

Priority scientific areas in sports dances research: the analysis of the scientific resources of Web of Science Core Collection

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim The increase in the popularity of sports dances recently has been confirmed. Dancing combines sports and aesthetic components. Dances are used for sports, recreational and rehabilitation purposes. The study aim is an analytical analysis of publications devoted to sports dances and the determination of priority scientific areas in this field.

Material and Methods The bibliometric database Web of Science Core Collection (WoS) is analyzed. For the primary analysis, 618 sources were selected which met the search criteria for 2018–2022. We used bibliometric methods for processing the information received in the context of sports dances for 173 sources. The VOSviewer 1.6.18 program was used: keyword analysis method and direct citation analysis with the construction of bibliometric maps, visualization of cluster density, weights – citations.

Results The constructed bibliometric maps made it possible to identify the leading thematic areas of research, current areas of research in this field. They can be divided into sports, recreational, medical and rehabilitation areas. The sports context is aimed at studying the performance of technical elements, the development of the physical qualities of athletes, the assessment of physical fitness, the dynamics of the morphofunctional state. Psychophysiological studies are aimed at analyzing balance and equilibrium. Publications of a recreational orientation study the health-improving use of dances, their impact on health. The medical and rehabilitation direction explores the features of sports injuries in dancing, injury prevention and the possibility of using dances in the complex rehabilitation. The use of the VOSviewer program, version 1.6.18, made it possible to conduct a comprehensive analysis of the problem, to determine the priority scientific directions in this area.

Conclusions The conducted bibliometric analysis of publications confirms the relevance of the problem of sports dances. A constant research interest in this problem has been determined. Research in this area has a pronounced sports and medical focus. Bibliometric analysis of publications allows identification the three following areas: sports, recreation and rehabilitation. Dancing is being explored as a sport, a form of physical activity, and a form of rehabilitation. A fairly high level of sports injuries has led to interest in the analysis of the prevalence and prevention of injuries. Its characteristic feature is the intersection of these directions. The study of athletes' state confirmed the lack of works devoted to a comprehensive study of athletes, predicting success and skill growth. There are not enough works studying the physical state of sports dancers. There are practically no studies aimed at studying the psychophysiological state. These types of studies should be assessed as relevant.

Keywords: sports dances, bibliometric mapping, VOSviewer, sports, recreational, medical, rehabilitation

Introduction

Sports dances attracted the attention of researchers in various areas and fields of science. Dancing combines sports and aesthetic components. Their duality is emphasized in the following studies [1, 2, 3, 4, 5]. There is debate about whether dancers are athletes or whether the sport has aesthetic qualities. They can reveal broader issues

of contemporary culture, health, competitiveness and commercial activities. Sports dance is a sports, entertainment and fitness project. It combines sports, music, aesthetics and dance.

The popularity of Sports dances has been confirmed to have increased recently. This is confirmed by a large number of national and international competitions, a significant increase in the number of athletes [4, 6]. The rules of modern dance are constantly being improved and complicated. This increases the requirements for athletes [4, 7].

Modern dance is characterized by high physical activity. A significant level of physical effort requires athletes to maintain fitness. The unique and complex physical activities in sports dances differ significantly from those in other sports. Sufficient development of basic physical qualities provides an increase in the level of skill and prevention of sports injuries [8, 9, 10]. To determine risk factors for injury in sports dances is essential for the health and career of dancers [11, 12, 13]. Determining injury risk predictors will allow organizing training in such a way as to minimize their probability. A promising way to reduce injuries is to study the correlation between the biomechanical and physiological parameters of athletes [11].

Increased stress levels are another risk factor in Sports dances. Athletes report stress, increased susceptibility to disease, poor mood and performance. These phenomena are observed most often during periods of high training load and competition. Preparation and participation in competitions require great physical and psychological endurance from dancers [14, 15].

The need to perform complex technical elements in dances causes increased requirements for coordination of movements [16, 17, 18, 19]. The study of the psychophysiological characteristics of sports dancers will allow analyzing their condition, predict the growth of sportsmanship, and ensure the prevention of sports injuries by improving the technique of performing elements.

Tovar-Garcia [20] suggests that those who participate in sports/physical exercise obtain higher wages, about 6-10%, in comparison with sedentary individuals. In addition, the intensity of physical exercise is positively linked to wages. Moreover, the empirical strategy pinpointed the specific activities with robust effects: using exercise equipment, swimming, dancing, and aerobics. The findings of this research are a reminder to support public policies on physical activities and sport facilities at the local level and for ordinary people.

Physical activity is closely correlate with a healthy lifestyle. Various types of physical activity can significantly optimize health. Dancing is one of the promising types of physical activity. The importance of sports dances in health-improving activities is emphasized [2, 21, 22]. Dancing is considered a type of organized leisure that can be used to improve the health of the population.

Sports dancing can not only improve the quality of life, but also affect the health of young people. Qi [21] researched and analyzed the impact of sports dancing on the mental health of college students. It is shown that sports dance has a positive effect on the mental health of students. The level of mental health of dancers is much higher than that of ordinary people.

Currently, the adult population uses many sports

to perform daily physical activity. One of the leading places among them is occupied by sports dances [22, 23]. Foley et al. [22] evaluated the possibility of using dancing as an additional physical activity. A survey of participants in the dance activity No Lights, No Lycra was conducted. This dance version encourages people to participate in free dancing in the dark for 60 min. It provides a modified opportunity for organized physical activity during free time. No Lights, No Lycra have recorded an increase in attendance at their events over the past decade.

Bibliometric analysis is a method of complex analysis of an array of publications [24, 25]. The content of this analysis was the construction of a bibliometric map [26, 27]. Such an analysis is aimed at assessing the number of citations, identifying the leading trends in the scientific direction under consideration. The graphical representation of the data array allows you to evaluate the relationship between the constituent parts - clusters, to identify the most significant components.

In this context, it was of interest to conduct a bibliometric analysis of scientific publications on Sports dances in the journals of the international base Web of Science Core Collection.

The purpose of the study is an analytical analysis of publications devoted to sports dances and the establishment of priority scientific directions in this area.

Methodology

Data sources

The Web of Science Core Collection (WoS) bibliometric database has been selected to create a sample of studies as of 07/01/2022.

The main criterion for choosing bases was the quality of the information sources. Received 618 records (Web of Science Core Collection). Sources matched the search term "sport dance" in the post subject. The search period was 2018–2022. The number of publications by years was the following: 2018 – 112 (18.12%), 2019 – 135 (21.84%), 2020 – 150 (24.27%), 2021 – 153 (24.77%), 2022 – 68 (11.00%).

