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ASSESSMENT OF THE IMPACT OF PHYSIOTHERAPY ON THE FREQUENCY OF INJURIES IN TENNIS

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Abstract

Introduction and purpose of the study: Participation in competitive sport is associated with the risk of sports injuries, micro-injuries and overloading the musculoskeletal system. Among the sports considered traumatizing, apart from contact games, which tennis is among the leaders. According to many authors of scientific papers in which the topic of searching for appropriate solutions aimed at preventing and thus reducing injuries in tennis players is discussed. There is a consensus on the need to implement appropriate medical training units in the sports training process. Therefore, the aim of the study was to assess the impact of physiotraining on the incidence of sports injuries in young tennis players.
Material and research methods: The research covered a group of 60 girls and boys aged 13-14, training tennis in the clubs of the Podlaskie Voivodeship. Tennis players were divided into two groups: group A (n=30) and group B (n=30). Both groups were characterized by a similar training load (technical and tactical), playing experience and the level of sport. The training plan of the players from group A included physiotraining, while group B did not attend training with a physiotherapist. The research method used in this study was the diagnostic survey method. The research tool was a questionnaire containing questions about playing experience, tennis training load and other types of physical activity. The next part of the survey contained questions about the players' health, possible injuries, micro-injuries and their occurrence. Each respondent also answered questions that provided information on the actions taken to prevent injuries.
Results: The number of injuries before the start of tennis training in both groups was at a similar level. In group A it was 6.67%, and in group B it was 13.33%. Over five years of systematic tennis training and active participation in tennis tournaments, 23.33% of all sports injuries were recorded in group A, which is an increase of 16.66% in relation to the pre-training state. On the other hand, in group B, 60% of all overloads and sports injuries were recorded throughout the training period, which is an increase of 46.67%.
Conclusions: The group of tennis players whose training plan included physiotraining was less sensitive to sports injuries. In turn, a group of tennis players not covered by medical training showed increased occurrence of sports injuries. In order to ensure the optimization of the training process for young tennis players, physiotraining should be implemented, as it reduces the risk of sports injuries.

Key words: tennis, physiotherapy, sport injuries

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Introduction

Modern competition in tennis is characterized by an increase in the speed and energy required for the game. Matches have definitely been gaining momentum, as an offensive style of play is preferred. Players from the top ATP and WTA ranking lists present a high level of physical fitness, enabling them to constantly move, make sudden directional changes , rapidly break and accelerate with simultaneous precision of the strokes [1, 2].

Currently, competitive tennis places more and more demands on tennis players. This is caused by the use of modern technologies in the production of tennis rackets, as well as the introduction of training solutions that increase the accuracy and speed of strokes. Specialists in the field of biomechanics of the musculoskeletal system point out that modern tennis requires more energy, mainly on the kinematic chain, which is the trunk--hips-knees-feet. Experts dealing with the analysis of the movement of a tennis player notice a significant increase in the acceleration of torsional movement within the torso and hip girdle. Therefore, along with the change in the biomechanics of tennis strokes, changes should be made in the training process that prepares the player for the physical effort undertaken during tournaments. Trends in tennis, as well as the progress observed in the development of technology used in sport, mean that the appropriate level of preparation of players at the early stage of professional training is of key importance in minimizing sports injuries [3, 4, 5, 6].

It should be noted that developmental trends and sports progress observed in competition on the court contribute to an increased risk of sports injuries. The increased susceptibility of athletes to injuries requires the need to introduce physioprophylactic programs aimed at minimizing the number of overloads and incidents related to sports injuries [7, 8, 9].

An important aspect in training is comprehensive and comprehensive preparation of the player. The main element is to work on core stability, i.e. the stability of the center that is responsible for the capacity of the deep muscles of the trunk working with the osteoarticular and ligament system. Maintaining a balance between agonists and antagonists is the key to maintaining the correct position of the body in statics as well as in dynamics. Muscle imbalance in this element can lead to muscle overload and, at a later stage, to injuries. The proper development of biomechanics of the player's movements in the current, dynamic tennis is the basis for safe practice of this sport [8, 9, 10].

