

Perceived self-efficacy was assessed through the PSP_C self-report (Children's Self-Efficacy Scale), (Colella et al., 2008). The questionnaire is made up of six items referring to the factors of strength, speed and motor coordination which provide a scale of values for the answers from 1 to 4 points. Children are asked to express a self-perception score, corresponding to when they play, participate in physical education or when they are involved in sports.

Data analysis

In addition to descriptive statistics (mean ± standard deviation) for all variables, a 2x3 Factorial ANOVA was performed to assess the main effect and possible interaction effect of gender (male and female) and BMI Cutoff (normal weight, overweight and obese) on physical fitness and self-perception. Post hoc analysis was also carried out using Tuckey HSD test to highlight significant differences according to gender and groups. All statistical analysis were conducted setting the significant index (p) < .05. "SPSS-Statistical Package for the Social Sciences" Software (IBM Corp. Released 2019, vers.26) was used to perform statistical analysis.

RESULTS

After collecting anthropometric data (**Table 1**), the sample was divided according to BMI Cutoff (Cole et al., 2000) in three subgroups: Normal weight (Male: 16.80±1.42; Female: 16.45±1.53), Overweight (Male: 21.01±1.22; Female: 20.72±1.25), and Obese children (Male: 25.59±2.28; Female: 25.49±2.91).

Table 1. Sample's Descriptive Profile
Anthropometric Characteristics

Gender	N	Group	Age	Height	Weight	BMI
Female	150	Nw	9.05 ± 0.27	1.36 ± 0.07	30.69 ± 4.48	16.45 ± 1.53
Female	150	Ow	9.21 ± 0.49	1.39 ± 0.06	39.88 ± 4.77	20.72 ± 1.25
Female	150	Ob	9.09 ± 0.31	1.41 ± 0.06	50.48 ± 7.49	25.49 ± 2.91
Male	150	Nw	9.14 ± 0.35	1.38 ± 0.06	31.94 ± 4.09	16.80 ± 1.42
Male	150	Ow	9.27 ± 0.46	1.40 ± 0.06	41.29 ± 5.29	21.01 ± 1.22
Male	150	Ob	9.29 ± 0.47	1.41 ± 0.07	50.90 ± 6.92	25.59 ± 2.28
Total	900	Overall	9.18 ± 0.39	1.39 ± 0.06	40.86 ± 5.51	21.01 ± 1.77

Sample's descriptive profile (mean ± standard deviation) has been reported in **Table 1** according to gender and BMI groups for age, weight, height, and BMI, while data obtained from physical fitness test and self-perception have been reported in **Table 2**.

Table 2. Results of Motor Assessment

Gender	N	Group	SLJ	10x4	MBT 1kg	6mWT	PSP
Female	150	Nw	1.26 ± 0.17	13.36 ± 1.36	4.25 ± 0.81	757.83 ± 124.72	18,97 ± 2.20
Female	150	Ow	1.11 ± 0.22	14.10 ± 1.79	4.39 ± 0.95	631.54 ± 91.63	18,13 ± 3.43
Female	150	Ob	1.00 ± 0.23	14.66 ± 2.43	4.33 ± 1.11	584.43 ± 122.29	17,57 ± 3.02
Male	150	Nw	1.49 ± 0.17	12.50 ± 0.89	5.19 ± 0.97	755.71 ± 132.23	20,35 ± 2.10
Male	150	Ow	1.24 ± 0.21	13.63 ± 1.47	5.33 ± 1.06	682.71 ± 94.72	19,50 ± 2.92
Male	150	Ob	1.09 ± 0.22	14.49 ± 2.52	5.13 ± 1.18	601.45 ± 105.52	17,94 ± 4.42

Table 3 showed the effect of gender, BMI Cutoff and interaction Gender*BMI Cutoff reporting F value and partial eta squared value (ηp^2). Results showed that F value for gender and BMI Cutoff groups were all significant with a significant index *p* less than 0.05 (excepted for MBT), while the interaction effect was significant only for SLJ (F= 10.472, *p* = .000), 10x4 (F= 3.153, *p* =.043) and 6mWT (F= 4.288, p = .014). Therefore, post hoc analyses were performed to analyze significant main effects of gender and BMI Cutoff.

Table 3. Main and Interaction Effect Between Subjects

	Gender			BMI Cutoff			Gender*BMI Cutoff		
	F	***p***	**ηp²**	**F**	***p***	**ηp²**	**F**	***p***	**ηp²**
SLJ	126.652	.000	.124	200.592	.000	.310	10.472	.000	.023
MBT	166.557	.000	.157	.910	.403	.002	.147	.863	.000
10x4	16.633	.000	.018	71.707	.000	.138	3.153	.043	.007
6mWT	8.557	.004	.009	160.353	.000	.264	4.288	.014	.010
PSP	24.995	.000	.027	28.139	.000	.059	2.613	.074	.006

Post-hoc analysis has been reported in **Table 4** and **5** according to BMI Cutoff and Gender, respectively. The results (**Table 4**) showed, in both male and female, significant better performance of Normal weight group for SLJ, 10x4 and 6mWT compared to overweight and obese peers. Moreover, physical self-perception differed significantly in favors of normal weight group in female, while obese male showed lower levels of physical self-perception compared to normal weight (p = .000), and overweight peers (p = .000).

Table 4. Tuckey HSD Post Hoc Test according to BMI Cutoff

			Female				Male			
Measure	**Cutoff**		**Mean diff.**	**p**	**LLCI**	**ULCI**	**Mean diff.**	**p**	**LLCI**	**ULCI**
SLJ										
	Nw	*Ow*	.15	.000	.09	.20	.26	.000	.20	.31
		Ob	.25	.000	.19	.30	.39	.000	.34	.45
	Ow	*Nw*	-.15	.000	-.20	-.09	-.26	.000	-.31	-.20
		Ob	.10	.000	.04	.15	.13	.000	.08	.19
	Ob	*Nw*	-.25	.000	-.30	-.19	-.39	.000	-.45	-.34
		Ow	-.10	.000	-.15	-.04	-.13	.000	-.19	-.08
MBT										
	Nw	*Ow*	-.12	.512	-.37	.13	-.04	.944	-.33	.25
		Ob	-.01	.995	-.26	.24	.06	.862	-.22	.35
	Ow	*Nw*	.12	.512	-.13	.37	.04	.944	-.25	.33
		Ob	.11	.572	-.14	.36	.10	.677	-.18	.39
	Ob	*Nw*	.01	.995	-.24	.26	-.06	.862	-.35	.22
		Ow	-.11	.572	-.36	.14	-.10	.677	-.39	.18
10X4										
	Nw	*Ow*	-.79	.001	-1.30	-.28	-1.18	.000	-1.64	-.71
		Ob	-1.37	.000	-1.88	-.86	-2.10	.000	-2.57	-1.64
	Ow	*Nw*	.79	.001	.28	1.30	1.18	.000	.71	1.64
		Ob	-.58	.020	-1.09	-.07	-.92	.000	-1.39	-.46
	Ob	*Nw*	1.37	.000	.86	1.88	2.10	.000	1.64	2.57
		Ow	.58	.020	.07	1.09	.92	.000	.46	1.39

6mWT										
	Nw	*Ow*	126.29	.000	95.37	157.22	72.99	.000	42.60	103.39
		Ob	173.40	.000	142.48	204.32	154.26	.000	123.86	184.66
	Ow	*Nw*	-126.29	.000	-157.22	-95.37	-72.99	.000	-103.39	-42.60
		Ob	47.11	.001	16.18	78.03	81.27	.000	50.87	111.66
	Ob	*Nw*	-173.40	.000	-204.32	-142.48	-154.26	.000	-184.66	-123.86
		Ow	-47.11	.001	-78.03	-16.18	-81.27	.000	-111.66	-50.87
PSP										
	Nw	*Ow*	.85	.034	.05	1.64	.85	.067	-.05	1.74
		Ob	1.40	.000	.60	2.20	2.41	.000	1.51	3.30
	Ow	*Nw*	-.85	.034	-1.64	-.05	-.85	.067	-1.74	.05
		Ob	.55	.232	-.24	1.35	1.56	.000	.67	2.45
	Ob	*Nw*	-1.40	.000	-2.20	-.60	-2.41	.000	-3.30	-1.51
		Ow	-.55	.232	-1.35	.24	-1.56	.000	-2.45	-.67

The results of Tuckey's HSD Post Hoc test have been reported in Table 5. As regards the normal weigh and overweight groups, male showed better motor performances than female in all physical fitness test and physical self-perception, except for 6mWT in normal weight sample. However, these differences are less evident in obese children. In fact, male showed higher strength level than female in SLJ and MBT ($p < 0.01$).

Table 5. Tuckey HSD Post Hoc Test according to Gender

		Normal Weight			**Overweight**			**Obese**		
		Mean	**SD**	***p***	**Mean**	**SD**	***p***	**Mean**	**SD**	***p***
SLJ										
	Female	1.25	.17	.000	1.10	.21	.000	1.00	.22	.000
	Male	1.49	.16		1.23	.20		1.09	.21	
MBT										
	Female	4.24	.80	.000	4.37	.93	.000	4.26	1.07	.000
	Male	5.17	.97		5.21	1.12		5.11	1.14	
10x4										
	Female	13.36	1.36	.000	14.15	1.78	.013	14.74	2.33	.643
	Male	12.50	.87		13.68	1.47		14.61	2.39	
6mWT										
	Female	757.83	124.72	.886	631.54	91.62	.000	584.43	122.29	.198
	Male	755.71	132.23		682.71	94.71		601.45	105.52	
SEE										
	Female	18.97	2.20	.000	18.13	3.42	.000	17.57	3.02	.402
	Male	20.35	2.10		19.50	2.91		17.94	4.41	

DISCUSSION

The present study is in continuity with previous studies (Deforche et al., 2003; D'Hondt et al., 2009; Yuksel et al., 2020) which evaluated different factors of motor development and PA of children in relation to BMI. Obese children had lower motor performance in all tests requiring horizontal or vertical movements of body mass (stand long jump, sit-up, shuttle run) than their normal weight peers; conversely, obese children showed greater strength performance. Also, in the study conducted by Carvalho Dumith et al. (2010) on a sample of 519 students (from 7 to 15 years), males perform better than females in all tests (sit-and-reach, stand long jump, pull-up, medicine ball throw, 20m speed).

Higher values of body mass index, therefore, were associated with decreased levels of physical efficiency, regardless of age. The results of the study by Joshi et al. (2012) on a sample of 7230 students (aged between 5 and 17 years), confirm previous studies regarding motor performance and levels of physical activity in relation to BMI. In general, participants of normal weight have the highest *Health Fitness Zone* (HFZ) levels, followed by overweight and obese subjects.