TOP-10 different subject areas are presented in Table 1. Given the context of the article, further analysis of publications in the subject area Sport Science (n=173) was carried out. These subject areas of WoS are of the greatest interest in the context of the topic of the article: Sport Science, Orthopedics, Rehabilitation, Physiology.

TOP-10 journals with articles on the research topic: Journal of Dance Medicine Science – 9, Revista Brasileira de Medicina do Esporte – 9, Physical Therapy in Sport – 8, Frontiers in Sports and Active Living – 5, Journal of Sport Medicine and Physical Fitness – 5, Clinical Journal of Sport Medicine – 4, European Journal of Sport Science – 4, Journal of Human Sport and Exercise – 4, Journal of

Table 1. Results analysis table for web of science category field (Web of Science Core Collection)

Category	Items (N; %)
All subject areas, n=618	
Subject area (top 10 items)	Sport Science (173; (27.99 %), Education Educational Research (65; (10.52%), Hospitality Leisure Tourism (64; (10.36 %), Public Environmental Occupational Health (40; (6.47 %), Rehabilitation (34; (5.50%), Orthopedics (33; (5.33%), Psychology Applied (25; (4.05%), Medicine General Internal (24; (3.88%), Neurosciences (24; (3.88%), Social Science Interdisciplinary (24; (3.88%).
Subject areas, in the context of the topic of the study, n=173	
Subject area	Sport Science (173; (100 %), Hospitality Leisure Tourism (23; (13.29%), Orthopedics (22; (12.72%), Rehabilitation (18; (10.40 %), Physiology (13; (7.51 %),

NOTE: the source of information is the authors' own research (07/01/2022).

Orthopaedic Sports Physical Therapy – 4, Journal of Science and Medicine in Sport – 4.

Method of Study

To clarify global trends in Sports dances research, the Web of Science Core Collection database was used: the period of publications for the period 2018–2022 was considered. The search results are presented in Table 1. by the most significant categories (Table 1, 173 sources), we analyzed the most priority scientific research in the field of Sports dances.

Data analysis

To determine the leading trends in the problems of our study, we used bibliometric methods [24, 25] for processing the information received in the context of Sports dances. To do this, we used VOSviewer 1.6.18, a software tool for creating and visualizing bibliometric networks [28]. The most important for the study was the implementation of the keyword analysis method [24] and direct citation analysis [25]. The methodology for calculating the main indicators for the analysis and identification of the most significant research categories is described in detail in the works of van Eck and Waltman [26, 27]. Based on the most cited references, we identified promising areas of research in this category. Distance-based bibliometric maps have been used - these are maps where the distance between two elements reflects the strength of the correlation between the elements. A smaller distance usually means a stronger connection.

Results

The use of VOSviewer 1.6.18 made it possible to create the corresponding bibliometric maps. The analysis of these maps was aimed at identifying trends in the scientific support of sports dances, highlighting priority areas.

The results for the main authors of the publications are shown in Figure 1. Authors with publications devoted to sports dancing in 2018–2022 were selected. The analysis involved 70 authors whose link strength was greater than 0.

The specificity of Figure 1 is its division into 2 clusters. They are characterized by the presence of 1673 links, the total link strength is 1674. The first cluster includes 63 authors, the second – 7 authors.

Analysis of Figure 1 does not allow to single out the most authoritative scientists in the field of sports dances. The two authors of the second cluster have the most links: Kelleher Cecily C (62 links) and Heinen Mirijam M (62 links). It is these authors who are the links between the two clusters. However, these links are formed by only two documents. The rest of the authors have one document each, the number of links varies within 6–57.

Network visualization is presented in Figure 2. The network was created based on the basis of 37 elements - keywords. They are grouped into 4 clusters. The network is characterized by the presence of 310 links, with a total strength of 652. The size of the circles - keywords corresponds to the number of links received. The proximity of these circles to the map reflects the strength of the correlation between objects. According to Figure 1 can highlight the most popular research. They are centered around the keywords “dance”, “sport”, “physical activity”, “injury”, “prevalence”, “exercise”.

The first cluster includes 14 keywords. It is marked in red on the map. The cluster received the conditional title “dance”. It is the most significant keyword. It has 35 links with other map keywords, total link strength (TLS) is 148. Then, in decreasing order of the number of links as follows: “prevalence” – 25, (TLS 44), “injury” – 25, (TLS 70), “performance” – 22, (TLS 45), “ballet dancers” – 20, (TLS 33), “ballet” – 19, (TLS 30), “injury prevention” – 18, (TLS 23), “reliability” – 16, (TLS 24), “strength” – 15, (TLS 23), “fitness” – 15, (TLS 25), “athlete” – 14 (TLS 18), “gymnastics” – 14, (TLS 17), “ validity” – 10, (TLS 14), “motion” – 7, (TLS 9). The keywords of this cluster reflect the focus of research on the use of dances for recreational and rehabilitation purposes, the analysis and prevention of injuries, the study of the characteristics of movements in dances. The maximum link strength between the keywords “dance” and “injury” confirms this assumption.

