

## Analysis of the use of isometric exercises to prevent injuries in beach soccer players

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### Abstract:

The article is devoted to the problem of using isometric exercises to prevent injuries in beach soccer players. The purpose of the work was to substantiate the effectiveness of the methodology of using a set of isometric exercises to avoid damage to beach soccer players in the sports training system. The following research methods were used: theoretical analysis and generalization of literature sources; pedagogical observation; pedagogical experiment (stating, forming); methods of mathematical statistics. The current stage of formation and popularization of beach soccer in Ukraine and the world is characterized by a significant increase in training and competitive loads, which in turn requires the prevention of injuries to players. The generally accepted methods of solving this issue only sometimes give the desired result due to the peculiarities and specifics of this sport. The study included the study of scientific, theoretical, and methodological aspects of the problem, conducting a survey of qualified players, coaches, and medical staff of men's teams, determining the level of physical fitness of beach soccer players, selection of isometric exercise complexes to prevent injuries to players, experimental substantiation of the methodology of using isometric exercise complexes in the training process of beach soccer. The analysis of scientific and methodological literature and survey of respondents allowed us to identify common types and leading causes of injuries of beach soccer players. It was found that isometric exercises are significant ( $p < 0.05$ ) for increasing physical fitness and preventing injuries in beach soccer players. The obtained data allowed us to substantiate the methodology of using isometric exercises in the annual training cycle, which showed effectiveness in preventing injuries in the training of beach soccer players.

**Key words:** beach soccer, injuries, isometric exercises, sports training.

### Introduction.

Based on the materials of History of soccer and Definition of beach soccer from the Cambridge Advanced Learner's Dictionary & Thesaurus, it can be determined that Beach football is a sport based on traditional football rules. Competitions are held on sandy beaches, and the technique of ball possession and the speed of movement on a slippery surface are of particular importance. The soft and dense sand forces players to improvise a lot to use beautiful techniques (for example, kicks in the fall through themselves – “scissors” or “bisiklets”) [material from Wikipedia].

However, despite the apparent simplicity of beach soccer, the game requires good physical fitness and is accompanied by the possibility of injuries to the musculoskeletal system of players. Constant accelerations and jumps in the sand, struggle for the ball, collisions, and falls during kicks over themselves - all these tests the strength of the players' joints, muscles, and ligaments. And suppose the musculoskeletal system is not adapted to such loads. In that case, very complex injuries can damage the knee and ankle joints, meniscus or Achilles tendon rupture, groin muscle stretching, ligaments, and powers of other body parts. Such injuries for a long time put players out of action, which negatively affects their playing activity, and sometimes there is a need to end an athlete's career.

Analyzing scientific works (Kostiukevych V.M. 2014; Platonov V. 2015; Brynzak S. and other authors 2021; Brynzak S. and other authors 2022) in the context of constant trends in improving the sports training system, the issue of managing the physical condition of the athlete and the team remains relevant.

Scientists and specialists (Blikenhaal S. 2022; Denisovets A. 2021; Kokareva, S., Kokarev, B., & Doroshenko E. 2018; Movchan V. 2018; Panchuk T. (2013; Stepanenko O. S. 2019; Yavtushenko P. 2020), who are working on a system to improve the training of athletes in-game sports, offer different ways to improve the training process, which would take into account the prevention of sports injuries. Therefore, in the educational

and training process, special attention is focused on combining physical training and sports injury prevention for the long-term continuous competitive and training performance of athletes.

As shown by research (Constantine, E. and other authors 2019; Filyh, M. M., & Alaneyi, A. M. 2019; Kerman, M. and other authors 2018; Kozina J. 2018; Kupreenko, M. 2020; Protenko, K. V. 2016), one of the effective means of solving this problem is the use of isometric exercises in the system of physical and technical training of players. However, there is no substantiation of the degree of influence of isometric exercises on the body of a beach soccer player by the peculiarities and specifics of this sport. That is why there is an urgent question of finding ways to optimize the knowledge and skills of isometric exercises in beach soccer to prevent players' injuries. In the opinion of (Filyh, M. M., & Alaneyi, A. M. 2019; Kupreenko, M. 2020), when solving the problem of injury prevention in the system of training football and basketball players, it is necessary to apply an approach when the risk of injury can be eliminated by following the program of isometric exercises, where maximum effort is carried out without dynamic work. We also note the study (Filih, M. M., & Alaneyi, A. M. 2019; Kerman, M., Atri, A. E., & Hashemi Javaheri, S. A. A. 2018; Protenko, K. V. 2016; Ostrokon, A. V. 2020), which considers the importance of using isometric tension method exercises in sports not only as a means of developing strength but also as a means of preventing injuries and actively restoring normal function after injuries. Holding work is performed due to muscle tension without changing length (isometric tension mode).