Utesch et al. (2018) examined children's physical self-perception as a predictor of their future physical activity. The analysis revealed that children with high self-perception show greater future physical activity, and the effect is greater for underweight and overweight/obese children than for children of normal weight. Controlled instructional interventions on motor activity are associated with increased self-perception and self-confidence in children and adolescents. Compared to other contexts and environments, intervention at school and in the gym is strongly associated with an increase in self-perception (Liu, Wu & Ming, 2015). In fact, Fu et al. (2019) studied the relationships between physical activity, sedentary behavior, and motivation during a 12-week classroom active video game program, highlighting a significant negative trend regarding sedentary behavior, a significant increase in physical activity levels, number of steps and enjoyment.

A breakthrough is underway. Motor activities in primary schools, through different curricular organizational methods and aimed at implementation and development of educational interventions aimed at prevention of the main pathologies, are among the priority public health measures (Ainsworth & Macera, 2018).

To implement the purposes of motor activities, measures are urgently needed that proceed in the following directions:

a) training and higher university education of teachers;

b) implementation of an integrated territorial training system, aimed at implementing methodological synergies between various socio-educational partners;

c) dissemination of results of good teaching practices, aimed at civil society;

d) multi-year projects and in educational continuity (order of schools that precedes-follows).

An inescapable condition is evidence-based teaching at school and in other contexts. The results of programs and institutional actions, oriented towards health promotion, are visible only in the medium or long term and their evaluation is difficult and complex.

CONCLUSIONS

Therefore, PE assumes a central role, allowing both learning of motor alphabet (individual repertoire of motor skills), and the reciprocal relationships and the integration of main learning of other disciplines (for example mathematics, geography, English, history, science, etc.), generating and structuring strong links between the different curricular fields and generating continuity and significance between learning.

From the study carried out, methodological indications emerge which are necessary for quality of didactic intervention. The data show that overweight and obesity negatively influence motor learning process, the execution of executive variants of motor task, necessary for coordination and conditional development and have an impact on the perceived self-efficacy. Furthermore, they are limiting factors for success in activities that require horizontal and vertical movement of body; these tasks are often associated with the perception of fatigue which leads to the avoidance or renunciation of any motor activity. It is therefore necessary to adapt the activities to motor abilities of children with a high BMI, in the parameters of executive difficulty, duration and intensity, to help increase the quantitative and qualitative levels of PA, promoting success and motivation to continue.

It is necessary to intervene on two levels, didactic and organizational, different and complementary.

The proposal of motor tasks, modulating and adapting the executive variants (spatial, temporal, quantitative and qualitative and reciprocal relationships), is essential to allow overweight and obese children to participate in activities successfully. Furthermore, proposing motor activities through production styles (Mosston & Ashworth, 2008), in particular guided discovery and problem solving

and through reproduction styles, inclusion, practice and self-check, are crucial in order to adapt load parameters to needs of each child, promote self-perception (task performed successfully; Was I good? How can I do to improve?) and enjoyment (emotional impact; When do we play again?) through autonomous and mediated discovery by teacher, of executive variants of motor task. The variation of teaching styles and the modulation of duration, intensity and executive difficulty are essential to encourage the personalization of motor activity, personal success and the continuation of motor and sports experiences outside of school.

CONFLICTS OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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DEVELOPMENT OF A DEVICE FOR MIRROR THERAPY

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ABSTRACT. Previous research on the interconnections between brain activity and actions had led to the discovery of mirror neurons, neurons that have two particularly important roles: they mediate the imitation of movements based on visual information, and they underlie the understanding of actions. Mirror therapy is a relatively new, non-invasive therapy based on the use of visual feedback in recovery. Since 1996, it has been introduced in medical rehabilitation programmes, targeting conditions such as: hemiplegia after stroke, gait recovery after stroke, improvement of finger coordination in Parkinson's patients, reduction of phantom limb pain after amputations, and chronic pain from hand osteoarthritis, fibromyalgia, and complex regional pain syndrome. The device that is the subject of the present work presents a new constructive variant of the mirror box, which offers a much more efficient method of applying mirror therapy in various conditions, both at the level of the upper and lower limbs. The results of two assessments on the effectiveness of visual stimulation in recovery, carried out with the help of this device, first on the recovery of the hand functionality in subjects with hemiparesis after ischemic stroke and second assessment in the treatment of chronic pain of subjects with hand osteoarthritis will also be presented.

Keywords: *mirror therapy, visual feedback, neuroplasticity, kinesthetic memory, stroke, phantom limb pain*

REZUMAT. ***Dezvoltarea unui dispozitiv pentru terapia oglindă.*** Cercetările anterioare privind interconexiunile dintre activitatea cerebrală şi acţiuni au dus la descoperirea neuronilor oglindă, neuroni care au două roluri deosebit de importante: mediază imitarea mişcărilor pe baza informaţiilor vizuale şi stau la baza înţelegerii acţiunilor. Terapia prin oglindire este o terapie relative nouă,

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neinvazivă, bazată pe utilizarea feedback-ului vizual în recuperare. Din 1996, a fost introdusă în programele de reabilitare medicală, vizând afecţiuni precum: hemiplegia după un accident vascular cerebral, recuperarea mersului după un accident vascular cerebral, îmbunătăţirea coordonării degetelor la pacienţii cu Parkinson, reducerea durerii membrelor fantomă după amputaţii şi durerea cronică cauzată de osteoartrita mâinilor, fibromialgia şi sindromul durerii regionale complexe. Dispozitivul care face obiectul lucrării de faţă prezintă o nouă variantă constructivă a cutiei cu oglinzi, care oferă o metodă mult mai eficientă de aplicare a terapiei prin oglindire în diverse afecţiuni, atât la nivelul membrelor superioare, cât şi al celor inferioare. De asemenea, vor fi prezentate rezultatele a două evaluări privind deficienţa stimulării vizuale în recuperare, realizate cu ajutorul acestui dispozitiv, prima privind recuperarea funcţionalităţii mâinii la subiecţii cu hemipareză după un accident vascular cerebral ischemic şi a doua evaluare în tratamentul durerii cronice a subiecţilor cu osteoartrită a mâinii.

Cuvinte-cheie: *terapie prin oglindire, feedback vizual, neuroplasticitate, memorie kinestezică, accident vascular cerebral, durerea membrului fantomă*

INTRODUCTION

Stroke is a major problem affecting the health of the population worldwide. Although compared to cardiovascular diseases, the prevalence of stroke is much lower, the severity is given by the fact that patients who survive a stroke often present persistent symptoms such as: impairment of motor functions, pain, ataxia, sensory deficits, perception deficits, aphasia, depression, dementia or other deficiencies of cognitive functions, also representing the main etiological factor of the installation of disabilities (Neagoe,2013). Another condition that causes obstacles to rehabilitation is pain. Pain is not only a state of physical suffering, it also has a strong emotional component, causing a state of psychological suffering. A type of neuropathic pain is also "phantom limb pain", following amputations (Richardson & Kulkarni, 2017).

Mirror neurons - were discovered in the early 80s by a group of Italian researchers from the University of Parma, who identified a special type of nerve cells with a special role in direct, automatic and unconscious cognition. of the environment, in learning simple and complex motor acts, based on imitation, using visual information (Gazzola & Keysers, 2009). Thus, the mirror neuron system is involved both in the immediate repetition of actions performed by other people, and in learning behaviors through imitation, thus they are also responsible for understanding intentions. So, their defining characteristic is the close relationship between the motor information they encode and the visual information they

respond to, connecting brain areas responsible for sensory and motor processing (Rizzolatti et al., 2004, Rizzolatti, 2005, Schieber et al., 2009). An example would be "contagious yawning", the studies of Robert Provine (2005), concluded that this manifestation is a social behavior, ordered to brain level, where mirror neurons are also involved, or another example of this would be laughter (Haker et al., 2013, Provine, 1996). Other studies have linked these neurons to empathy in relating, understanding, with other people (Hausser, 2012). Neuroplasticity is the property of the brain to change through learning, it having a determining role in the process of functional recovery. Thus, stimulated neurons can create numerous synapses to increase the effectiveness of neural circuits or to transfer certain lost functions. However, this reparative process is not sufficient and cannot ensure the replacement of all lost neurons, respectively it cannot fully compensate for the recovery of lost neural functions (Bulboacă, 2003, Becker, 1953). In the process of learning or relearning deficient motor functions, repetitive movements are particularly important, which lead to the coordination of movements, their automaticity and the creation of motor engrams (Carpinella & Ferrarin, 2011). In the case of mirror therapy, these mirror neurons are activated by observing the mirror image, which replaces the image of the affected or amputated limb.

Neuroscientist Vilayanur Subramanian Ramachandran, a professor at the University of Cambridge, is considered to be the inventor of the mirror box and was also the first to introduce the visual feedback effect of the mirror in 1996 as a treatment method for reducing phantom limb pain in people who have suffered amputations (Guo et al., 2016). The aim of the therapy was to give the brain the illusion that the amputated limb exists, by placing a mirror in the sagittal plane, between the patient's limbs, using the hypothesis that the reduction of pain through mirror therapy would be due to the activation of mirror neurons in the brain hemisphere located on the contralateral side of the affected limb. Later, together with his colleague, professor Eric Lewin Altschuler, they implemented the method for hemiplegic patients as well. In this case, the goal was to improve motor control, deficient due to a stroke (Kim et al., 2016). The results of the studies, carried out in patients suffering from phantom limb pain, showed that mirror therapy reduced the intensity of pain, the number and duration of painful episodes (Lee et al., 2009, Sae et al., 2012, Sayegh et al., 2013, Yildirim et al., 2016). Mirror therapy favors the learning/relearning process due to the essential role that visual information plays in therapy, the credibility factor of the viewed image being also influenced by the quality and correctness of the image received by the visual receptor. In this regard, working protocols, Rothgangel and Braun (2013) propose that any item such as jewelry, watches, etc., be removed from the healthy limb, even certain scars or tattoos be covered with a skin-colored patch, as pictured visualized to be as real as possible, so that

the patient perceives that the affected limb is healthy. Mirror therapy has been present in numerous studies, its field of application knowing a continuous development. Some studies have demonstrated the effectiveness of mirror therapy in various pathologies, starting from motor deficits in the upper limbs in the case of hemiplegic patients after a stroke (Nistor et al., 2017), improving dexterity, movement speed, or the improvement of plantar dorsiflexion for gait recovery in patients with post-stroke sequelae (Guo et al., 2016, Hu et al., 2006), and studies in Parkinson's disease patients, which showed an improvement in finger movement in the affected hand and an increase in cortical excitability (Bonassi et al, 2016). Other research has aimed to study the effectiveness of mirror therapy in reducing other types of pain, such as pain in fibromyalgia, complex regional pain syndrome, diabetic neuropathy, pain of musculoskeletal origin (Castelnuovo et al., 2016).