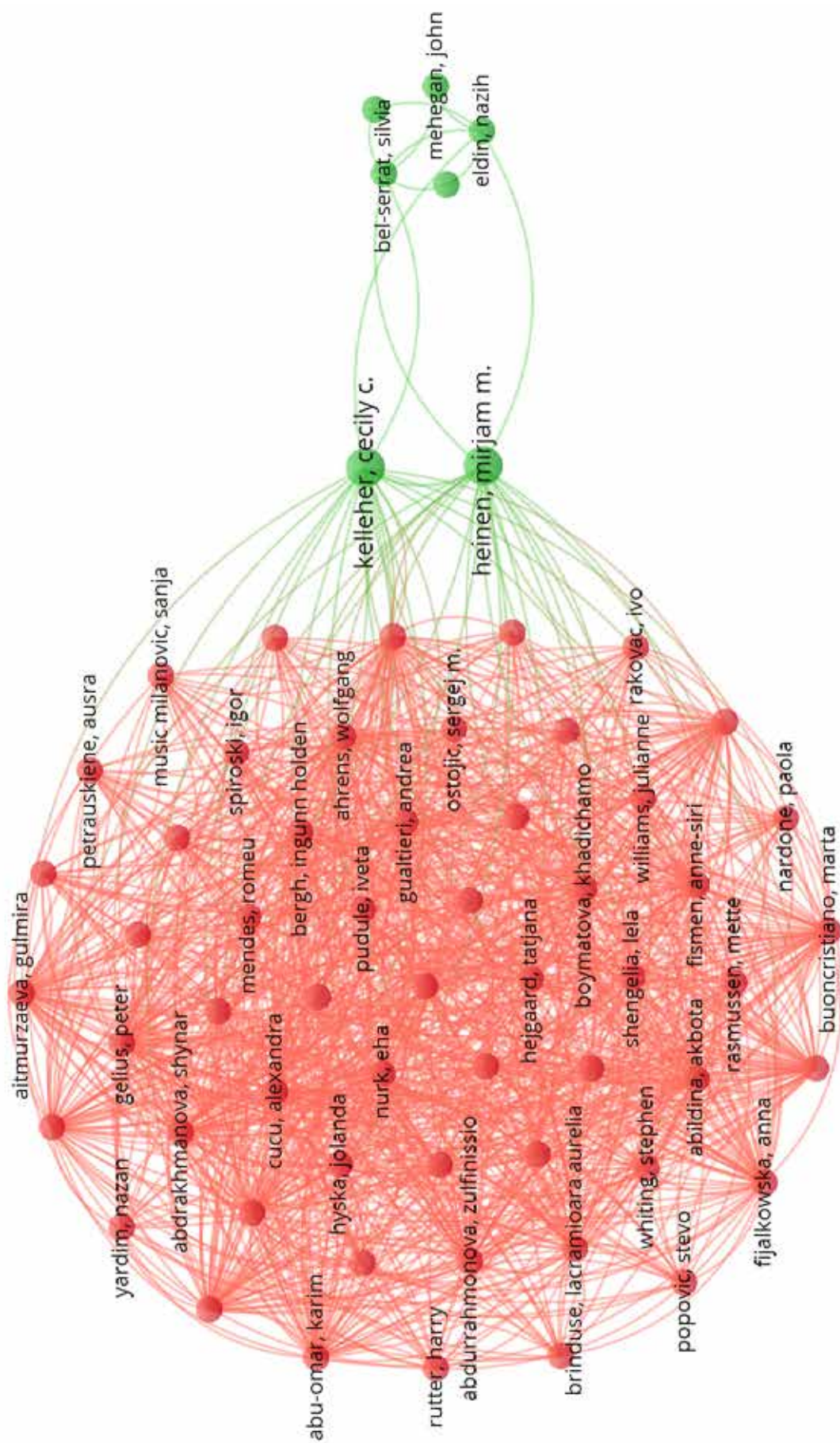


Figure 1. Leading authors of publications devoted to sports dances, network visualization. Source: own research based on data sourced from WoS and analyzed with VOSviewer (07/01/2022).

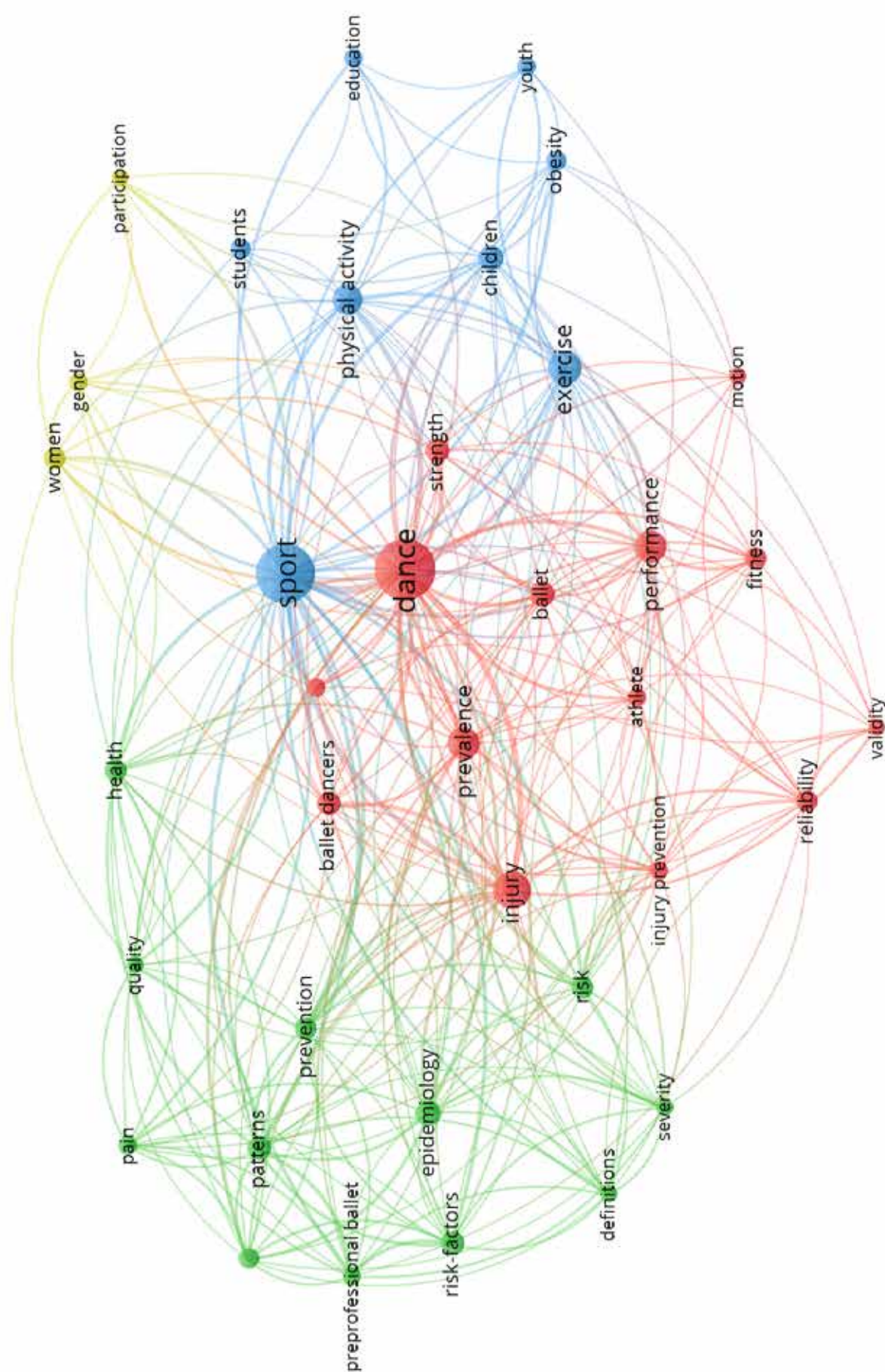


Figure 2. Main keywords in publications devoted to sports dances, network visualization. Source: own research based on data obtained from WoS and analyzed with VOSviewer (07/01/2022).