A variant of the exercise method in isometric mode (Rojas- Quinchavil, G. and other authors 2021; Protenko, K. V. 2016) indicates that each effort is performed with maximum tension for 6-10 seconds. Such steps should be performed 2-3 times in a series of 4-6 actions. As for football, according to (Ostrokon A. V. 2020; Panchuk T. M. 2013; Yavtushenko P. V. 2020), it is better to perform isometric exercises in the training of players before the beginning of the preparatory part of the classes to move on to other dynamic forms of training smoothly. Based on the obtained results, leading scientists and practitioners (Kupreenko, M. 2020; Kozina, J. 2018; Kerman, M., Atri, A. E., & Hashemi Javaheri, S. A. A. 2018; Protenko, K. V. 2016) found that performing exercises in the isometric mode for 30 seconds to 5 minutes creates the prerequisites for the formation of strength properties of muscle and tendon tissue, especially in those places that are most exposed to dynamic loading.

#### **Hypothesis.**

1. It is believed that the use of isometric exercises in the training system of beach soccer will affect the increase of the fitness level and prevention of players' injuries.
2. There need to be more isometric exercises in the training process to improve preparedness and prevention of injuries by beach soccer players.

**Purpose.** Substantiation of the effectiveness of the methodology of using a complex of isometric exercises to prevent injuries of beach soccer players.

#### **Material and Methods.**

To achieve this goal, theoretical analysis and generalization of literature sources; pedagogical observation; pedagogical experiment (stating, forming); methods of mathematical statistics were used.

During 2019-2021, experimental work was carried out with qualified players, coaching staff and medical staff of men's teams that played in the Kyiv and Ukrainian Beach Soccer Championship (170 players, 5 sports doctors of teams at clubs and 15 coaches). The research covered three stages of the scientific and pedagogical search.

**The first stage** (June-December 2019) involved the study of scientific, theoretical, and methodological aspects of the problem. A stated experiment was conducted by interviewing respondents to establish possible types of injuries and their causes and determine beach soccer players' physical fitness levels.

**The second stage** (March-September 2020) was aimed at selecting complexes of isometric exercises that would take into account the specifics of the beach soccer game and help prevent injuries by improving players' physical fitness levels.

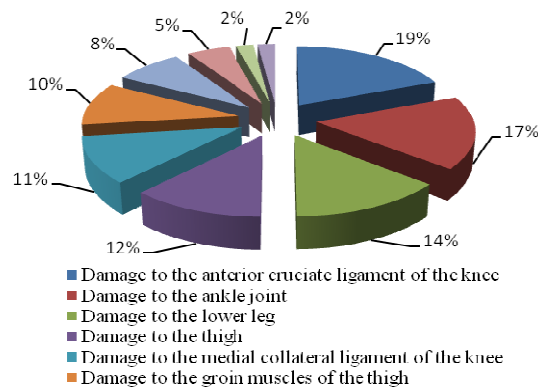
**The third stage** (2020-2021) included a formative experiment to experimentally substantiate the methodology of using complexes of isometric exercises in training sessions to prevent injuries of qualified beach soccer players.

#### **Results.**

The processing of these literary sources allows us to testify that the possibility of injuries in athletes is most often observed during intensive pre-competition training and competitions.

A survey was conducted to determine the types and causes of injuries to beach soccer players and found that about 90% of field players' injuries are to the lower extremities. Conversely, goalkeepers are 75% less injured than field players, and usually, most injuries are of mild severity. Bruises from falls, collisions, blows, and injuries to the hands and wrists characterize them.

As a result, the analysis of the obtained data allowed us to generalize the types of injuries of players in beach soccer, which is presented in Figure 1.