To date, numerous device variants have been created for the application of this therapy. A first category of devices would be those in which the diseased limb, or amputation stump, is inserted to be masked in a box, and on the outer wall of the box is a mirror that reflects the image of the healthy limb. which the brain perceives, seeing it in the mirror, as the image of the affected limb. This type of device has the disadvantage that the person using it has to sit in an asymmetrical position with the neck flexed and rotated to look into the mirror on the outer wall of the box. This position is tiring, creates discomfort and cannot be maintained for a long time. In addition, in the patient with spastic paresis due to cerebral or spinal pathology (vascular accident, trauma, tumor) this position produces aggravation of spasticity and a greater limitation of mobility due to the tonic postural reflex of the neck (O"Dweyr, 1996, Pandyan, 2005). Thus, the positional discomfort of the user leads to a decrease in the time of use and together with the worsening of the spasticity decreases the efficiency of the use of the device. A second category are devices that have made an image acquisition of the healthy limb with the help of a photo or video camera, placed above it. The image of the healthy limb was then converted by specialized software into a mirror image on a monitor in front of the patient, under which the affected limb was placed in a box. This category of devices presents the disadvantage that the location of the camera being in the patient's visual field and the fact that the patient sees one of his limbs, leads to the loss of credibility of the image on the screen, reflecting the illusion that the affected limb is healthy.

OBJECTIVES

1. description of the innovative device
2. description of the effectiveness of mirror therapy with the innovative device in the case of people with hemiparesis and those with arthrosis of the hand

METHOD

The designed device (figure) has the following components: a box with two rooms (A) and (B), a video camera (1), a mirror (4) and a monitor/screen (6), under the monitor being placed a led strip, for lighting the space as needed so that the physiotherapist can see how the patient performs the movements and help him if needed. The room (A) is equipped with two rails on which two interchangeable walls (c) and (d) slide, inside the room (A), on wall c there is also a hole (g) for inserting the patient's sick limb. A mirror (4) is placed on the common wall with the room (B), and on the wall opposite the mirror (4) a 3D camera/webcam (1) is positioned, also tilted, and at the base of the room (A) is a plan inclined (a), on which the patient's healthy limb is positioned, the mirror (4), the inclined plane (a) and the 3D video camera (1) form an assembly that allows a personalized adjustment of the position and inclination of the healthy limb. Thus, the image taken from the 3D camera/webcam (1) from the mirror being clear and realistic, The image is transmitted in real time to the monitor/screen, placed outside the box, on the upper part of the room (B) and can also be viewed with the help of 3D glasses. (Ver & Ungur, 2021) (figure 1)

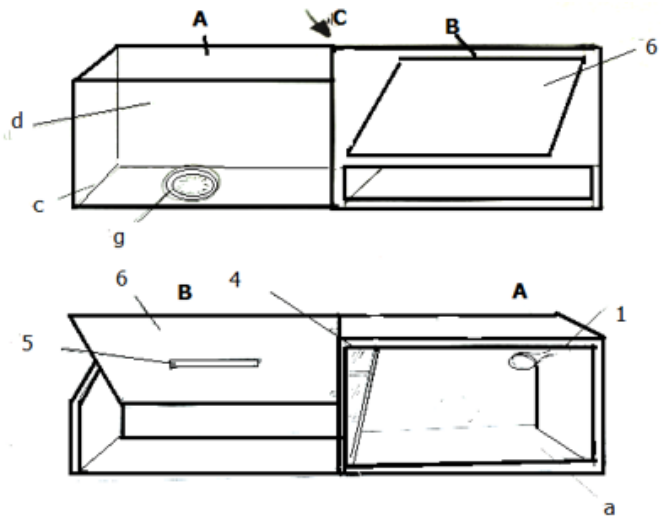

Figure 1. Device components

Also, the constructive solution of the device allows the therapist to observe and, if necessary, help the patient in making movements with the affected hand. (figure 2)

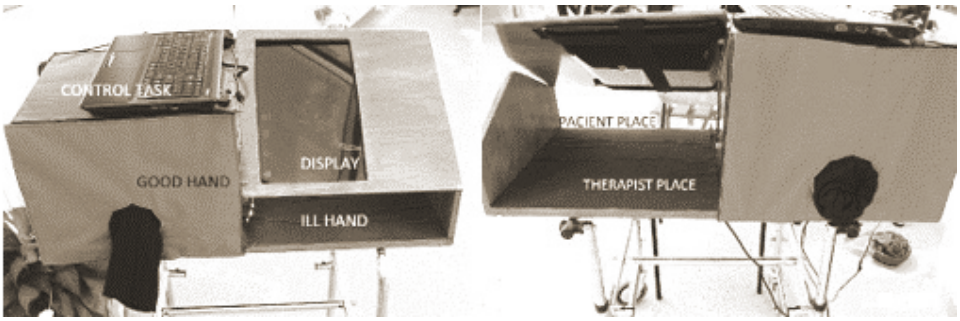

Figure 2. Therapist-patient relationship mode

By using 3D glasses, the patient can focus only on the image, not being distracted by what is happening around him (external visual stimuli) and thus being able to concentrate better on the therapy. Also, the vicious position of the patient has been eliminated, he no longer has to lean and look sideways at the mirror – as in classic models but looks at the screen/tablet or can use a VR system to view the rendered image.

Figure 3. Viewing mode of the image

In order to capture the image in the mirror as faithfully as possible, so that the visualized image is almost impossible to differentiate from the natural image, the inclined positioning of the mirror was realized, as well as an inclined plane for the positioning of the healthy limb. At the same time, the device can be used both for the treatment of the upper limb and the lower limb, with the possibility of positioning the device on the right or left side of the patient.

Two cases were studied in which mirror therapy was applied with the help of the designed device, one regarding the recovery of the paretic hand after stroke and the other regarding the reduction of pain in osteoarthritis of the hand.

In the first assessment - a group of 7 people, 5 women and 2 men aged between 50 and 75 years, who share the diagnosis of sechelal hemiparesis after ischemic stroke, was studied.

The hemiparetic subjects met the following characteristics: cooperative behavior, diagnosis of sechelal hemiparesis after ischemic stroke, cognitive skills: be able to focus for at least ten minutes on the reflection in the mirror and follow the instructions given by the therapist, sufficient trunk control to be able to sit unsupervised in a wheelchair or regular chair throughout treatment, stable cardiorespiratory functions. The hemiparetic subjects were informed about how to apply the therapy, and the exercises were explained to them, as well as the fact that they will always be practiced below the pain threshold. The training of the skill to practice individually was also pursued. Once hemiparetic subjects understood the exercises and were able to perform mirror therapy without the guidance of a therapist, self-directed treatment was initiated. In the first sessions it started with simple exercises, such as: flexion and extension movements of the fingers and wrist, then, gradually the range and complexity of the movements increased, realizing various types of prehensions. Testing of subjects was done at the beginning and end of the exercises period, according to the test procedure, the way of assessment and scoring of G-scores for simple hand movements and H-scores for complex hand movements of the Motor Assessment Scale for Stroke CARR. **The second assessment** was carried out on a group of 10 female with hand osteoarthritis, aged between 45 and 75 years, to whom mirror therapy was applied to reduce hands chronic pain. Both before and at the end of the exercises period, the subjects with hand osteoarthritis were tested, with the following scores: VAS for pain assessment, Stanford HAQ for autonomy assessment and Jebsen-Taylor for hand function assessment. The subjects with hand osteoarthritis met the following characteristics: cooperative behavior, with cognitive and control skills, common diagnosis of arthrosis of the hand. The exercises protocol was identical to that of the first batch, aimed at familiarizing the subjects with hand osteoarthritis with this therapy, training the ability to work independently, and progressively increasing the difficulty of the exercises.

In both assessments, the tests were done on both hands, at the beginning and at the end of the test period.

RESULTS

The assessment of hemiparetic subjects is indicated in figure 4 and the evolution performed by an hemiparetic subjects, at the beginning and at the end of the exercises program in figure 5.

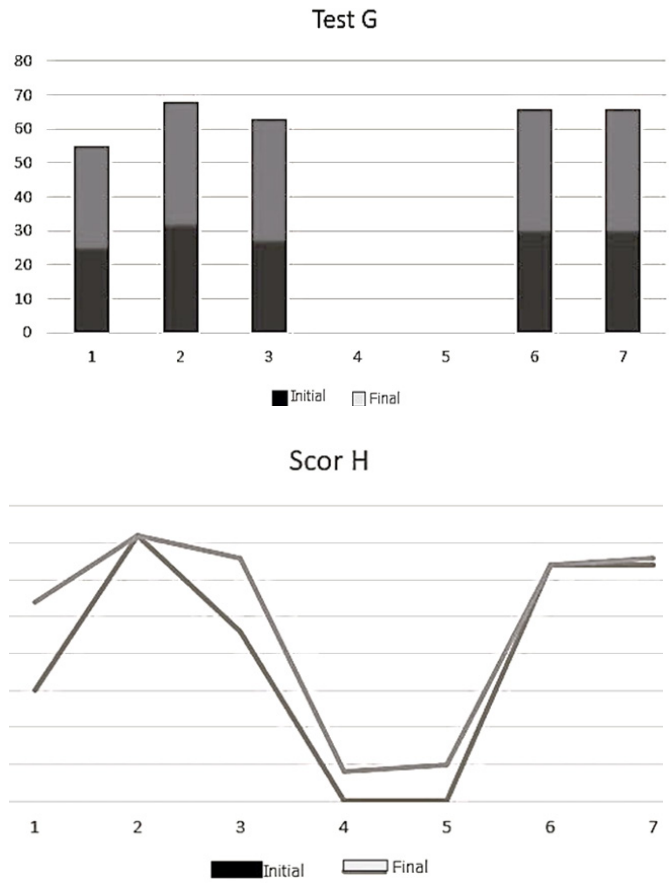

Figure 4. Graphs of initial and final G and H motor assessment scores

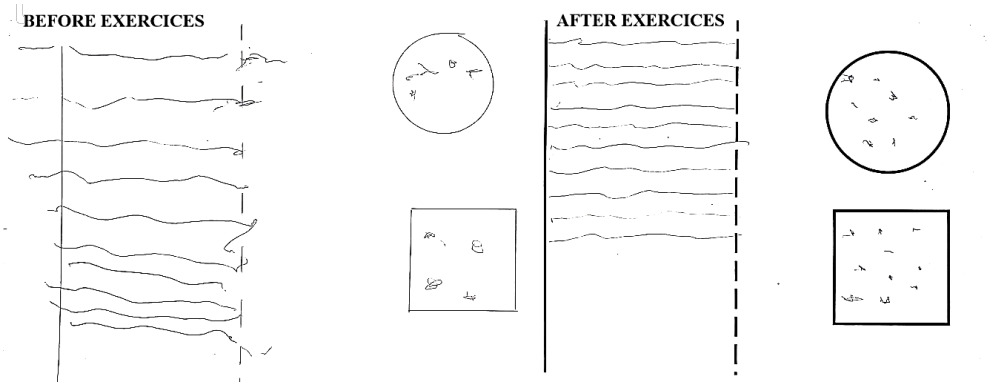

Figure 5. Graphical test example

From the observations collected from hemiparetic subjects regarding the effectiveness of the therapy, the following aspects were noted: - the tremor has reduced, movement coordination has been improved, the prehension has improved, opposability was achieved faster and more precisely, they noticed a reduction in pain and they felt a slight elasticity of the hand, they found a better concentration in doing the exercises and an increase in motivation, none of the patients noted negative effects.