The definition of physioprophylaxis includes physiotherapeutic procedures, which consist in slowing down, counteracting, inhibiting or limiting the adverse effects of an unhealthy lifestyle, involuntary changes and diseases. It popularizes physical activity, health education and functional diagnostics, which minimizes the risk factors of undesirable diseases of the musculoskeletal system and lifestyle diseases [11, 12, 13].

Physioprophylactic activities play a significant role in tennis. The acyclic nature of the game, short breaks for regeneration, and the lack of a longer period of detraining require excellent motor preparation from the player, which consists of strength and endurance. It is the degree of their development that affects the speed of movement, reaction time, motor coordination of the player and the efficiency of energy systems (ESD - Energy System Development) [3, 7, 10].

Physiotherapy prophylaxis can be used by tennis players, both at the professional and amateur level. It includes preventive measures before and after physical exercise. Elements of physioprophylaxis may include exercises performed before the actual physical effort (jogging, dynamic stretching, mobilization and manipulation of joints, taping and stabilizers). They are designed to increase the temperature of the muscles, prepare them for increased work and improve the range of joint mobility, which reduces the potential risk of injury. Activities performed after physical activity, e.g. massage, static stretching, foam rolling, cooling baths are also important elements. Due to this, we accelerate the physiological processes of muscle and joint regeneration, and as a result, the athlete is able to return to his availability faster [12, 13].

Systematically conducted physiotraining will contribute to improving the efficiency of deep torso muscles, will improve proprioception, and will solve the problem of possible muscle imbalance. Working comprehensively, you gain a tennis player characterized by excellent neuromuscular sensation, performing undisturbed movement patterns, characterized by impeccable precision and purposefulness of movements. Such feeling of one's own body in space and work in the physiological ranges of joint mobility will definitely contribute to minimizing the risk of overloading and sports injuries while playing on the court [2, 3, 6].

The methods of work used during physiotraining use work in closed kinematic chains rather than in open ones, where the final link is in contact with the ground or is stabilized. The training includes sensorimotor exercises on an unstable surface in the form of sensorimotor pillows, shapes, bosu, fitness balls, platforms or trampolines [3, 5, 6].

Another, commonly used method of working on improving the deep stabilization of the trunk and building correct movement patterns is the S-E-T method according to Master Therapy.

In the application of exercises, the principle of gradation of difficulty is applied. Initially, exercises in isolation positions and static training are applicable. After mastering the basic tasks, the physiotherapist makes the exercises more difficult by using dynamic training. In the final stage of the exercises according to Master Therapy, dynamic training is started on an unstable ground and with movements of the lower and upper limbs [3, 4, 5].

The aim

The aim of the study was to obtain knowledge about the impact of physiotraining on the frequency of injuries in tennis.

Material and methods

The research covered a group of 60 girls and boys aged 13-14, training tennis in clubs in the Podlaskie Voivodeship. All respondents had professional licenses of the Polish Tennis Association (PZT), and were currently playing in the Youth age category. The training loads of the study group were in accordance with the PZT recommendation. Girls and boys practiced tennis 4-5 times a week, 1.5 clock hours each. Tennis players were divided into two groups. Group A (n=30) was covered by physioprophylactic activities, and group B (n=30) did not attend training with a physiotherapist.

No accelerated biological development was found in the study group (percentile charts according to Łaska-Mierzejewska).

A questionnaire recommended by the Podlaski Provincial Tennis Association was used for the study. The survey included questions about playing experience, tennis training load and other types of physical activity, and provided information on the number of tennis tournaments played. The next part of the survey contained questions about the players' health, possible injuries, micro-injuries and their repetition. Each respondent also answered questions that provided information on the actions taken to prevent injuries. In group A, physiotraining was systematically introduced once a week. The physiotherapist worked according to an annual training program aimed at a systemic approach to prophylaxis in tennis. Progress was monitored by the use of sensorimotor tests to check the proprioception of the joints of the upper limbs, lower limbs and trunk.