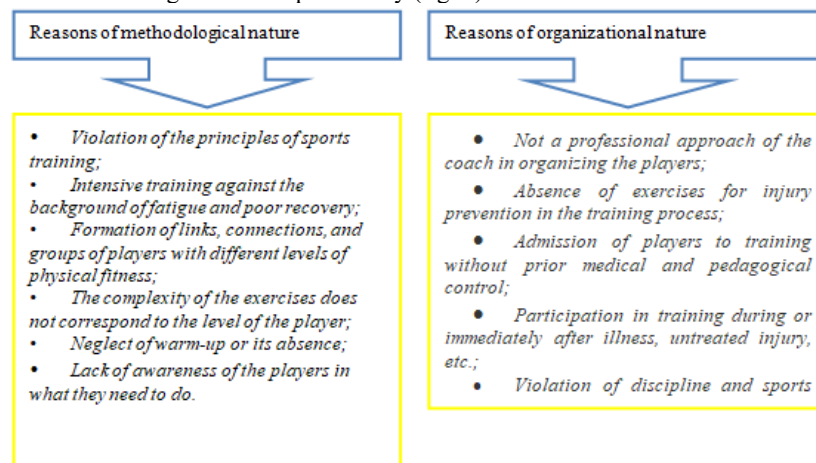


**Fig. 1. Percentage distribution of types of injuries of beach soccer players who played in the Championship of Kyiv and Ukraine during 2019-2021.**

As can be seen from Figure 1, the most common injuries in field players are injuries to the anterior cruciate ligament, which is responsible for fixing the knee joint. The survey showed that these are usually tears or sprains of the ligament. At the same time, a severe damage condition is observed in only 1% of players. Ligament damage in a mild form is observed in 10% of cases. Ankle injuries are the subsequent most common injury among beach soccer players. Usually, the sandy surface on which players play barefoot contributes to frequent sprains and strains of the ankle ligaments. Only 2% of players have a severe injury. Mild damage is observed in 9% of players. Injuries of the lower leg are observed in 14% of players. Damage to the lower leg occurs in direct hits and collisions. Hip injuries occur in 12% of players, of which 2% have severe injuries to the hip joint, and the rest have mild sprains and bruises to the muscles in the front and back of the thigh. The medial collateral ligament, located on the inside of the knee, is injured in 11% of players. Only 1% of players have a severe form of this injury. In 3% - the damage is of moderate severity. In most players, the impairment is mild. The reason for the injury of this ligament respondents called the knee movement during its twisting or a direct blow to the ball. Injuries to the groin muscles of the thigh account for 10% of all injuries. 1% of players suffer severe injuries. Other cases are mild sprains. The cause of sprains or tears of one or more adductor or abductor's muscles is resistance leg movements. According to the survey, beach soccer players' meniscus tear is 8%. 1% of cases are complete meniscus tears.

Like the damage to the medial collateral ligament, the meniscus tear occurs during an incorrect knee movement or a direct hit on the ball. Injuries to the hamstring are in eighth place with a mass share of 5%. In general, there were only sprains of mild and moderate severity. According to the respondents who participated in the survey, no complete rupture of the hamstring was recorded. Damage to the anterior and posterior surface of the thigh occurs in a small percentage of players (2%) and is mild. As a rule, such injuries include sprains of the muscles of the front surface of the thigh during solid blows on the ball and the forces of the back cover of the thigh during maximum acceleration on the sand. As for the goalkeeper's game, injuries occur less than in field players. As seen from the table - these injuries occupy a small share of only 2%. According to the information received, such damages included dislocated fingers, muscle sprains and dislocations of wrist joints, and bruises of shoulders and elbows.

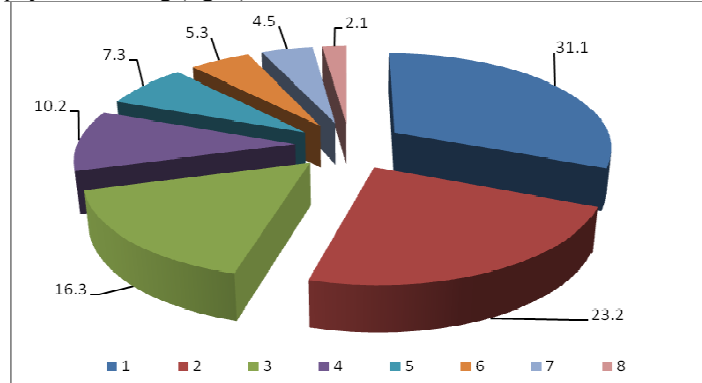
In particular, the survey allowed us to generalize the reasons for injuries by players in beach football. Thus, coaches and sports doctors point to the causes of a systematic character, noting these reasons as a priority factor and motivations of an organizational personality (fig. 2)