The assessment of subjects with hand osteoarthritis, present the followings results (figure 6):

- t**he VAS test (visual analogue scale – pain test)** revealed a reduction of joint pain (figure 6a);

- the HAQ index (disability index), indicated a significant improvement in autonomy (figure 6b);

- **the Jebsen-Taylor score (hand functionality score)** showed an improvement in hand functionality (figure 6c).

Regarding the feedback of the subjects with hand osteoarthritis regarding the efficiency of the therapy, the following were reported:

- a significant reduction in pain
- feeling of relaxation and elasticity of the hand and fingers- improving coordination and safety
- increasing confidence and motivation for recovery
- no subjects with hand osteoarthritis noticed the induction of pain as a result of the therapy or any other unpleasant sensation

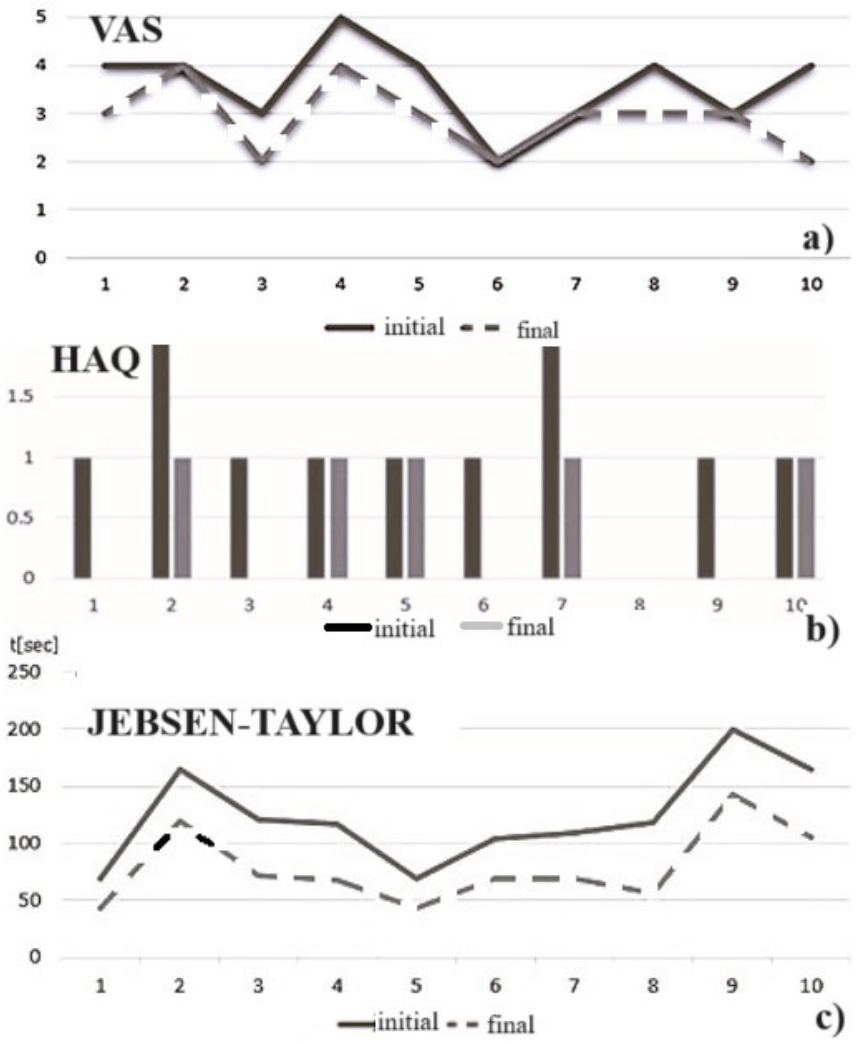

Figure 6. a) – VAS score; b) – HAQ score; c) Jebsen-Taylor index

DISCUSSIONS

When they found out what the exercises consisted of, most subjects were reluctant. However, from the very first session, they were surprised by the credibility of the visualized image, which gave them the "false" feeling that they

could indeed mobilize their affected limb and they looked under the screen to see their affected limb, even though they had been repeatedly warned not to do so. However, they said that the image was so real that they wanted to check whether the affected limb was indeed performing the movements they had visualized. At the end of the exercise period, patients noticed improvements in both functionality and pain reduction. Our device provided good results in terms of functional hand recovery for hemiparetic subjects and in terms of pain relief for subjects with osteoarthritis.

The features proposed by the designed device are:

- to create a credible image visualized in real time, the basis of treatment being visual feedback

- ensure patient comfort and reduce the effects of spasticity due to incorrect posture

- to offer the possibility to perform the treatment also at home - where there is peace and quiet in the home environment, without being disturbed by external disturbing factors

- by the constructive solution to offer the possibility of its acquisition by the widest possible category of patients: in the case of post-stroke recovery and other neurological conditions, for the treatment of pain from various conditions, including phantom limb pain after amputations, prevention of complex regional hand pain (post-stroke, post-surgical, post-traumatic), etc. Thus, reducing pain may implicitly lead to a decrease in medication consumption.

Our observations suggest that the new device deserves to be tested in clinical trials for its efficacy in the recovery of functional deficits caused by stroke and in the treatment of chronic pain.

CONCLUSIONS

Mirror therapy is a therapy based on the effect of visual feedback in neuromotor recovery by activating neuroplasticity phenomenon. Also, thanks to the visual feedback, which is in real time, the patient's motivation is stimulated and his active involvement contributes to increase the efficiency of the recovery process, thus reducing the recovery time. Repetitive exercises also play an important role in the application of therapy, with the help of which the kinaesthetic memory of movements is maintained.

Many studies in recent years have confirmed the effectiveness of using mirror therapy in rehabilitation exercises, for example the paper by Hyunjoong, Eunsang, Jihye, and Seungwon (2023) on the use of mirror visual feedback in the recovery of upper limb function in post-stroke patients, Mohammed Ismael

Elsepaee's (2016) paper on the use of visual feedback in the recovery of hand functions in children with hemiparesis, or Mei-Hong, Ming, Ming, Mei-Fang, Xu-Dong, Fang, Ye-Ping, and Ya-Ping's (2020) paper based on the mirror neuron theory of post-stroke upper limb recovery.

Through the evaluations presented in this paper, we have confirmed the effectiveness of using mirror therapy in rehabilitation exercises using the designed device. It has enabled the effectiveness of this therapy by: Avoiding the subject's vicious position (of looking at the mirror from the side) and keeping him in a correct and comfortable position, and by using 3D glasses he can better focus on the exercises without being affected by external visual disturbing factors, it can be used both in hospital and at home, where, being in a home environment, can concentrate better on the exercises and perform them for longer, which helps to reduce pain and thus recovery time, can be used for a variety of pathologies and stages of damage, and can be made in a variety of versions so that it can be purchased by a wide range of patients.

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THE INFLUENCE OF PHYSICAL EXERCISES CARRIED OUT IN THE AQUATIC ENVIRONMENT ON PHYSIOLOGICAL PARAMETERS FOR 10 – 12 YEAR TENNIS PLAYERS

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ABSTRACT. The objective of this study is to highlight the effect of physical exercises specific to the game of tennis, carried out in the aquatic environment to optimize the effort capacity of the players practicing this sport on the physiological parameters of the players in this sport. The impact of such an intervention program in the aquatic environment is a multilateral one, having benefits on optimizing performance capacity, maintaining an optimal state of health and opening new horizons for children practicing the game of tennis. A novelty element of this experimental research is represented by the implementation in the training program of tennis players in the aquatic environment and exercises from other sports branches such as swimming, gymnastics and athletics. The intervention program is a bold attempt to weave and combine exercises from different sports, in a non-specific and totally different environment, in order to improve performances and results, looking at the perspective, without necessarily aiming at great current performances, in the short term, which could bring disappointments, create certain barriers or even lead to the abandonment of sports activities.

Keywords: *tennis, performance, aerobic capabilities, unconventional training*

REZUMAT. ***Influența exercițiilor fizice effectuate în mediul acvatic asupra parametrilor fiziologici la jucătorii de tenis de 10 -12 ani*.** Această lucrare își propune să evidențieze efectul exercițiilor fizice specifice jocului de tenis, desfășurate în mediul acvatic asupra parametrilor fiziologici ai jucătorilor din acest sport. Tenisul modern se caracterizează prin restructurarea conținutului

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pregătirii, în contextul amplificării spectacolului sportiv. Azi, tenisul presupune un fond specific de aptitudini ale jucătorilor, care include în primul rând o pregătire polivalentă, manifestarea unei mari libertăţi de creaţie, de inventivitate tactică, ce nu poate fi exprimată decât de indivizii care au atins un înalt nivel de măiestrie tehnică, fizică si psihologică. Sportivii de tenis de performanţă au nevoie de un amestec de abilităţi anaerobe, cum ar fi viteza, agilitatea şi puterea, combinate cu capacităţi aerobe mari. (Kovacs et al., 2007). Frecvenţa cardiacă este un aspect esenţial pentru un antrenor, deoarece oferă informaţii despre intensitatea efortului fizic în raport cu capacităţile fiecărui individ (Cumming, 2017). Însemnătatea pregătirii fizice este unanim recunoscută, deoarece constituie suportul activităţii jucătorilor care astfel îşi pot valorifica posibilităţile tehnico-tactice si psihologice. În aceste condiţii, necesitatea aplicării unor mijloace şi metode de pregătire inedite, "neconvenţionale" adecvate influenţării pozitive a capacităţii de performanţă, reprezintă din punctul nostru de vedere o preocupare esenţială a specialistului din domeniul motricităţii. În timpul alergării prin apă, consumul de oxigen este de 3 ori mai mare, la o viteză de 50m/min, această valoare se poate obţine la o viteză considerabil mai mică decât la o alergare pe uscat (Brinks et al., 2009).

Cuvinte cheie: *tenis, performanţă, capacităţi aerobe, antrenament neconvenţional*

INTRODUCTION

Tennis is the sport in which elegance, dynamism and emotional many states combine harmoniously, contributing considerably to the development and maturation of man on a sporting and social level. It is considered one of the most complex sports and at the same time the most demanding. It requires balance control, eye-brain-limb coordination, quickness, speed of thought, speed of reaction and movement, endurance, and a strange combination of caution and abandon that we name courage.

The theoretical-practical knowledge related to the game of tennis demonstrates the fact that this sport has evolved significantly in terms of the effort it involves and therefore I consider it imperative to improve and develop the effort capacity, the physiological parameters as well as the motor qualities, speed in all its forms of manifestation, strength and resistance.

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During running through water, oxygen consumption is 3 times higher at a speed of 50m/min, this value can be achieved at a considerably lower speed than running on land (Brinks et al., 2009).