Results

The first part of the survey contains questions about the training load of the players, collected information characterizing both groups (including the gender of the respondents, training experience). The information gathered is presented below in Figures 1-13.

The characteristics of the study group, taking into account the gender of the respondents, are presented in Figure 1.

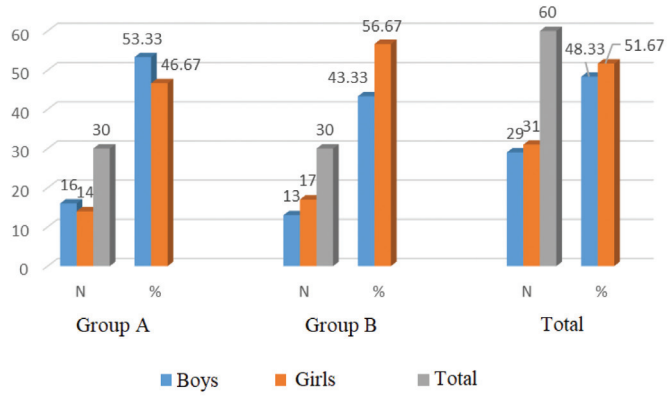

Fig. 1: Characteristics of the surveyed group, taking into account the gender of the respondents.

Among the respondents there were 29 boys (48.33%) and 31 girls (51.66%). There were 16 boys and 14 girls in group A, 13 boys and 17 girls in group B.

The respondents were asked a question about the training experience. Looking at Figure 2, it can be seen that 90% of the surveyed tennis players in group A declared training experience over 5 years, and 10% of the surveyed tennis players in group A trained for 4 years. In the case of group B, the training experience was 5 years or more for 93.33% of the respondents and 4 years for 6.67% of the respondents.

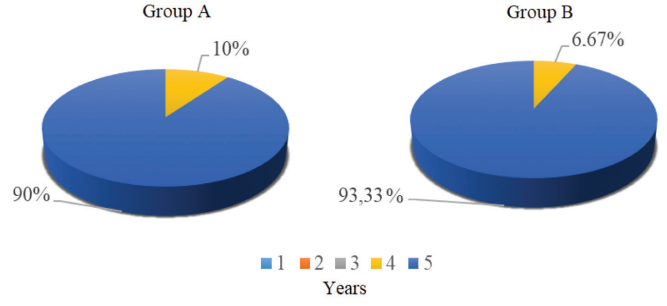

Fig. 2: Training experience.

The players were asked a question about the time load of tennis training shaping the technical and tactical elements on the court. Group A in 76.67% was subjected to a training load of 7 hours per week, the rest of group A 5-6 hours, i.e. (23.33%). Group B also mostly answered 7 hours and more in 93.33%, and a much smaller part in 5-6 hours, i.e. 16.67%. This is illustrated in Figure 3.

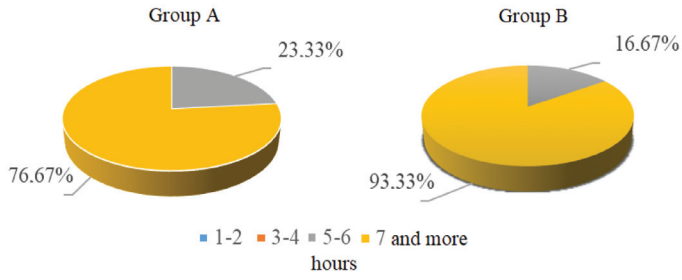

Fig. 3: Weekly training time of tennis players.

Group A stated that 50% of time was devoted to general development training, which shapes fitness and coordination motor skills, it was a weekly training of 1-2 hours and 3-4 hours. For comparison, group B, similarly to study group A, uses general development training in 56.67% for 1-2 hours and 43.33% for 3-4 hours a week (Figure 4).

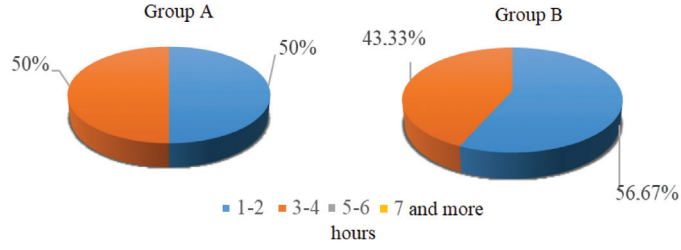

Fig. 4: Weekly time devoted to general development training.