The second cluster includes 12 keywords. It is marked in green on the map. The conditional name of this cluster is the keyword “health”. It is characterized by the presence of 20 links with other words, (TLS 31). We consider that the choice of this word for the title of the cluster is correct because of its integral character. The keywords “prevention”, (TLS 36), “epidemiology” (TLS 40) have the same number of links. A feature of this cluster is the absence of sharp differences between the number of links of individual keywords. In descending order of the number of links, the cluster keywords were arranged as follows: “risk” and “patterns” 18 each (TLS 35 and 44), “musculoskeletal injury”, “risk-factors”, “severity” 17 each (TLS 33, 35 and 27), “definitions” – 16, (TLS 25), “preprofessional ballet” – 15, (TLS 34), “quality” – 15, (TLS 22), “pain” – 14 (TLS 23). An analysis of the composition of the cluster suggests that research is focused on the prevention of injuries and disorders of the musculoskeletal system, and study of the prevalence of risk factors in sports dancing and their neutralization.

The third cluster includes 8 words. It is marked in blue on the map. The most significant word is “sport”. It is characterized by 36 links to other keywords (TLS 154). In the decreasing order of the number of links, the words were arranged as follows: “exercise” – 21, (TLS 50), “physical activity” – 20, (TLS 44), “children” – 17, (TLS 36), “education”, “obesity” 13 each, (TLS 13 and 21), “students”, “youth” 7 each, (TLS 9 and 14). Analysis of the cluster allows us to conclude that it reflects the sports, recreational and educational focus of the articles.

The last cluster includes 3 words and is marked in yellow on the map. The most significant keyword is “women”. It is characterized by 12 links (TLS 24). The cluster includes the words “gender” (10 links), (TLS 16) and “participation” (8 links), (TLS 15). The small size of the cluster does not allow making reasonable assumptions about the direction of publications.

The overlay visualization network is shown in Figure 3. Keywords are analyzed by frequency of citation and differ in color. Blue corresponds to the lowest average number of citations, yellow corresponds to the highest.

In the first cluster, this indicator is the highest for “injury prevention” – 10.33, in the second cluster – for “pain” – 15.50, in the third – for “obesity” – 8.29 and in the fourth – for “participation” – 4.00.

The results of density visualization are shown in Figure 4.

Data interpretation Figure 4 is similar to Figure 2: the more important is the subject, the larger is its circle and font size. According to Figure 3 can be identified studies that can be categorized as the most popular. These include studies on the topic (in descending order of importance): “sport”, “dance”,

“injury”.

Discussion

An analysis of the multiplicity of publications allows us to conclude a constant research interest in the problem of sports dances. The number of publications is quite stable during the analysis period.

The data in Table 1 confirm the pronounced sports and medical orientation of the study on sports dances. Almost every fourth article had a sports focus. Eight of the ten priority subject areas are directly related to medicine. When analyzing subject areas in the context of the article, this trend is confirmed. Four of the five most significant subject areas were also related to medicine. This conclusion is confirmed by an analysis of priority journals. Virtually all journals in the TOP-10 have a medical focus.

The analysis of network visualization allows us to identify three main areas of publications: sports, recreation and rehabilitation. This assumption is confirmed by the characteristics of the most significant keywords in Figure 1. A characteristic feature is the intersection of directions within different clusters. For example, health and sports publications include keywords from other areas.

When studying the state of athletes, there is practically no studies devoted to a comprehensive study of success, forecasting the growth of skill. There is also a lack of articles on classic sports issues such as the study of physical development, physical fitness, psychophysiological characteristics. The range of studies that study the physical condition of sports dancers is rather narrow. They studied only the features of the somatotype.

There are practically no studies aimed at studying the psychophysiological state. The authors studied this problem very narrowly: maintaining balance, range of motion of some joints, biomechanical features of the performance of individual technical elements - jumps. There are no studies on the study of coordination, sense of rhythm, concentration and switching of attention, motor memory capacity. It has been confirmed that these qualities are essential for success in dancing [29].

There are no comprehensive developments for studying and predicting success. A lot of is declared about the intermediateness of dances between sports and art, the presence of physical and aesthetic components, but there is practically no transition to their quantitative analysis.

An important feature of sports dancing is a fairly high level of injuries. Most researchers recognize the existence of an inverse correlation between the level of injuries and the success of a dancer's career. This leads to the study of the prevalence of injuries, the severity of risk factors as actual anti-predictors of success. Most studies of functional status are