Competitive tennis athletes need a mixture of anaerobic skills, such as speed, agility and power, combined with high aerobic capabilities (Kovacs et al., 2007).

Heart rate is an essential aspect for a trainer, as it provides information about the intensity of physical effort in relation to the capabilities of each individual (Cumming, 2017).

The judicious intercession of conventional means with the "unconventional" adapted (in which practical executions are doubled by the permanent cerebral demand, where the intervention of some new stimuli requires the ability of attention forcing the player to overachiever thus inducing adaptations of performance capacity) must be an essential requirement of current preparation and an essential concern of the specialist in the motor field.

From a biological point of view, physical and especially sports effort is an appropriate biological (exciting) stimulus that forces the body to respond through electrical, mechanical, thermal manifestations (Monea, 2010).

In the specialized literature, there are scientific articles that demonstrate the fact that an aquatic gymnastics program that includes aerobic exercises, running, specific jumps and different distances covered by swimming procedures, significantly improves blood oxygen intake, heart rate and muscle strength, so these programs are also recommended for people who want to get in the best possible physical condition (Villacis, 2017; Ivanova, 2019; Pieniązek et al., 2021).

MATERIAL AND METHODS

Purpose of research

Monitoring training programs in the aquatic environment in order to identify the most relevant aspects that can contribute to the optimization of effort capacity and their subsequent implementation in long-term planning in the tennis game.

The selection of some means and the development of an unconventional methodical line (carried out in the aquatic environment) dedicated to optimizing the physiological profile, respectively increasing the effort capacity imposed by current tennis.

The comparative analysis of the recorded values, their interpretation and the statement of conclusions that reveal the efficiency (inefficiency) of the integration of the previously mentioned means in the sports training of children and juniors in the game of tennis.

Hypotheses of the research

The starting point in the proposed practical-methodical approach has as its starting point the following remark: if the situations in which the athlete is transposed in the preparation process are diversified and the executions have an appropriate dosage (volume, intensity, complexity) the motor accumulations obtained through the specific exercise can be effectively transferred to current court tennis (positive transfer).

Considering that the optimization of sports training in current field tennis is conditioned by the level of effort capacity, we will organize (carry out) an experimental study that will confirm/invalidate the hypothesis according to which the integration in training of tennis-specific motor structures adapted (held) in the aquatic environment will had the effect of optimizing the effort capacity of 10-12 year old tennis players and will induce increases in physiological parameters as expected.

Procedures and methods of research

Bibliographic Bibliographic study, organizing-conducting the experimental study, graphical analysis, statistical relevance (arithmetic mean, median, standard deviation, coefficient of variation, amplitude);

Procedure

This research used the Cosmed K5 spirometer, wich is a portable device used to assess lung function during exercise. This is a useful method to assess lung capacity, tidal volume and airflow under exercise to assess respiratory function and fitness in athletes. This spirometer provides data such as tidal volume, vital capacity, maximum expiratory flow rate, inspired and expired oxygen and many other parameters that can be used to monitor and optimize training. The K5 also allows the evaluation of a number of cardiovascular parameters such as heart rate, blood pressure and oxygen saturation, thus enabling the overall assessment of sports and fitness performance. The device was used to monitor vital capacity.

Applied test

The VAMEVAL test being the means of evaluation for this physiological parameter.

The field test consists in two chalenges of a progressive run between two lines drawn at a distance of 20 meters from each other. The pace of the run is dictated by a CD-player that emits audible beeps, the player must cover the distance between the two lines in the interval between the beeps. The player will aim to move at a running speed so that they reach the line and turn at the beep.

Participants and experiment development

The subjects of the experiment in number 20 organized in the two conventional experimental groups (experimental and control) are engaged in performance activity with numerous participations in field tennis competitions.

While the control group performed a standard training programme according to the conventional training plan, the experimental group took part in adapted training stages (where the actuators are adapted to the aquatic environment), traineeships inserted in conventional annual plan. The means and methods applied under the adapted, unconventional program refer synthetically to: displacement in water, water games (volleyball, polo, badminton, exercises imitative forehand and backhand strokes using mis stringless racquets). All these means and methods are carried out in swimming pools, where athletes have evolved into water with increased progressive depth (knee level, coxofemurale joints, elbow, scapular-humerale joints).

The introduction in the training program of swimming exercises (free style) over a distance of 100-125m can have a significant contribution to the improvement of physiological parameters of junior tennis players.

The short-term cold water program increases the output of striated muscles, so fatigue sets in later (Knechtle et al., 2020). Increases cardiopulmonary endurance - swimming trains and strengthens the cardiovascular system, increasing the ability of the heart and lungs to deliver oxygen to the muscles and remove carbon dioxide (Muniz-Pardos et al., 2022). The tennis players of the experimental group who took part in the research carried out physical exercises in the aquatic environment with an average of 7.5 hours during one month. Thanks to a systematic physical effort, dosed and adapted to the particularities and needs of each individual, the nervous system, which coordinates the entire activity, undergoes a series of positive changes (Görner, 2020; Turdaliyevich & Pulatovna, 2020; Yapici-Öksüzoğlu, 2020).

The introduction in the training program of swimming exercises (free style) over a distance of 100-125m can have a significant contribution to the improvement of physiological parameters of junior tennis players.

Table 1.
Initial evaluation
Systolic and diastolic blood pressure and vital capacity
Experimental Group

No.	Name	Systolic and diastolic blood pressure	Vital capacity
1	M.C	115-70	3348.5
2	F.I.	120-70	3480
3	A.M.	120-75	3650
4	F.S.	110-65	3285.5
5	S.C.	100-60	3860
6	F.A.	115-75	3530
7	S.D.	115-75	3115.5
8	P.M.	100-55	3360
9	P.A.	100-75	3575
10	S.A.	115-70	3060.5

Table 2.
Initial evaluation
Systolic and diastolic blood pressure and vital capacity
Control Group

No.	Name	Systolic and diastolic blood pressure	Vital capacity
1	S.R.	120-70	2755
2	O.K.	110-65	3435
3	L.C.	120-70	3320.5
4	H.E.	125-75	3800
5	R.G.	100-55	3000
6	M.S.	125-80	3220
7	T.D.	110-60	3475.5
8	M.R.	105-65	2985.5
9	N.S.	105-60	3100
10	R.A.	120-70	3635

Table 3.
Final evaluation
Systolic and diastolic blood pressure and vital capacity
Experimental Group

No.	Name	Systolic and diastolic blood pressure	Vital capacity
1	M.C	120-70	3590.5
2	F.I.	125-75	3710
3	A.M.	125-80	3840.5
4	F.S.	115-70	3500
5	S.C.	110-70	4025.5
6	F.A.	120-75	3795
7	S.D.	120-70	3325
8	P.M.	110-70	3545.5
9	P.A.	115-80	3690.5
10	S.A.	120-80	3220

Table 4.
Final evaluation
Systolic and diastolic blood pressure and vital capacity
Control Group

No.	Name	Systolic and diastolic blood pressure	Vital capacity
1	S.R.	120-70	2865
2	O.K.	115-70	3530
3	L.C.	125-75	3420.5
4	H.E.	130-75	3870.5
5	R.G.	110-65	3115
6	M.S.	130-85	3295
7	T.D.	115-60	3580
8	M.R.	105-70	3100.5
9	N.S.	110-65	3195.5
10	R.A.	120-70	3755

RESULTS AND DISCUSSIONS

In the experiment aimed at optimizing the physiological parameters, the results with reference to the systolic pressure indicate a statistically insignificant difference, therefore the hypothesis is rejected.

In the experiment aimed at optimizing the physiological parameters, the results with reference to the diastolic pressure indicate a statistically insignificant difference, therefore the hypothesis is rejected.

In the experiment aimed at optimizing the physiological parameters, the results with reference to the vital capacity indicate a statistically insignificant difference, therefore the hypothesis is rejected.

Regarding the hypothesis according to which the integration into the sports training of some motor structures specific to tennis carried out in the aquatic environment can have a positive effect on the effort capacity of 10-11-year-old tennis players and can induce increases in physiological parameters, the results of the experiments from hypothesis perspective are still uncertain and requires more research on this. However, preliminary data show that water training may be beneficial for developing exercise capacity and improving performance in tennis athletes.

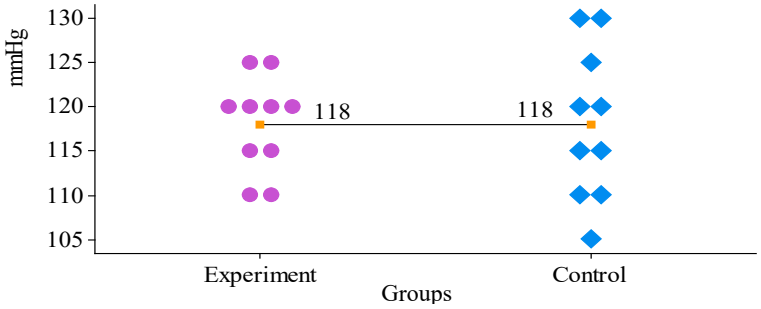
Table 5. *Systolic Blood pressure Test/Statistics*

Statistical indicators	Experiment	Control	Statistical indicators	Experiment-Control	
Average	118	118	Average difference		0.00
Median	120.0	117.5	Average difference (%)		0.00%
Std. deviation	5.37	8.56	The non-parametric test Mann-Whitney	Z	p
Minimum	110	105		-0.077	0.938
Maximum	125	130	Effect size		0.02
Amplitude	15	25			
Coef. variability	4.6%	7.3%			

The mean systolic blood pressure has a value of 118 mmHg in both the experiment and the control. In the case of both groups the dispersion of the results is homogeneous. The size of the effect is very small, almost non-existent. The Mann-Whitney test indicates a statistically significant difference between the two groups, the significance threshold $P = 0.938 > 0.05$, for $Z = -0077$.

Synthesis

Mean difference	Effect size	The difference between the groups is	Null hypothesis
0.00(0%)	Very low	statistically insignificant	Is accepted



Graph 1. *Diastolic blood pressure/ average representation*

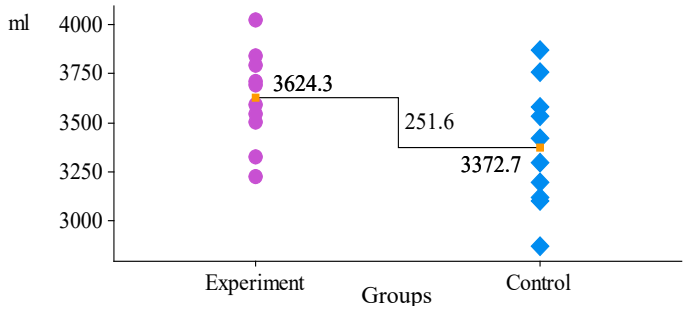
Table 6. *Diastolic Blood pressure Test/Statistics*

Statistical indicators	**Experiment**	**Control**	**Statistical indicators**	**Experiment-Control**	
Average	74.0	70.5	Average difference		3.5
Median	72.5	70.0	Average difference (%)		4.73%
Std. deviation.	4.59	6.85	The non-parametric test Mann-Whitney	Z	p
Minimum	70	60		--1.435	0.151
Maximum	80	85	Effect size		0.32
Amplitude	10	25			
Coef. variability	6.2%	9.7%			

The diastolic blood pressure is higher in the experiment Group on average with 3.5 mmHg (4.73%). The results are homogeneously dispersed for both groups. The size of the effect is medium. The results of the Mann-Whitney test indicate a statistically significant difference between the two groups, the significance threshold P = 0.151 > 0.05, for Z =-1,435.