Apart from tennis, the students also practiced other sports (Figure 5). In group A, people practicing additional discipline accounted for 80%, and people training only tennis accounted for only 20%. Group B Group B were also playing another sport 73.33% said yes, and 26.67% said no.

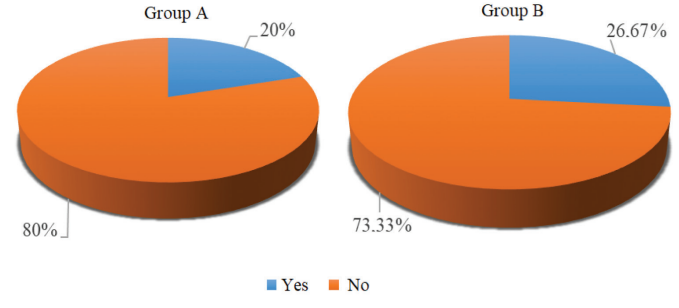

Fig. 5: Practicing other sports.

The data in Figure 6 illustrate that the most popular additional sport in group A was swimming (50%), followed by karate, football and basketball (both 16.67%). For comparison, in group B swimming was also the most popular answer 50%,, followed by karate with 25% support and 12.50% each for football and basketball. It can be concluded that the leisure time physical load of both groups was very similar.

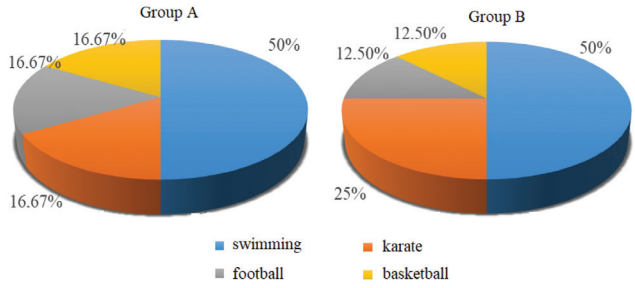

Fig. 6: Other sports disciplines practiced by tennis players.

All respondents took part in tennis tournaments, which clearly indicates that respondents from groups A and B are at a similar level of training and regularly participate in tennis tournaments (Figure 7).

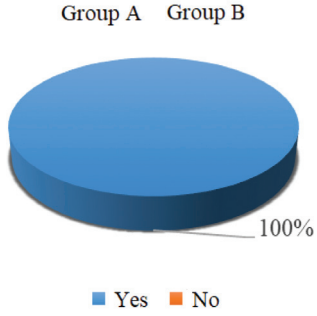

Fig. 7: Declaration of participation in tournaments.

Figure 8 illustrates the tournaments of which rank the respondents participated in. In both groups, starts in tournaments at the provincial and national level prevailed, in group A 86.67% and in group B as much as 90%. The rest of the students limited their starts to local games. It follows that both groups were at a similar level of sports advancement.

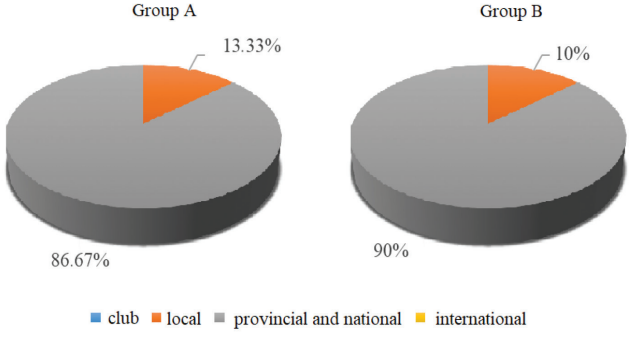

Fig. 8. Rank of tennis tournaments.