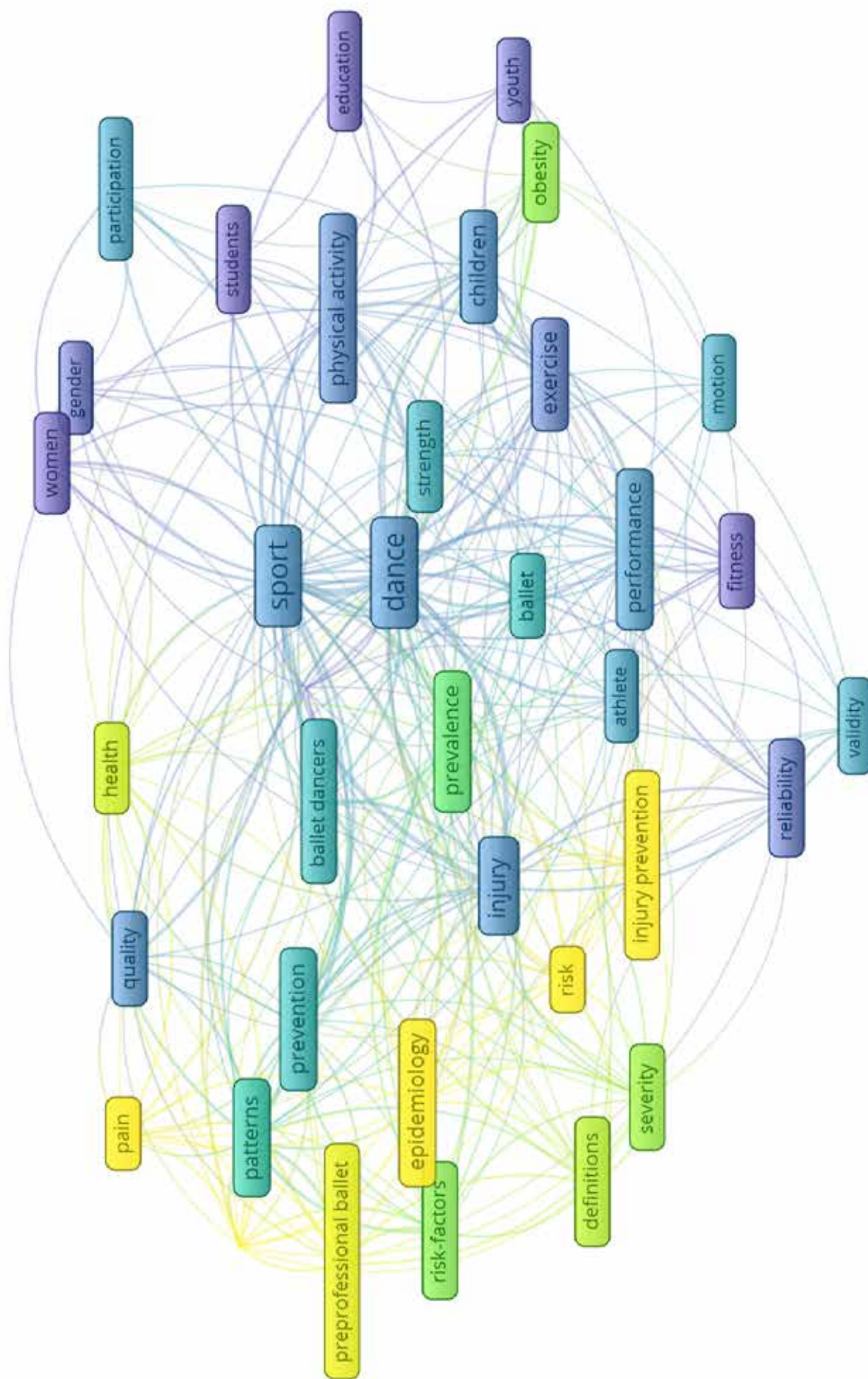


Figure 3. Average number of keyword citations in publications devoted to sports dances, overlay visualization. Source: own research based on data sourced from WoS and analyzed with VOSviewer (07/01/2022).

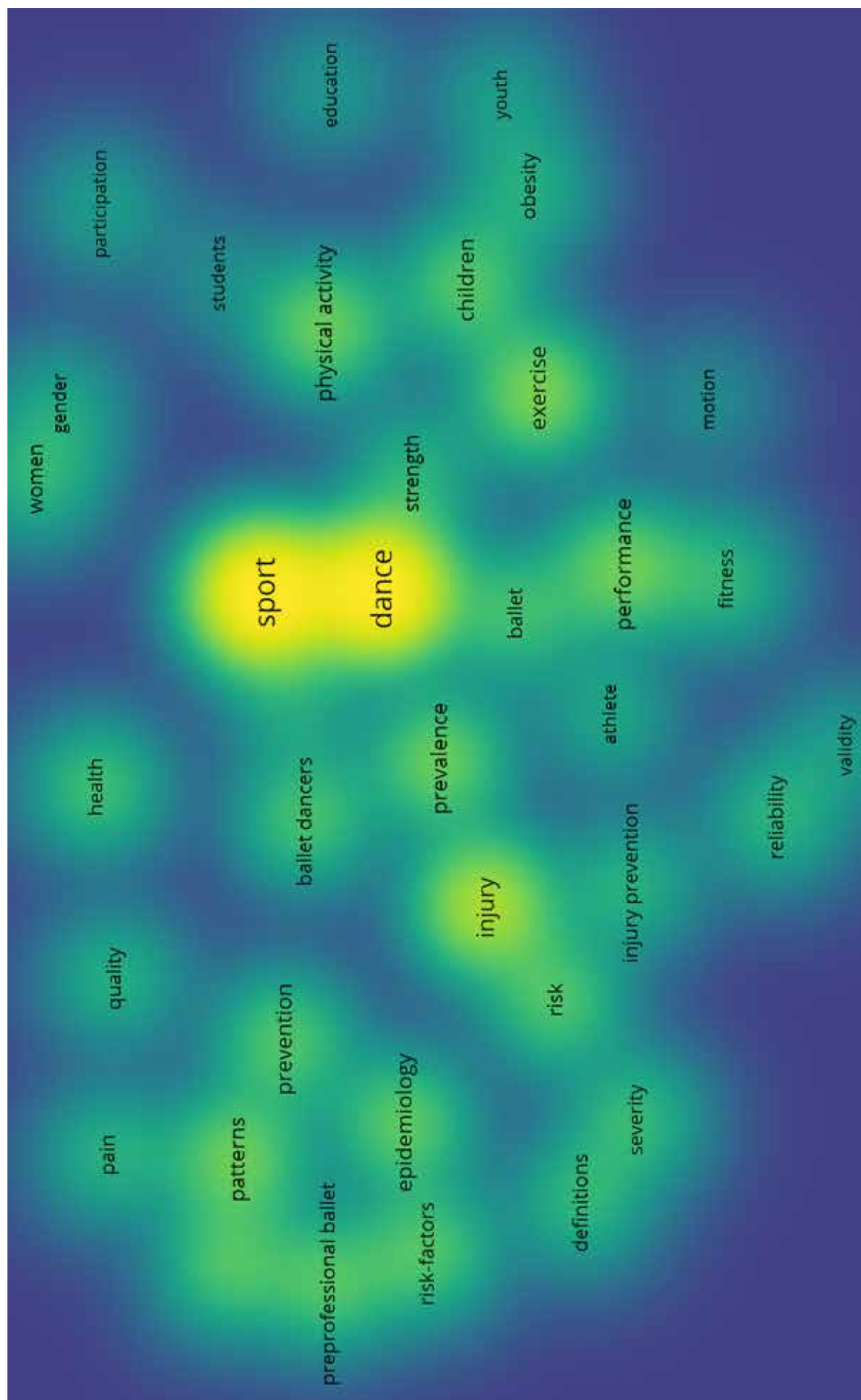


Figure 4. Directions of research in publications devoted to sports dances (direct citation analysis, visualization of cluster density, weight – citations). Source: own research based on data sourced from WoS and analyzed with VOSviewer (07/01/2022).

aimed at identifying risk factors for injuries and ensuring their prevention.

An analysis of the visualization of the overlay allows us to conclude that rehabilitation-oriented publications are the priority in terms of the average number of citations. These studies highlight the possibility of using sports dances to normalize body weight, evaluate the prospects for preventing injuries, reducing pain in dancers.

The density visualization results actually replicate the network visualization results. This should be evaluated as a confirmation of the correctness of the assumptions made.