**Fig. 2. Causes of injuries of players in beach soccer**

The survey of respondents from beach soccer (coaches, players, doctors, and masseurs of teams) allowed us to analyze and expand the analysis of the functional component of the system of physical training of beach soccer players and move on to the study of the primary measures that affect its effectiveness.

Respondents were offered to define measures of physical training by the degree of importance of influence on the prevention of injuries of beach soccer players. It is established that the most significant measures for the prevention of injuries in players is the use of specific isometric exercises which are organized within the system of physical training (fig. 3).



- 1 - Specific to beach soccer isometric exercises that strengthen muscles, ligaments, increase the level of physical fitness of players and, therefore, contribute to the prevention of injuries;
- 2 - Timely medical and pedagogical control over the level of functional and physical fitness of players;
- 3 - Methodical clarity in the dosage of physical activity that corresponds to the level of fitness of the players;
- 4 - Methodological readiness of coaches to properly and rationally build each training session and the preparatory process in general in order to prevent injuries to players;
- 5 - Injury prevention measures related to the equipment, outfit and condition of the sandy surface of the site;
- 6 - Permanent briefing before the training session on measures to prevent injuries to players;
- 7 - A system of preventive measures for players who feel unwell on the day of training or are involved in training after an illness;
- 8 - Measures to harden the body of players and full recovery.

**Fig. 3. Percentage indicators of the importance of measures in the system of sports training of players for the prevention of injuries in beach soccer (n=190)**

To test the significance of isometric exercises for increasing the level of physical fitness and preventing injuries of beach soccer players, a pedagogical experiment was conducted during one preparatory period. For the purity of the study, experimental and control groups were formed, which included teams whose players had the same level of physical fitness and underwent a medical examination of the musculoskeletal system. In the training of both groups were observed those measures that are shown in Figure 3. However, in the experimental group the emphasis was on the regular use of isometric exercises in the preparatory part for 20-25 minutes between the general and special warm-ups, and in the control group the training process took place in the usual form using traditional exercises.

Finally, the level of physical fitness of players was estimated by the dynamics of indicators of strength, exceptional speed, extraordinary endurance, speed, and power qualities in the experimental group (Table 1) and the control group (Table 2).

**Table 1 Dynamics of indicators of physical fitness of beach soccer players after the use of isometric exercises in the training process (EG n = 40)**

Test exercises		At the beginning of the experiment		After the experiment		t	P
		x	S	x	S		
Static dynamometry, kg	field players	224	1,21	263	1,09	2,28	P < 0,05
	goalkeepers	218	1,06	249	1,01	3,73	P < 0,05
Running 15 m from a standing start, s	field players	2,67	0,02	2,21	0,06	2,43	P < 0,05
	goalkeepers	2,71	0,05	2,36	0,07	2,11	P < 0,05
g 15 m at a run, s	field players	2,21	0,09	1,83	0,04	3,33	P < 0,05
	goalkeepers	2,33	0,06	1,97	0,09	3,12	P < 0,05
Yo-Yo test, m	field players	1220	4,07	1450	3,08	4,77	P < 0,05

	goalkeepers	763	3,26	846	3,12	4,09	P < 0,05
Jump from a place, cm	field players	220,4	1,18	244,5	1,08	2,79	P < 0,05
	goalkeepers	228,3	0,95	251,2	1,01	2,65	P < 0,05

**Table 2**  
**Dynamics of indicators of physical fitness of beach soccer players after the use of isometric exercises in the training process (CG n = 40)**