In the case of group A competitors, the smallest number of starts, 10 and more per year, was indicated by 33.33% of the respondents. 66.66% of group A members participated in 5-10 tournaments a year. In group B, the largest number of respondents played in 5-10 tournaments a year, 73.33% of the group. More than 10 tournaments a year were played by 26.66% of players. Both groups were very similar in terms of the number of starts in competitions, as shown in Figure 9.

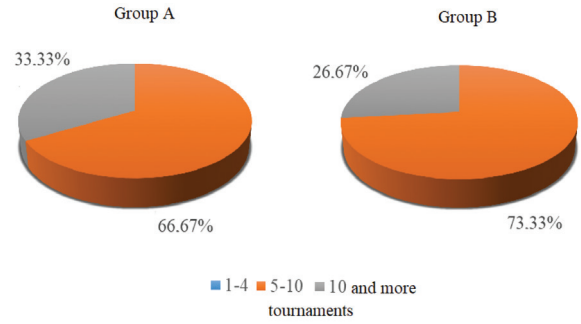

Fig. 9. Number of starts in tennis tournaments during the year.

The data collected from the first part of the survey definitely confirm that both study groups showed a similar level of training advancement.

The next part of the survey concerned the acquisition of information on tennis players' injuries both in the period before the start of tennis training and during the start of tennis training.

Among the players, a classification of injuries, contusions and micro-injuries suffered before and during tennis training was carried out.

In group A, 93.33% of the subjects did not suffer any injuries before attending tennis training, the result was also similar in group B, 86.67%.

Starting to practice tennis significantly increased the injury rate in group B from about 13% to 60%. A slight increase in injury rate can be observed in group A from 6.67% to 23.33%.

The type of injuries sustained before and during tennis is presented in Table I. Injuries suffered before the start of tennis training concerned the following areas: wrist joint, ankle joint, knee joint, hip joint and trunk area. Group B turned out to suffer more injuries 67%, while group A had less - 33%.. During training in 2014-2022, the number of injuries in group B increased to 72% and affected more places susceptible to injuries. Injuries suffered during tennis training affected the following areas: wrist joint, ankle joint, knee joint, hip joint and spine. The size of the injuries concerned pain, strain, inflammation in the joint and spin.

Tab. I. Suffered sports injuries, including the area before the injury and during tennis training.

AREA OF INJURY		Before starting tennis training	During tennis training					
			2018	2019	2020	2021	2022	Razem
Wrist joint	R	-	2	-	2	-	-	4
	L	2	-	-	-	-	-	-
Elbow joint	R	-	-	1	-	1	-	2
	L	-	-	1	-	2	2	5
Shoulder joint	R	-	-	1	2	1	-	4
	L	-	-	-	-	-	-	-
Ankle	R	1	1	-	-	-	2	3
	L	2	-	-	-	-	-	-
Knee-joint	R	-	-	-	1	1	-	2
	L	-	-	-	1	-	-	1
Hip-joint	R	-	-	-	-	-	-	-
	L	-	-	-	-	-	-	-
Spine cervical section		-	-	-	-	-	-	-

thoracic section	-	-	-	-	-	-	-
lumbar region	-	-	-	1	1	-	2
Other	1	-	-	1	1	-	2
Total	**6 (100%)**	**3**	**3**	**8**	**7**	**4**	**25 (100%)**
Group A	**2 (33%)**	**1**	**0**	**3**	**3**	**0**	**7 (28%)**
Group B	**4 (67%)**	**2**	**3**	**5**	**4**	**4**	**18 (72%)**

Figure 10 presents the areas of injuries suffered before and during tennis training among all respondents. In injuries before training, the area of the ankle joint was dominant (50%), followed by the wrist joint (33%) and others (17%), in this case it concerned the fracture of the fifth finger of the left hand. Among the injuries sustained during tennis training, the following were the most common: the elbow joint (28%) and the wrist joint with the shoulder joint (16% each). An increase in the trauma rate was noted within the knee joint (from 0% to 12%). There were also symptoms characteristic of this sport discipline, such as pain in the lumbar region (8%). Other injuries were classified as insignificant - 8%.