Exploring dance as a sport

The increase in technical requirements in sports dances occurs constantly, due to an increase in the number of syllabus figures corresponding to each sports category [4]. This study included a survey devoted to sports dances professionals about the importance of physical fitness and its place in a strategy to maximize performance. Physical training programs improve motor skills. This, in turn, raises the level of technical and artistic actions [4, 30].

The development of physical qualities of dancers improves the level of their training, ensures the prevention of health disorders [9, 10]. Changes in the strength, flexibility and functionality of young dancers were assessed during the summer intensive dance program [9]. A battery of tests for strength, flexibility, balance, performance of technical elements was used. Adolescent dancers improved lower abdominal muscle strength as well as functional dance techniques in demonstrating correct alignment and performing demi-plie and passe dance positions despite a decrease in passive lower extremity range of motion. Similar results were obtained in the study [10, 31]. A comparison of physical fitness in the groups of modern (CD) and Irish dance (ID) was carried out using a specialized battery of tests. The CD participants performed significantly better than the ID group on the Star Excursion Balance Test, Plank Hold, and Fitness Test [10].

A battery of tests for general and special physical fitness was used in the study [31]. The period of observation of students in the department of choreography was two years. Positive dynamics of explosive strength, power endurance, coordination, flexibility was confirmed.

The need for special tests and standards of physical fitness for sports dancing is substantiated in the study [8]. It is proposed to use push-ups from the floor and a throw of a stuffed ball. The development of specific standards will significantly improve the process of selection and prediction of success in this sport.

The aim of the study [15] was to determine the degree and nature of the influence of dancing classes on the morphofunctional and psychological state.

To predict the adaptation to adverse environmental conditions, the index of functional changes (IFC) was calculated. This indicator reflects the adaptive capacity of the circulatory system. A correlation was determined between the body type of dancers and the main criteria for anxiety. Girls with different somatotypes have different indicators of anxiety, psycho-emotional state and adaptive capabilities. The qualities that provide favorable adaptation and affect success are highlighted.

The quality of the performance of technical elements is a criterion for assessing the level of dancers. Premelc [16] studied the characteristics of movement and performance of dance elements in tango dancers of various levels. Top-level dancers spent less time performing elements, had a greater variety of movements in the dance.

A comparative analysis of coordination in dancers and non-dancers was carried out in [18, 19]. The indicators of coordination among the dancers in different phases of the performance of the elements were less variable. This confirms the higher level of control in athletes compared to non-dancers. The groups being studied were characterized by different hardness landing techniques during jumps. A softer landing technique provides injury prevention due to better cushioning of the foot [19, 32].

Control over the implementation of technical elements in dances predetermines the need to improve the accuracy and quality of video filming. A wireless eye movement measurement device was developed by Sarugaku et al. [17]. The new video recording method simultaneously displays the line of sight and movement of the athlete. In a full-scale experiment, the accuracy of the device was evaluated before and after the high-speed rotation of the dancer. By analyzing eye and body movements, the authors successfully measured the spotting technique used by dancers to suppress dizziness.

A device for improving the flexibility and strength of the muscles of the hip joints was described in the study [33]. Referred to as the Flexibility Trainer (FT), the device is equipped with sensors that measure and evaluate athletes' hip torques. FT uses the lifter's body weight to perform controlled leg extensions. The use of this device allows you to improve the performance of technical elements in dancing.

The optimization of technologies for collecting data on movements during dancing can significantly improve the control of athletes' motor skills. The review [34] is devoted to the analysis of the use of these sensor technologies. Combining two or more types of technologies can improve data reliability and optimize motion performance. A promising direction has been identified – the study of the interaction between muscles and the brain in dancers. The use of quantitative tools allows you to determine the level of skill of the dancers.

A promising scientific direction is the study of body changes under the influence of training and competitive loads. A study of physiological and biochemical changes caused by sports dancing was conducted in the study [5, 30]. Athletes showed individual changes in biochemical parameters with an emphasis on increasing the level of hemoglobin. Physiological parameters also changed significantly. The average reduction in body fat was more than 5%. The dynamics of blood lactate, the level of heart rate and the results of functional tests confirm the gradual development of fatigue.

Informativeness of heart rate variability predetermined interest in its study for predicting sports activity [35, 36]. The review carried in the study [35] confirmed the positive relationship between heart rate variability and the psychophysiological characteristics of athletes.

The heart rate (HR) variability (HRV) is a useful tool for assessing cardiac autonomic function and identifying the potential readiness to perform in athletic populations. HRV may be able to provide valuable insight into the preparedness of dancers and the demands of performance in a dance population [36]. The results suggest dancers responded to concert dance performances similarly to other athletic populations approaching the intense competition by exhibiting decreased parasympathetic activity before the dance performances, which returned to baseline values 36 h after their performances. Given the increase in self-efficacy, these fluctuations may indicate a readiness for a performance comparable to that of athletes.

In competitive ballroom dancing, the assessment of the aesthetics of physique directly affects the result. Physique is an important determinant of selection in this discipline. Banio et al. [37] estimated the dimorphic differences in the distribution of adipose tissue in a group of male and female dancers practicing competitive ballroom dance at the highest level. The obtained results allow concluding that systematic, multi-annual, task-oriented physical activity of dancers eliminates sex differences in the scope of adipose tissue. Most importantly, the obtained data may be helpful in the development and optimization of selection systems of dance partners for couples practicing competitive ballroom dancing.

Success in dance sport is determined not only by physical and aesthetic factors but also by psychological preparation. Motivation is one of the most important aspects of this training. Zaletel et al. [38] studied the motivational structure of athletes in Latin American and ballroom dancing, acrobatic rock and roll, contemporary jazz, and ballet. This study aimed to determine the role of motivation as a performance factor. Male dancers tend to dominate and lead with a strong power motive. Female dancers are more focused on motives such as emotional

relaxation, self-control and social understanding.

The use of tests and functional tests allows assessing the development of motor skills. It was proposed to use the Oseretsky-Gilman test for this purpose [39]. This test is a tool for assessing psychomotor age. It evaluates the possibilities of maintaining balance and equilibrium. It is shown that children involved in dancing perform better on this test. Additionally, the correspondence between chronological age and psychomotor age was confirmed.

Postural stability (PS) plays an important role in many sports [40, 41, 42]. Modern dance requires increased PS. This is due to high aesthetic requirements and speed of movement. In the study [40], the static and dynamic PS of young dancers and athletes of other sports were compared. Static PS was assessed using the two-legged test on the Force platform. Dynamic PS was assessed using the Korperkoordinatestest fir Kinder (KTK), a backward walking test on a bar. It is shown that girls involved in dancing have the best indicators of static and dynamic PS.