Synthesis

Mean difference	Effect size	The difference between the groups is	Null hypothesis
3.5 (4.73%)	medium	statistically significant	Is accepted



Graph 2. *Diastolic blood pressure/ average representation*

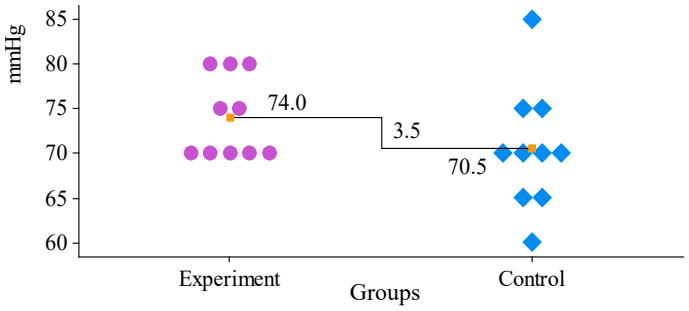
Table 7. *Vital Capacity Test/Statistics*

Statistical indicators	Experiment	Control	Statistical indicators	Experiment-Control	
Average	3624.3	3372.7	Average difference		251.6
Median	3640.50	3357.75	Average difference (%)		6.94%
Std. deviation.	241.39	316.17	The non-parametric test Mann-Whitney	Z	p
Minimum	3220	2865		-1.814	0.070
Maximum	4026	3871	Effect size		0.41
Amplitude	806	1006			
Coef. variability	6.7%	9.4%			

The average value for vital capacity is higher in the experiment Group with 251.6 ml (6.94%). The results are homogeneously dispersed for both groups. The size of the effect is medium to sea. The results obtained by the athletes of the two groups are not significantly different, according to the Mann-Whitney test. Significance threshold P = 0.070 > 0.05, for Z = - 1.814.

Synthesis

Mean difference	Effect size	The difference between the groups is	Null hypothesis
251.6 (6.94%)	Medium to high	statistically insignificant	Is accepted



Graph 3. *Vital capacity/ average representation*

DISCUSSIONS

Regarding the physiological parameters Igarashi & Nogami (2018) after conducting a study stated that exercise on land, aquatic exercise should have a beneficial effect by lowering blood pressure. In addition, aquatic exercise should lower the blood pressure of subjects with hypertension, and other forms of aquatic exercise besides swimming should also lower blood pressure.

According to a study carried out by Shei (2018), by practicing physical exercises and swimming in the aquatic environment, the functional capacity of the respiratory system (total lung capacity, expiratory reserve volume and inspiratory reserve volume) improves, as well as that of maximal oxygen absorption and consumption during exertion (Shei, 2018).

Another study conducted by Yardley et al. attests to the fact that physical exercise in the aquatic environment contributes to maintaining stable blood pressure – by improving circulation and cardiovascular health (Yardley et al., 2012).

Following an experiment carried out in the aquatic environment, Mooventhan & Nivethitha (2014) concluded that Aerobic exercise is specific to these physical activities, programmed systematically, continuously and gradually, with intensity and volume adapted to the objectives pursued, significantly improves cardiovascular resistance.

Kwok et al. (2022) concluded that running in the aquatic environment and variation in water temperature have a positive influence on maximal oxygen volume and physiological parameters but at the same time recommend in-depth studies on this aspect.

CONCLUSIONS

The body's ability to adapt to effort is improved due to the versatility of the exercises applied in difficult conditions.

The hypothesis according to which the integration in the sports training of certain motor structures specific to tennis carried out in the aquatic environment can have a positive effect on the effort capacity the results of the experiments are still uncertain.

The coordinative and physical capacities of the aquatic environment (repetitions characterized by superior concentration parameters – request of Nas and skeletal muscle) produce positive accumulations on the tenismanilor's capacity of effort.

It is observed an improvement in the practical way of addressing unpredictable situations in training and in competition;

Even the progress of the experimental group was noticable higher than the control group, the obtained **results do not validate the research hypothesis**. Nevertheless we recomand the implementation of such program wich has beneficial effects that are found in the performances of 10-12-year-olds.

The small number of subjects negatively influences the research results.

The first limitation of our study derives from the small sample of participants.

This aspect is related to the difficulties in identifying children who will accept belonging to an experiment involving physical exercise in a non-specific environment, as well as their willingness to engage in intervention programs, despite the fact that they can produce positive changes on sports training.

We recommend the use of these programs and in early stages as the engine profile of children involved in the sports performance of the formation during this period, and the uniquely diversified, adapted means (which manage to capture the interest) must be integrated into the conventional sports training programme.

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THE EFFICIENCY OF ROMANIAN PLAYERS, COMPARED BETWEEN THE TWO NATIONAL COMPETITIONS: ROMANIAN CUP AND NATIONAL LEAGUE, DURING THE 2021-2022 SEASON

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ABSTRACT. Premises: Completing this kind of research is making it easier to gather, process and analyse these types of data to create a database that would house all the information related to the players' behaviour and tendencies and help coaches take objective decisions in real time during games. **Subject of research:** All data and analysis were completed based on three Romanian players, part of the U-BT Cluj-Napoca basketball team, during the 2021-2022 season, and their performance in both the Romanian Cup and the National League competitions. **Method:** The research was completed based on main and relevant reference points from the already published literature. Data collection was done through examination and recording of key parameters specific to the game of basketball. The subsequent analysis of data was completed utilizing statistical and mathematical methods. **Hypothesis:** Documenting and understanding the various tendencies within their play for the members within the team are critical for a coach to be able to make robust decisions. Comparing and studying the player's performances and results in competition games allows for a better, realistic appreciation of each player's contribution and role within the team, which in turn makes the coach's decisions optimal. **Results:** The statistics for the young Romanian players (U23) – shooting percentages, offensive and defensive rebounds, interceptions, blocks, assists, turnovers, points scored are presented and analysed. Based on that, a comparative model was completed regarding the performance of the Romanian players in the respective two national competitions: Romanian Cup and National League, that have different

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rules related to number and presence of Romanian players in the game, throughout the game. In the Romanian Cup, the rule says that each team must play with two (2) Romanian players on the field for the entire game, of which at least one is under 23 years old, compared to the National League where the rule says that each team should play with at least one (1) Romanian player on the field the entire game, and additionally the player should be under 23 years old during the 1st and 2nd quarter and the 2nd quarter. **Conclusion:** Observing, recording, processing, and analysing data/statistics of the game provides the coach with objective data which he can use to better know the players, the overall evolution of the team and thus make more correct decisions during games. The comparative analysis of the data shows that, in the Romanian Cup, the players have a better game performance, due to the more playing time compared to the National League, where the playing time is reduced by half. By adopting the rules used in the Romanian Cup, the efficiency of young players increases, thus contributing to raising the value of the team and implicitly to increasing the value of native players for representative teams.

Keywords*: basketball, players, men, Cluj-Napoca, Romanian Cup, National League*.

REZUMAT. ***Eficacitatea jucătorilor români în cele două competiții naționale Cupa României și Liga Națională, în anul competițional 2021-2022.*** **Premise.** Prin realizarea unei astfel de lucrări se contribuie la crearea unei baze de date. Concomitent, prin strângerea, prelucrarea, studierea și fructificarea acestor date se ajunge la o mai bună cunoaștere a jucătorilor, la ajutorul dat antrenorului pentru luarea unor decizii pe baze obiective, în timp real. **Subiecți.** Cercetarea s-a realizat pe trei jucători autohtoni, componenți ai echipei de baschet UBT Cluj-Napoca, care au făcut parte din lotul echipei în anul competițional 2021/2022, atât în Cupa României cât și în Liga Națională. **Metode.** Pentru a comunica tema analizată s-a folosit studiul literaturii de specialitate. Adunarea datelor s-a obținut prin examinarea și înregistrarea principalilor parametrii specifici jocului de baschet. Prelucrarea datelor s-a realizat folosind metoda statistico-matematică. **Ipoteze.** Documentarea și înțelegerea diverselor ipostaze privind deprinderile în joc al jucătorilor echipei prezintă premise pentru ca antrenorul să-și dirijeze munca pe principii reale. Prin compararea performanțelor obținute de jucători în competiție se poate vedea o mai bună apreciere și ierarhizare a contribuției, a rolului pe care îl au aceștia în cadrul echipei, care să direcționeze la luarea unor decizii optime. **Rezultate.** Sunt arătate și examinate cei mai importanți parametrii realizați de către jucătorii români tineri(U23) – aruncările la coș, recuperările ofensive, recuperările defensive, intercepțiile, capacele - blocările mingilor aruncate la coș, pasele decisive, mingile pierdute, punctele marcate. La sfârșit, s-a obținut un model comparativ urmărind comportamentul jucătorilor români în cele două competiții, Cupa României și Liga Națională. În Cupa României, regula jucătorilor români pe teren este ca fiecare echipă să joace cu doi jucători români pe teren, tot meciul, dintre care cel puțin unul să fie sub 23 de ani, în comparație cu Liga Națională unde regula jucătorilor români pe teren este ca

fiecare echipă să joace cu cel puțin un jucător român pe teren tot jocul, dar în sfertul 1 și sfertul 2, acesta să fie sub 23 ani. **Concluzii.** Observarea, înregistrarea, prelucrarea și analiza datelor urmăresc o serie de caracteristici ai jocului care sunt prezentate antrenorului, date reale pe baza cărora acesta poate să aprecieze mai bine jucătorii, desfășurarea de ansamblu a echipei și astfel să ia decizii mai exacte. Din studierea comparativă a datelor rezultă că, în Cupa României, jucătorii au deprinderi în joc mai eficiente, datorită timpului de joc mai mare față de Liga Națională, unde timpul de joc este redus la jumătate. Adoptând regulamentul folosit în Cupa României, eficacitatea jucătorilor tineri crește, astfel contribuind la ridicarea valorii echipei și implicit la creșterea valorii jucătorilor autohtoni pentru echipele reprezentative.