Test exercises		At the beginning of the experiment		After the experiment		t	P
		x	S	x	S		
Static dynamometry, kg	field players	221	1,09	223	0,89	1,08	P > 0,05
	goalkeepers	217	1,16	220	1,04	0,96	P > 0,05
Running 15 m from a standing start, s	field players	2,62	0,09	2,58	1,01	1,06	P > 0,05
	goalkeepers	2,69	0,07	2,66	0,09	1,23	P > 0,05
Running 15 m at a run, s	field players	2,22	0,06	2,19	0,12	1,35	P > 0,05
	goalkeepers	2,30	0,16	2,28	0,09	1,66	P > 0,05
Yo-Yo test, m	field players	1224	4,12	1239	5,04	1,02	P > 0,05
	goalkeepers	766	3,15	770	4,12	1,05	P > 0,05
Jump from a place, cm	field players	219,1	0,18	221,5	0,07	1,15	P > 0,05
	goalkeepers	229,8	0,05	232,2	0,08	1,18	P > 0,05

The obtained data allowed us to compare the indicators of physical fitness of players of the experimental group (EG) (where isometric exercises were used in training) and players of the control group (CG) (where isometric exercises were not used), which is presented in table 3.

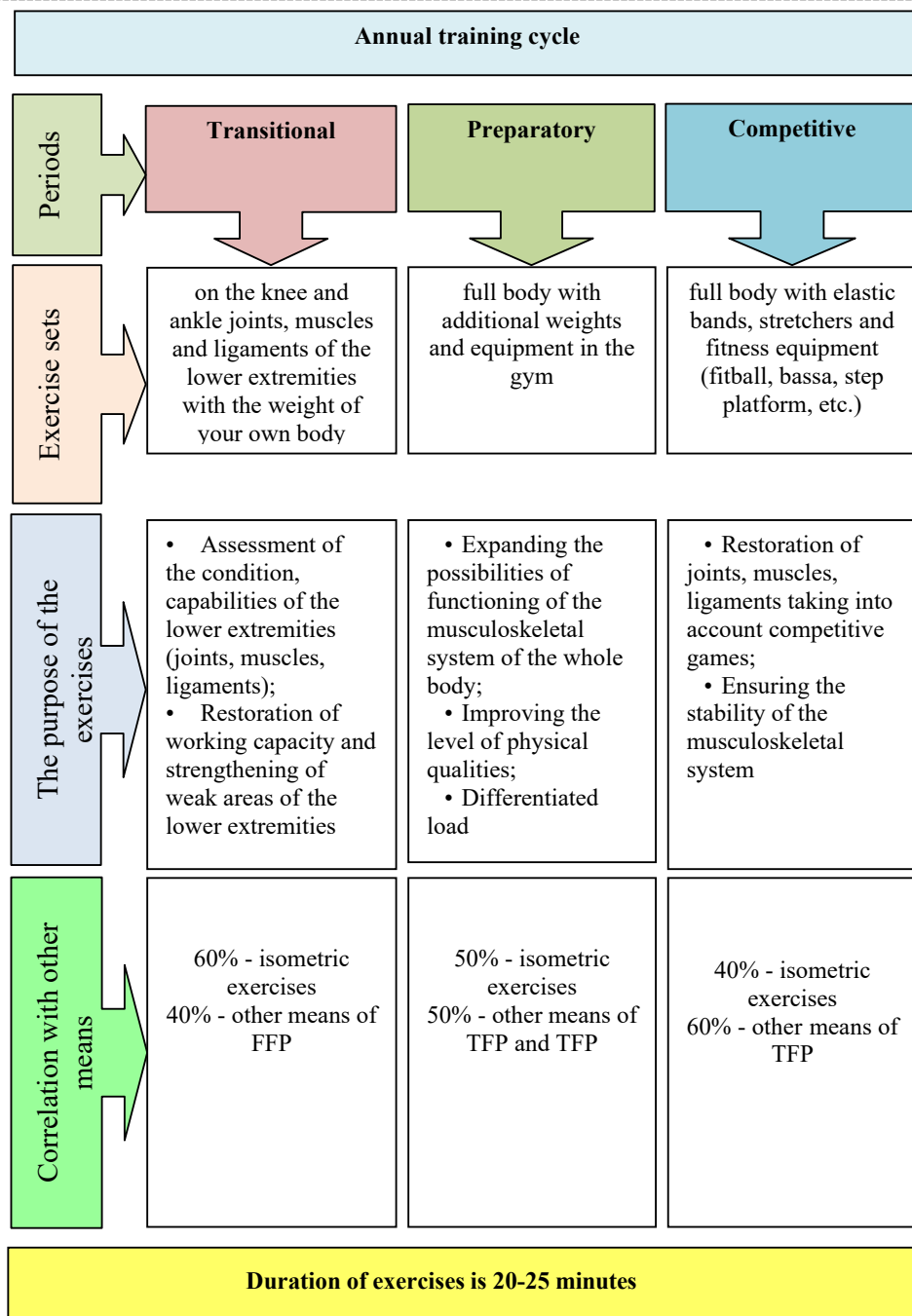
**Table 3**  
**Comparative characteristics of physical fitness of players of the experimental group and players of the control group after the experiment**