Improving the quality of movements is an important component of improving technique in sports dancing [43, 44]. The special tests for balance and a three-dimensional analysis of movement with the determination of biomechanical parameters were used in the study [43] for this purpose. The results confirmed the effectiveness and informativeness of the methods used, the possibility of their application to improve technique, and prevent injuries. The specificity of dance movements predetermined the interest in assessing the motor control of the lumbopelvic region [44]. A battery of special tests was used in dancers and non-dancers. Athletes-dancers were characterized by better control of lumbopelvic motor skills, dynamic stability and lumbar movements.

A comparative analysis of the tests for balance and balance maintenance was carried out in the study [42]. They executed the Star Excursion Balance Test (SEBT), the modified Romberg test, the Airplane test, the BioSway Balance System (Biodex, Shirley, New York, USA), and a dance-specific pirouette test. Spearman's correlation coefficients examined relationships between the measures of the balance tests. The results showed the strongest relationships between some SEBT reach directions and feeble to moderate relationships between some balance tests, including some SEBT directions, Romberg, Airplane, Biosway, and pirouette.

An important predictor of success in sports dances is the ability to control posture and maintain balance [45, 46, 47]. This control is necessary for the correct execution of complex movements in the dance. Gimunova et al. [46] analyzed differences in static postural control among dancers of classical ballet, Slovak folk dances, and sports dances. The

effects of body weight, height, and toe grip strength on postural control were analyzed. Sports dancers showed better postural stability compared with classical ballet and folk dancers. Sports dancers are accustomed to a greater load on the forefoot and to particular rolling of the foot in the dance. This can increase their postural stability. An additional factor influencing PS is the constant change in the environment during the competition.

Similar results were obtained in the study [47]. The aim of this work was to analyze the methods of posture control in sports dancers and to evaluate the effect of functional training on the state of posture. A significant increase in postural control was found in athletes in the functional training group. It is proposed to use the ability of postural control as a test indicator.

The use of cross training from other disciplines is a means of optimizing training in sports dances [48, 49, 50]. The study [48] assessed the effectiveness of the additional training program for developing flexibility and strength of the lower limbs of dancers. The program was based on rhythmic gymnastics exercises. The implementation of the program for 8 weeks provided an increase in the active range of motion of the legs and the strength of explosive dance movements. A similar program lasting 1 year was used in the study [49]. The combination of dance training and rhythmic gymnastics provided an improvement in physical fitness.

Similar results were obtained in the study [50]. The authors have developed and tested programs for optimizing psychomotor abilities in sports dancing. An important component of the programs was the use of exercises borrowed from other sports. The use of the program during the year confirmed its pronounced effect.

Flexibility is another quality essential to success in dancing. Zhang et al. [51] studied the role of functional dynamic stretching in dance sports. Dynamic-stretching training can effectively improve ankle stability in athletic dancers. Simultaneously, this method effectively prevents injuries to the athlete's ankle joint.

The state of the musculoskeletal system is one of the leading predictors of success in sports dancing. It, in turn, depends on bone mineral density (BMD). A comparative analysis of BMD in dancers and non-dancers was carried out in the study [52]. A specific osteogenic effect of pre-professional training in adolescent girls has been determined. It consisted of lowering BMD of the upper extremities compared with the control group of the same age.

The most salient characteristic of ballroom dance is the closed-hold position, during which the upper body segments of partner-dancers are linked. The study investigated the partnering effects on joint motion ranges of the lower extremities and step lengths during the waltz in 13 national level

competitive dance couples and a world champion couple [53]. Analysis of the videos showed that the world champion couple demonstrated excellent dancing skills in the waltz. This was especially evident in the champion dancer's stride length and range of motion in female's joints.

A comparative analysis of the physical development and somatotype of female athletes in dance and gymnastic sports was carried out in the study [54]. Most of the participants had an average harmonious physical development. This is due to the peculiarities of sports, their team nature and reflects the aesthetic orientation of the sports being studied. Deviations in physical development are most often associated with lack of body weight. The use of the bioimpedance method determined an increase in the content of muscle mass above the average age standards for all participants.

The intense physical activity in dancing requires adequate recovery [55, 56]. A special technique for the recovery of highly qualified athletes-dancers in the post-competitive period was developed in the study [55]. The technique was based on the use of Pilates, static and dynamic exercises. A purposeful improvement in the adaptive and functional capabilities of athletes has been confirmed.

The use of nutrition is one of the most effective ways to restore the condition of athletes. Challis et al. [56] studied the diet and body composition of Irish dancers. The consumption of fruits and vegetables was low. The energy content of the diet, the content of fiber, iron, magnesium, selenium, iodine and folic acid were below the UK dietary standards. The average body fat percentage measured using DXA was higher than that of the other dance groups. Body composition was not correlated with the intake of any nutrient, but was correlated with nutritional knowledge questionnaire scores.

Rosselli et al. [57] studied the eating habits and body composition of adolescent classical and contemporary dancers during the prepubertal period. The mean BMI was within the normal range in both groups. No significant differences in anthropometric parameters and body composition were found between the two groups. Despite non-compliance with the Mediterranean diet, no risk of developing eating disorders or athlete's triad syndrome has been identified.

Sports dancing as a form of recreational activity

Sports dances are widely known as a type of sport, but they have not been sufficiently studied as a leisure activity for middle-aged and elderly people [2]. The authors studied the effect of regular physical dance exercises on the shape, function and body quality of this age group. The program of classes with various dance styles lasted three months. Women improved in BMI, body fat percentage, waist circumference, diastolic blood pressure, depth of forward bend from a sitting position, and time of standing on one

leg with eyes closed. It is concluded that long-term aerobic sports dance exercises of medium intensity can improve the physical form and function of the cardiovascular system of middle-aged and elderly people.

An analysis of the intensity of loads during various types of dances makes it possible to recommend them as recreational exercises [23, 58]. Indicators of the cardiovascular system were used as criteria for the intensity of loads. Hip-hop dancing is rated a load of medium and maximum intensity. Salsa is a load of moderate intensity. Both dances meet the recommended intensity for the healthy adult population. The weekly duration of hip-hop classes should be 75 min, salsa – 150 min [23]. According to the American College of Sports Medicine (ACSM) guidelines, a 60-min pole dance class can be classified as a moderate-intensity cardiorespiratory exercise. Performing for at least 30 min 5 days a week satisfies the recommended level of exercise for improved health and cardiorespiratory fitness [58].