Cuvinte-cheie: *baschet, jucători, masculin, Cluj-Napoca, Cupa României, Liga Națională.*

INTRODUCTION

As indicated by (Colibaba-Evuleț and Bota, 1997), any two teams playing the game of basketball have players with exceptional somatic and genetic features whose physical capabilities are trained to alternate between submaximal intensity and short bursts of maximal effort (Baroga, 1994) to be as successful as they can be while playing offence/defense against their opponents (Teodorescu, 1975). Considering all the aspects of the basketball game in general, one of the most important ones is related to the shooting of the ball, which requires spatio-temporal representation, a special kinesthetic skill, high precision, and efficiency – all of these achieved and targeted trained over the course of time (Ionescu and Dîrjan, 1997).

Taking all these factors into consideration, in order to achieve a high-performance level later in their career, young basketball players need to train hard for at least ten to twelve years. Therefore, the selection process and the initial physical preparation needs to start very early, around seven to nine-years old as the optimal age for peak performance would be around twenty-five to twenty-seven years old (Răduț and Răduț, 1989). The training to reach this peak level is a very complex and long-term process, that needs to be systematic and have a gradually increased load, based on principles anchored in educational, biology and psychology methods for a multidisciplinary approach, the result of which will be an athlete that is adaptable to required high level of efforts and continue to better themselves by participating in competitions (Dragnea and Mate, 2002).

For a basketball coach, similar with other sports, the planning and execution of the training and participation in competitions require the systematic action of several objective and subjective factors, such as the methodology and technology used, the environment and human resources at its disposal and the coordination and management of any activities (Florescu, 1985).

Currently, any coach would need to have the support and expertise of specialists from different areas: training theory and methodology, medicine, psychology, sociology, computer science etc., contributing to the right technical and non-technical environment for them to be able to reach the high-performance required by today's competitions level (Epuran, 2005).

The supporting cast's research and guidance is contributing to the player's health, the more efficient training protocols and the right level of effort in training (Nicu, 1993).

There are many studies and research papers focusing on the different aspects of the basketball game. Depending on the required outcome, some of the research has been focused on the teaching approach for learning and perfecting basketball skills some are looking at teachers' specialization in the higher learning environment for sport and physical education, some are covering the theory and methodology of physical training, the progressive training or how to adapt and optimize the coaching activities using research studies' results.

Alongside these general approaches, other studies looked at more specific topics, such as: a mathematical and physical approach to the game of basketball, the biomechanics of technical skills, researching the in-game behaviour, the evolution of technical elements, physical exercise, and many others (Pop and Roman, 2003; Predescu and Negulescu, 1998; Colibaba-Evuleț and Bota, 1998; Berceanu and Moanță, 2007; Vicenzi et al., 2007; Hajossy and Macura, 2011; Brancazio, 1981; Hay, 1980; Feflea, 2011; Schmidt and Clausmayer, 1995; Smirnov, 1973; Feflea and Roşca, 2013).

The studies completed to explore and develop different aspects of the game of basketball are based on significant statistic information, gathered by observing and recording the players' behaviour during games (Bachner, 1998). These data points are considered by the specialists in the field the basis for an objective evaluation of the game of basketball and they constitute the start for databases that would facilitate an objective analysis and help know the teams as a whole and the individual characteristic of the players as well (Maroti, 1996). Any researcher can then access any of the sites for any competition, any organization (national or international) in order to access the existing data or can collect them by personally recording them as well.

STUDY SUBJECTS AND METHODOLOGY USED

Three Romanian players were part of this study: two were U23 (under 23) and one was over 23 years old, all of them members of the U-BT Cluj-Napoca basketball team, which participated in the 2021-2022 season, playing in both the Romanian Cup competition and in the National League. All the information regarding the level of knowledge and interest in the topic as well as establishing the indicators for game performance and gathering and analysis of the data points was scientifically based and documented. The data points observed and recorded during the 5 games of the "Final Eight" tournament of the Romanian Cup and during the 9 play-off games in the National League covered the following: shots, offensive and defensive rebounds, steals, blocks, assists, turnovers, points – all related and compared to the playing time of each player that has been the subject of the study; all data points were taken off the respective competition's website. The following abbreviations have been used in the registration process: Min / GAMES - minutes played per game; 3PA –three points shot attempt; 3PS – scored three points shot; 2PA – two points shot attempt; 2PS - scored two points shot; 1PA – attempted free throws ; 1PS – scored free throws; REB O - offensive rebounds (offensive) ; REB D - defense rebounds (defense), ST/GAMES - number of steals ; BS / GAMES - number of blocked balls; AS / GAMES - the number of assists ; TO / GAMES - the number of turnovers; WB / GAME – the number of balls won; FV/GAME – the number of balls lost; P / GAMES - Total points scored per game, EFF - The players' efficiency (coefficient of efficiency). Data processing and calculating averages, percentages, efficiency indicators were completed through the statistical-mathematical method.

PURPOSE OF THE STUDY

Objective assessment of the game performance of the best Romanian U23 players (under 23) members of the team, using the specific regulations of the Romanian Cup to raise the value of the native(local) players, where you have the possibility to use two Romanian players compared to the regulations of the National League, where, in comparison, the playing time is reduced by half and the requirement is to use only one Romanian player.

Comparative analysis of the results and the efficiency for these young players within the two competitions (with different sets of rules).

Documenting and providing the coach with an objective data set that would help create and implement the training schedule in such a way that would help support an optimal coaching approach during games and competition and better resource/player allocation.

HYPOTHESES

A coach would need to not only study but know the different aspects of all players' performance during games to be able to objectively adjust their training process and approach in coaching.

Comparison of the performances achieved by the U23 players in competitions will help the coach to be able to know them better and grade them thus highlighting their contribution to the team, leading to the coach making optimal decisions.

RESULTS AND KEY CONSIDERATIONS

Comparing the games and their playing time, we find that all players have been part of five games in the Romanian Cup 5, except for the KN player, who played in only three games. If we look at the National League, all the players have been part of nine games. The average playing time of the three players who were the subject of the research is higher in the Romanian Cup (except for the KN player who played 3 games - injured), than in the National League, the reason being the specific regulations created in the Romanian Cup where you have the possibility to use two Romanian players, compared to the regulations of the National League, where the playing time is reduced by half and the requirement is to use only one Romanian player.

Table 1. Games and minutes played

	Romanian Cup			**National League**		
	GS	CLA	KN	GS	CLA	KN
Games	5	5	3	9	9	9
Minutes	100.11	122.9	39.86	130.96	117.23	149.1
Average/ Game	20.022	24.58	13.28	14.55	13.02	16.56

One of the indicators of performance in games is the ball shooting efficiency index, given the main purpose of the basketball game is to score as many points as possible.

The analysis of the shots to the basket shows that the three-point attempts represented 35.24% the average of the three players in the Romanian Cup and 21.24% in the National League. In the case of two-point throws, the average of the three players in the Romanian Cup was 47.41% compared to 56.12% in the National League. The average for the free throws of the three players in the Romanian Cup was 44.79% compared to 43.86% in the National League. It is noticed that the average percentages of the three players in the Romanian Cup, both at 3 points and free throws, is higher than in the National League, while the average of the percentages of 2 points the three players have a lower average in the Romanian Cup.

Table 2. Efficiency Index of shooting

Shots	**Romanian Cup**									**National League**								
	GS			**CLA**			**KN**			**GS**			**CLA**			**KN**		
	A	S	%	A	S	%	A	S	%	A	S	%	A	S	%	A	S	%
3 points	14	4	28.57	23	12	52.17	4	1	25	14	1	17.14	13	3	23.07	17	4	23.52
2 points	22	7	31.81	9	4	44.44	9	6	66	33	21	63.63	18	6	33.33	35	25	71.42
1 point	36	11	30.55	32	16	50	13	7	53.84	47	22	46.80	31	9	29.03	52	29	55.76

The ranking based on the points scored shows that the three players have an average of points scored per game higher in the Romanian Cup, 8.94 points per game compared to the National League, where the players have an average of 6.99 points per game. From the above table, we note that the specific regulation created in the Romanian Cup to raise the value of the native (local) players compared to the regulation of the National League, where the playing time is reduced by half and the obligation to use only one Romanian player compared to the Romanian Cup where you have the possibility to use two Romanian players, gives a greater chance of affirmation to the native (local) players.

The number of ball possessions is playing an important role in the game strategy and execution. Ball possession is obtained after a field goal scored by the opponent or because of a misconduct, a wrong action of a defense player or as a result of a player's individual moves (a rebound, intercepting a pass, a block, a steal etc.).

Table 3. Player ranking based on points contributions

Player	Scored shots Romanian Cup			Total	Game average	Scored shots National League			Total	Game average
	3pct.	2pct.	1pct.			3pct.	2pct.	1pct.		
GS	12	14	11	37	7.4	3	42	22	67	7.44
CLA	36	8	16	49	12	9	12	9	30	3.33
KN	3	12	7	22	7.33	12	50	29	91	10.11
TOTAL	51	34	34	108	8.94	24	104	60	188	6.99

Out of all of the above, we have focused next on offensive rebounds, given the important role they play in ball possession. The difference between two teams in what concerns possession of the ball is in tight connection with the number of offensive rebounds made by the members of each team (Dîrjan, 1974).

Table 4. Offensive and defensive rebounds

Indicator	Romanian Cup			National League		
	GS	CLA	KN	GS	CLA	KN
Offensive rebounds	4	2	0	6	9	12
defensive rebounds	7	12	5	13	15	14
Total	11	14	5	19	24	26
Average/Game	2.2	2.8	1.66	2.11	2.66	2.88
Average Cup/League	2.22			2.55		

Comparison of the rebounds' averages per game shows that the players have an average of 2.22 rebounds in the Romanian Cup, compared to 2.55 obtained in the National League. The number of rebounds made in the National League per game is higher due to the higher number of games played (nine matches compared to five) and due to the KN player who in the Romanian Cup played only in three games (injured) compared to five games.

Looking at the other ways of gaining possession, from Table no. V it shows that steals numbers in the Romanian Cup are better than the numbers in the National League, but the results on block shots are better in the National League, except for the CLA player who has as average better results in the Romanian Cup.

Table 5. Steals and blocks

Parameter	Romanian Cup			National League		
	GS	CLA	KN	GS	CLS	KN
Steals	0.5	0.8	0.3	0.1	0.3	1
Blocks	0	1.8	0	0.5	0.4	0.4

Table 6. Comparative analysis of the performance model

Parameter		Romanian Cup	National League
MIN/GAMES		19.29	14.71
3 P	**S**	5.6	2.66
	A	13.66	14.66
	%	35.24	21.24
2 P	**S**	5.66	17.33
	A	13.33	28.66
	%	47.41	56.12
1 P	**S**	11.33	20
	A	27	43.33
	%	44.79	43.86
REB	**O**	4	5.33
	D	7.33	11.66
	T	11.33	16.99
ST/GAME		1.33	3.66
FV/GAME		1.66	1
WB/GAME		13	21.66
AS/ GAME		1.15	1.18
TO/GAME		1.26	0.81
TOTAL POINTS SCORED/ GAME		7.26	5.7
EFF/GAME		6.77	6.29

Based on the mathematical averages obtained at the studied parameters, we compared the performances of the Romanian players in the Romanian Cup and in the National League, which can constitute a model of their game.