Test exercises		EG		CG		t	P
		x	S	x	S		
Static dynamometry, kg	field players	263	1,09	223	0,89	2,28	P < 0,05
	goalkeepers	249	1,01	220	1,04	3,73	P < 0,05
Running 15 m from a standing start, s	field players	2,21	0,06	2,58	1,01	2,43	P < 0,05
	goalkeepers	2,36	0,07	2,66	0,09	2,11	P < 0,05
Running 15 m at a run, s	field players	1,83	0,04	2,19	0,12	3,33	P < 0,05
	goalkeepers	1,97	0,09	2,28	0,09	3,12	P < 0,05
Yo-Yo test, m	field players	1450	3,08	1239	5,04	4,77	P < 0,05
	goalkeepers	846	3,12	770	4,12	4,09	P < 0,05
Jump from a place, cm	field players	244,5	1,08	220,5	0,07	2,79	P < 0,05
	goalkeepers	251,2	1,01	223,2	0,08	2,65	P < 0,05

Comparing the physical fitness results for the specified test exercises in Table 3, it was found that EG players significantly outperformed CG players in all indicators (P < 0.05).

According to our hypothesis, improving the level of physical fitness of players who used isometric exercises in their training should be accompanied by an improvement in the condition of the muscles and ligaments of the body of athletes.

To test the hypothesis, we developed a complex methodology of isometric exercises application in the process of annual training of beach soccer players, which provided for the prevention of injuries in the experimental group (Fig. 4). Players of the control group continued to be engaged in the usual form of training during the whole annual cycle of preparation.



**Fig. 4. Methods of application of isometric exercises in the annual cycle of training to prevent injuries in the process of preparation of beach football players**

This methodology was based on the complexes of isometric exercises developed by us, which took into account the specifics of beach soccer and were used throughout the entire annual cycle of training players.

Thus, in the transition period, the selection of isometric exercises was carried out by the level of physical fitness and the state of the musculoskeletal system of players after the end of the competitive period in the season. The performance of the formed complex of isometric exercises began after a week's rest. It gave workers an emphasis on the lower extremities using only the weight of their bodies. It was a one-time training with a small amount of load. The duration of this period was 3 weeks.

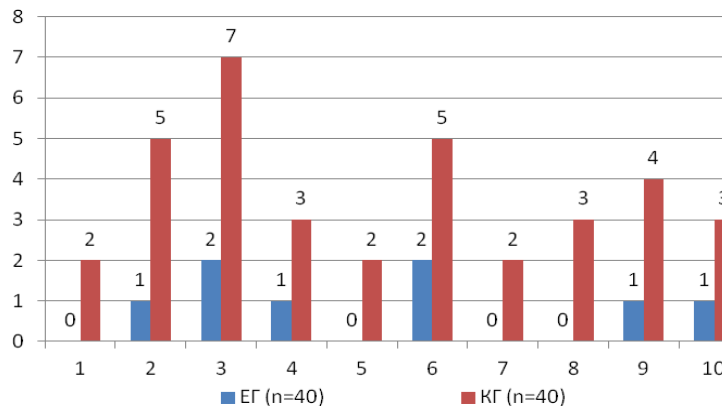
In the preparatory period, which lasted 4 months, the complexes of isometric exercises were selected, taking into account the peculiarities of physical, technical, tactical, and pre-competitive game training. The classes were held with an emphasis on the use of isometric exercises for the whole body with weights and additional equipment in the gym.

The defining moment of the competitive period was the optimal selection of a set of isometric exercises based on the load received by the players during the games to prevent their injuries. The activities were performed without weights but with elastic bands, stretchers, and fitness equipment (fitball, bass, step platform, etc.).