Similar results were obtained by Longo et al. [6]. An analysis was made of the prevalence of dancing as a recreational activity. It has been established that dancing is one of the three most popular types of physical activity. A third of the respondents work out at least 3 h a week.

Sports activities in adolescence affect health characteristics in later age periods. The work [59] studied the correlation between various types of physical activity and body composition. We assessed the correlation between anthropometric parameters (body length and weight, waist circumference, triceps and thickness of the subscapular skin fold) and jogging, fitness dancing and other sports.

Recreational dance classes are considered a way to develop coordination of movements, improve balance [60]. The presence of a significant correlation between the indicators of balance and BMI was confirmed. Physical activity, which includes performing various balance tasks, offers children more opportunities to improve in this area.

Wang et al. [3] studied the effect of physical dance exercise on serum immunoglobulin and T-lymphocyte subpopulations in college students. After ten weeks of dancing sports, both men and women in the experimental group had a significant increase in serum IgG levels. CD4(+) and CD4(+)/CD8(+) ratios of T-lymphocytes showed a significant increase. Serum IgM tended to increase. It is concluded that long-term physical dance exercises can improve the body's immune function.

The health-improving orientation of the dance classes suggests their positive impact on well-being. The correlation between dancing and health was studied in the study [12, 13]. It was a negative correlation between improved sleep and general health with the number of days of incapacity for work and the negative consequences of injury.

A connection has been determined between the deterioration of health and an increased level of injuries.

Injury prevention in sports dancing and their rehabilitation value

The requirements for dancers have increased significantly recently. Increased physical and mental stress. Professional dance activities significantly increase the risk of illness and injury. Injuries during one season of performance have from 50 to 85% dancers. The reason for the increase in injuries is deemed a significant physical exertion in dancing. Most dancers' injuries are related to the lower extremity (LE) and are chronic [61]. It has been proposed to use the Functional Movement Screen (TM) (FMS(TM)) as a screening tool to determine the risk of injury.

Almasi et al. [62] identified the main criteria for the state of the musculoskeletal system to determine suitability for dancing sports. These criteria should be determined by a professional medical examination. This will reduce the risk of injury and improve the prospects for skill growth.

Sports dancing are quite a traumatic sport [12, 13, 61]. They are characterized by certain injuries. Sugimoto et al. [63] studied the prevalence of big toe injuries in athletes. The most common diagnosis was sesamoiditis. Dancing, running and football were among the top three most traumatic sports. It has been confirmed that women take almost twice as long to recover compared with men.

Injuries of the hip joint are quite common among sports dancers [64, 65, 66]. The aim of the review [64] was to determine the range of active actions of the hip joint. Literature analysis has confirmed that many activities place superphysiological demands on the movement of the hip joint. These kinematic components differ dramatically depending on the specific activity. Rehabilitation should be performed considering the individual characteristics of each patient.

Injuries of ankle and ankle injuries are also common in sports dances. Shi et al. [7] investigated the efficacy of functional rehabilitation for ankle injuries. Special exercises have been proposed for Latin American dancers. A significant reduction in pain compared with the control group was confirmed.

Caine et al. [67] described this status of knowledge on the occurrence and outcome of primary periphyseal stress injuries (PPSIs) affecting the EPM complex in the extremities of children and adolescents involved in youth sports. PPSIs may affect the extremities of children and adolescents engaged in various youth sports, especially at advanced levels of training and competition. The early diagnosis of PPSIs and providing timely treatment of these injuries are needed to ensure the skeletal health of youth sports participants.

Henn et al. [68] reviewed the prevalence of low back pain and injury in ballet, modern and hip hop dancers. The main research instrument was a questionnaire. Dancers are at risk of back pain or injury regardless of gender, age, or skill level. A conclusion was reached about the need for more informative research methods.

The work of Larson et al. [65] studied the effect of arthroscopy on the speed of rehabilitation and recovery in dancers of various styles. The high efficiency of this method has been confirmed. A return to dance sport was found in 84% dancers after three years. However, only 63% of the participants reached the competitive level before the injury.

The available results show that joint hypermobility is a predictor of arthralgia, dislocations, and subluxations [69]. A special Beighton scale was used to assess the condition of the joints. Comparison of dance, rugby, netball athletes with non-athletes confirmed the possibility of predicting disorders in athletes.

Low energy availability (LEA) is a medical condition observed in athletes, with higher prevalence in aesthetic sports. Dancers must be considered at risk for developing LEA. These nutritional features require a targeted rehabilitation strategy [70, 71]. For the first time, this study evaluated the relative prevalence of LEA in female elite athletes (ELA) and recreational athletes (REA) in aesthetic sports in China [71]. The results show that there is a risk of LEA in Chinese female athletes involved in aesthetic sports. This risk is significantly higher in elite athletes than in amateurs. More than 40% of participants had an increased risk of LEA, and more than 50% of participants were classified as

high risk for eating disorders. Elite female athletes at an increased risk of LEA had significantly lower levels of estradiol and MOC.

A promising way is to use dancing in the rehabilitation of patients after therapy. An example is the Dancing with Health (DWH) project. It is funded by the ERASMUS+ SPORT program of the European Union and is intended for patients after breast cancer treatment. Cerulli et al. [72] studied the effectiveness of this protocol on the dynamics of fitness and quality of life. It has been shown that the DWH protocol has a positive effect on psychological well-being and physiological parameters, improving the quality of life of patients after breast cancer.

Conclusions

The conducted bibliometric analysis of publications confirms the relevance of the problem of sports dances. A constant research interest in this problem has been established. Research in this area has a pronounced sports and medical focus. Bibliometric analysis of publications allows us to identify three areas: sports, recreation and rehabilitation. Dancing is being explored as a sport, a form of physical activity, and a form of rehabilitation. A fairly high level of sports injuries has led to interest in the analysis of the prevalence and prevention of injuries. A characteristic feature is the intersection of these directions. When studying the state of athletes, there are practically no studies devoted to a comprehensive study of athletes, predicting success and skill growth. There are lacks of studies devoted to the physical state of sports dancers. There are also lacks of studies aimed at studying the psychophysiological state. These types of studies should be assessed as relevant.

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Cite this article as:

Podrihalo O, Xiaohong G, Mulyk V, Podrigalo L, Galashko M, Sokol K, Jagiello W. Priority scientific areas in sports dances research: the analysis of the scientific resources of Web of Science Core Collection.

Physical Education of Students, 2022;26(5):207–223.

<https://doi.org/10.15561/20755279.2022.0501>

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Received: 29.07.2022

Accepted: 04.09.2022; **Published:** 31.10.2022