CONCLUSIONS

The observation, recording and analysis of game performance data points for players gives the coach objective information regarding them and an opportunity to build a database for both his own players and opponent team's players. Processing and analysing the data leads to a better understanding and awareness of the players' performance, resulting in better and more objective decisions during games.

The comparative analysis of the data shows that, in the vast majority of situations, the players obtained better results for game indicators in the Romanian Cup compared to the National League. Using the specific regulation created in the Romanian Cup, where you have the possibility to use two Romanian players on the court, compared to the regulation of the National League, where the playing time is reduced by half and the obligation to use only one Romanian player, we could raise the value of the native players, thus contributing to raising the value of the team and implicitly to increasing the value of the native (local) players for the representative teams.

SPECIFICATIONS

The data points related to game parameters analysed were downloaded from the official website of the Romanian Basketball Federation and respective competition noted. A special thanks goes out to the players, coaches, and managers of U–BT Cluj-Napoca for collaboration and support.

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DETERMINING THE EXPLOSIVE POWER LEVEL OF THE LOWER LIMBS TO THE WOMEN'S VOLLEYBALL TEAM *CSU MEDICINA* TG. MURES IN THE COMPETITIONAL SEASON OF 2022-2023

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ABSTRACT. Introduction: Explosive lower body strength in volleyball is a constant challenge for every coach and physical trainer who is involved in training a team. The concern is mostly important not only due to the vertical jump but also due to the movement in the field. During the game of volleyball, because of the small dimension of the court, the first 2-3 steps, the starting steps are crucial in the successful execution of each phase during the game. **Methods:** To detertoase of or area of interest in a representative volleyball team, we applied two tests using the optojump device, as follows: 15 sec jumps test and 30 sec jumps test. **Objective:** These two tests were performed at the beginning of the training season in order to see the level of explosive strength parameters **Results:** These parameters were analyzed for each subject as well as for the entire tested team. The average height reached by the center of gravity for the entire team during the 15 sec jumps test is 20.1 cm, while the average jumps in the 30 sec jumps test is 16.6 cm. Analyzing the explosive force parameters shows the direction in which the team's physical training should be designed.

Keywords: *volleyball, optojump, explosive power*

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REZUMAT. ***Determinarea nivelului forţei explozive a trenului inferior la echipa de volei feminin CSU Medicină Tg. Mureş în sezonul 2022-2023.*** **Introducere:** Forţa explozivă la nivelul trenului inferior în jocul de volei reprezintă o provocare constantă pentru fiecare antrenor şi preparator fizic care este angrenat în pregătirea unei echipe. Preocuparea este în mare parte importantă nu doar datorită desprinderii pe vertical, ci şi datorită deplasării în teren. În jocul de volei, terenul are dimensiuni mici, iar primii 2-3 paşi, paşii de pornire, sunt cruciali în executarea cu succes a fiecărei faze din timpul jocului. **Metode:** Pentru a determina parametrii ariei noastre de interes la o echipă reprezentativă de volei, am aplicat două teste cu ajutorul dispozitivului Optojump, după cum urmează: 15 sec. *Squat Jump* şi 30 sec. *Squat Jump*. Aceste două teste au fost efectuate la începutul sezonului de pregătire, cu scopul de a vedea nivelul parametrilor de forţă explozivă la începutul pregătirii. **Rezultate:** S-au determinat înălţimea la care ajunge centrul de greutate în timpul fiecărei sărituri, timpul de zbor şi timpul de contact cu solul. Au fost analizaţi aceşti parametri la fiecare jucătoare, cât şi per ansamblu, la toată echipa testată**.** Media înălţimii la care ajunge centrul de greutate la nivelul întregii echipe, în timpul testului de 15 sec. *Jumps*, este de 20.1 cm, în timp ce media săriturilor la testul de 30 sec. *Jumps* este de 16,6 cm. Analiza parametrilor de forţă explozivă ne arată direcţia în care trebuie proiectat antrenamentul de pregătire fizică al echipei.

Cuvinte-cheie: *volei, optojump, forţă explozivă*

INTRODUCTION

The testing was done at the women's volleyball team CSU Medicina Târgu Mureş at the beginning of the season 2022-2023. The number of participants to the test was 14 volleyball players. The competition they participated in was A2 Romanian National Championship. Volleyball is characterized by a great number of jumps, skips, hops and other kinds of take-off (Abendroth-Smith & Kras, 1999). Explosive lower body strength in volleyball is a constant challenge for every coach and physical trainer who is involved in training a team. Maximal strength represents the support in the development of dynamic strength and subsequently, of explosive strength (Bompa & Carrera, 2006). The explosive power in volleyball. During the match, a volleyball player performs over 100 jumps in either of the four elements: attack, block, serve or playing the ball. The number of jumps differs according to the player's role and his specialization (Lobletti et al., 2010). The aim of the plyometric regime is to develop the ability of the muscles to generate maximal work in the shortest possible time. This occurs as an effect of the reduction in the time required for the switch from a stretch to contraction (Smith, 1996). The follow-up of a physical training program through plyometric exercises determines increases in the speed of execution and the height of jumps (Lehnert et al., 2009; Myer et al., 2006). The vertical

jump is important in volleyball because of the need to hit the ball around the opponent on the opposite side of the net (Schaal, 2011). The maximum exploitation of an athlete's potential is possible only when the training is systematically planned in the long-term (Neagu, 2015, p. 47). The test execution was made in the training hall after warming up for 30 minutes. The warm-up consists in 10 minutes easy running, 10 minutes of stretching and 10 minutes of running school. Owoeye et al. (2018) showed that neuromuscular exercises significantly reduced the risk of ankle sprain in juvenile football and basketball players. Zakaria et al. also found there was no significant difference between dynamic stretching and dynamic plus static stretching in the prevention of lower limb, core and back injuries in high school male football players After warm-up, the tested subjects started with the 15 sec. jump and after all the subjects were tested, the second test was made 30 sec. jump.

METHODS

The testing was done with the Optojump device. It is an innovative system of analysis and measurement that brings a new philosophy of assessment and optimization of performance to the world of competitive sport: it is designed for the development of a specific and customized training programme for the athlete, based exclusively on precise objective data. It is an optical measurement system consisting of a transmitting and receiving bar (Microgate, n.d.). In order to determine the level of explosive force, two tests were used: 15 sec jump test and 30 sec jump tests. Vertical jumps were performed for 15 seconds and 30 seconds. During the test, the hands were positioned on the hips.

Table 1. The anthropometric data of the tested team CSU Medicina Tg. Mureş

Subject	Kg	H
A. C.	51	176
A.B.	76	188
B.D.	77	181
M.F.	73	191
D.M.	68	187
N.E.	67	179
C.A.	52	163
D.A	57	173
P.E.	63	171
G.D.	61	185
C.M.	67	182
P.D.	56	176
M.M.	69	185
S.L.	66	172
S.A	51	176

Figure 1. Representation of the Optojump Device

With the help of Optojump software we analyzed:

- The ability to jump high and reach maximum height quickly represents a success in volleyball (Potteriger et al., 1999). Explosive strength in the lower extremity is responsible for a good jump (Smith, 1996).
- The height to which the center of gravity reaches for each player tested and also for the whole team. We determined the value of the best result and the value of the worst result.

Figure 2. Representation on the Optojump analysis software

OBJECTIVE

To determine the level of explosive power in the tested volleyball team; analyzing and interpreting the results obtained; identifying the best and the worst result; the average of the results obtained by the whole team; indication of the direction in which to do the physical training.

RESULTS

These parameters were analyzed for each subject, as well as for the entire tested team. The average height reached by the center of gravity for the entire team during the 15 sec jumps test is 20.1 cm, while the average jumps in the 30 sec jumps test is 16.6 cm.

Table 2. Results in 15 and 30 sec jump test

Subject	15 sec jump test (average) cm	30 sec. jump test (average) cm
A. C.	19.3	14.1
A.B.	18.3	15.6
B.D.	20.9	17.9
M.F.	18.6	15.7
D.M.	18.0	14.1
N.E.	19.4	14,1
C.A.	24.3	20.0
D.A	22.4	19.3
P.E.	18.7	16.0
G.D.	19.2	15.5
C.M.	21.5	17.3
P.D.	20.3	17.0
M.M.	22.2	18.9
S.L.	17.6	13.8
S.A	21.3	19.3

The average result in the 15 sec. jump test for the tested team is 20.1 cm, with a minimum average on subject S.L. of 17.6 cm and maximum average on subject C.A. of 24.3 cm.

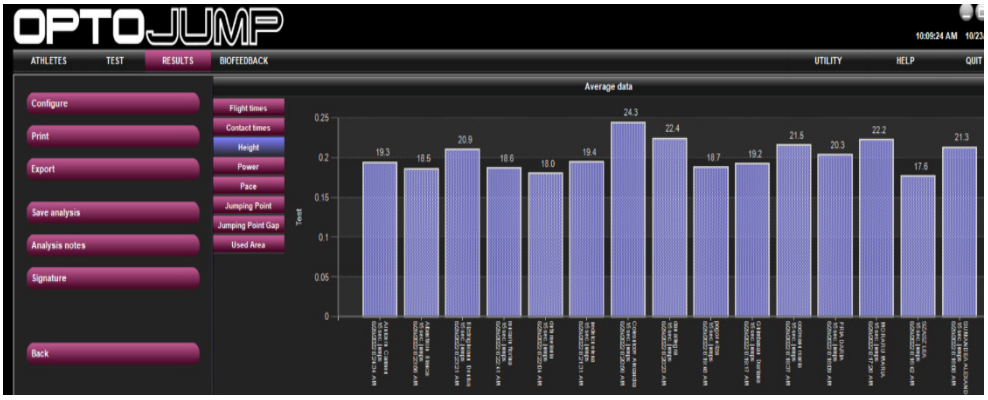

Figure 3. Graphical representation in 15 sec jump test

The average result in 30 sec jump test for the tested team is 16.6 cm, with a minimum average on subject S.L. of 13.8 cm and maximum average on subject C.A. of 20.0 cm.

Figure 4. Graphical representation in 30 sec jump test

As we can observe, the same subject obtained the minimum value and maximum value on both tests. In the 30 sec jump test, the average of the flights obtained is lower compared to the result obtained in the 15 sec jump test.

CONCLUSION

As we can see, the direction in which physical training should be oriented to the tested volleyball team!!!?:

- increasing strength parameters in all forms of manifestation;
- increasing speed parameters in all forms of manifestation;
- increasing the explosive power indices;
- increasing the level of explosive power in condition of endurance.

All these indications must be applied and introduced in the physical training of the tested volleyball team.

In physical training, the exercises must imitate the motor pattern specific to the game of volleyball. It is important to note that the test used to find out the level of the explosive power at the lower limbs must be performed periodically throughout the entire competitional season depending on the obtained results we can model the physical training according to the needs of the tested team.

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