Particular attention in the information received was focused on the pre-competition stage and the competitive period, where the possibility of injury is the greatest. As a result, data on the number of players' injuries were obtained, presented in Figure 5.

The data obtained indicate a smaller number of injuries of EG players compared to CG. In addition, by the nature of the injuries, EG players' injuries were mild in contrast to CG players, whose injuries were primarily severe.

The survey of EG players during training and competitions should also be noted, who indicated an increase in muscle tone, tendon strength, and ligaments and confirmed the reduction, and sometimes absence, of pain in the back and joints of the lower extremities.



1 - Damage to the anterior cruciate ligament of the knee, 2 - Damage to the ankle joint, 3 - Damage to the lower leg, 4 - Damage to the thigh, 5 - Damage to the medial collateral ligament of the knee, 6 - Damage to the groin muscles of the thigh, 7 - Meniscus rupture, 8 - Damage to the hamstring, 9 - Damage to the front and back of the thigh, 10 - Damage to the shoulders, wrists, hands of goalkeepers

**Fig. 5. Comparative analysis of injuries in EG and CG players (at the end of the 2019-2021 competitive season)**

## Discussion.

Analysis of literature sources on the system of sports training, familiarization with the content of textbooks and manuals (Anikienko L. V. 2020; Blienkendaal S. 2022; Constantine, E., Taberner, M., Richter, C., Willett, M., & Cohen, D. D. 2019; Denisovets, A. P. 2021; Kozina, J. 2018; Lacasse, D. 2021; Movchan, V. P. 2018; Ostrokon, A. V. 2020; Panchuk, T.

M. 2013; Stepanenko, O. S. 2019; Kostiukevych, V. M. 2014; Platonov V. N. (2015) allows asserting that today there is not enough educational and methodical material to prevent sports injuries of players taking into account the specifics of beach football. That is why searching for ways to optimize knowledge and approaches to avoiding sports injuries of players in beach football is actual.

The analysis of the works of several authors (Anikienko L.V. 2020; Kerman, M. & other authors 2018; Kozina J. 2018; Kupreienko, M. 2020; Protenko, K.V. 2016; Stepanenko, O.S. 2019; Constantine, E. & other authors 2019) on the study of the system of training athletes, showed the existence of an approach to injury prevention based on the use of isometric exercises in the training process.

Taking into account the offered approach, using prevention of traumatism of beach football players, we have created a technique of application of isometric exercises, complexes of which, in our research, were checked experimentally in EG and CG.

As a result, it can be stated that the positive dynamics of physical fitness indicators, the reduction of injuries of EG players, and the results of the survey of athletes confirm the high efficiency of the proposed methodology of using isometric exercises to prevent injuries of beach soccer players.

The positive results of our study allowed us to complement the achievements of other studies on this issue (Constantine, E. & other authors, 2019; Filyh, M. M., & Alaneyi, A. M. 2019; Kupreienko, M. 2020; Protenko, K. V. 2016; Yavtushenko P. V. 2020).

Using isometric exercises in beach soccer with the help of our proposed methodology will help prevent injuries and improve the sports training of players in the annual cycle of training and competition.

## Conclusions.

The scientific and methodical literature analysis showed that the current state of affairs in the sports training of beach soccer players requires a purposeful search for effective means and methods of educational and training work. It was found that scientists and sports specialists consider isometric exercises to be one of the effective means of preventing injuries in athletes. However, this question still needs to be studied in beach soccer players' sports training system.

The survey of respondents from beach soccer (coaches, players, doctors, and masseurs of the teams) allowed us to determine that isometric exercises are essential to increase physical fitness and prevent players' injuries.

It is established that due to the use of isometric exercises in the training process of beach soccer players, there was a significant increase in physical fitness ( $p < 0.05$ ).

The obtained results allowed us to develop a methodology for using isometric exercises to prevent injuries to players, taking into account the specifics of beach soccer.

The effectiveness of the method of application of the complex isometric exercises, under which there were positive changes in the indicators of physical fitness and reduction of injuries of the players of the experimental group in beach soccer, was substantiated.

Further research on this problem will be aimed at conducting a comparative analysis of the technical and tactical performance of competitive teams with different injury levels in beach soccer.

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