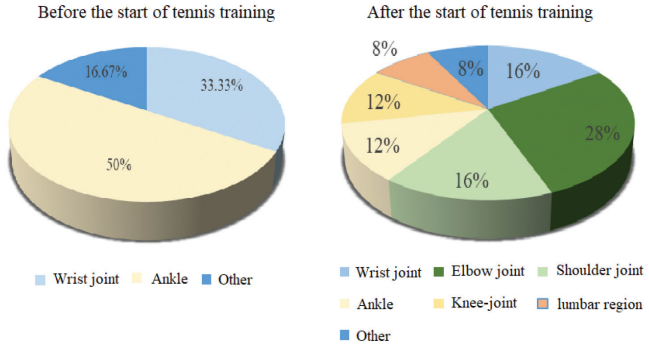

Fig. 10. Areas of injuries suffered before and during tennis training among all examined tennis players.

The number of injuries consulted with a specialist is shown in Figure 11. It shows that only 16.67% of group A required reporting to a medical facility, while in group B it was as much as 50% of all injuries in this group.

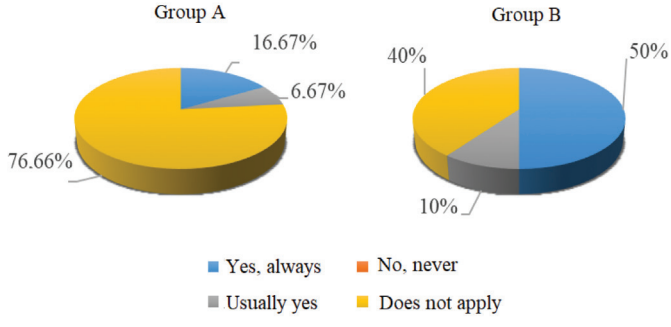

Fig. 11. The number of injuries consulted with a doctor among all examined tennis players.

Injuries in most cases required stopping training for the period of convalescence. In group B, 43.33% of injuries required a break in training, and in group A it was only 16.67% (Figure 12).

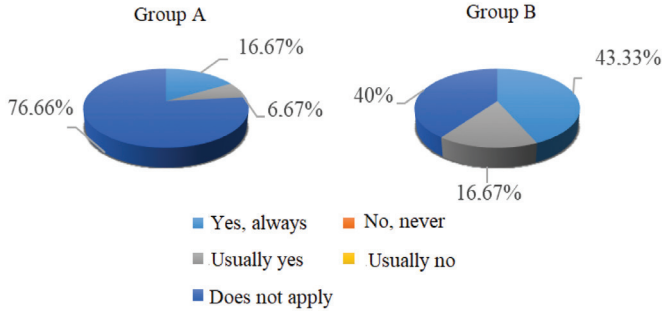

Fig. 12. Interruptions in training caused by an injury.

In the case of injuries, the time of break from participation in training in group A was the shortest: 1 month for 10% and less than 1 month reported by 13.33%. On the other hand, 76.67% of the remaining respondents did not have this problem.

For group B players in 20% a training break was not necessary. Other interruptions lasted less than 1 month for 20% and 1 month also supported by 20% (Figure 13).

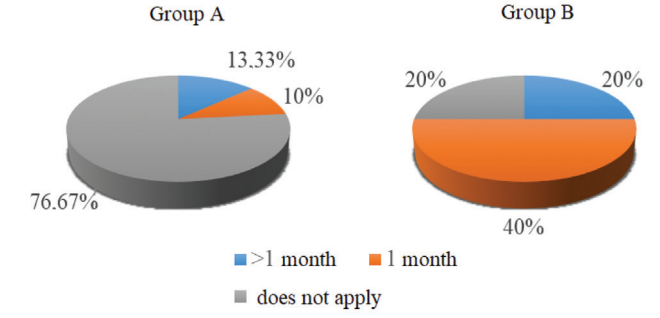

Fig. 13. The length of the training break caused by the injury.

There were also repeated injuries, especially when they were not fully healed. Only 10% of group A, and 23.33% of group B were injured in the same body region. The rest were not re-injured, as shown in Figure 14.

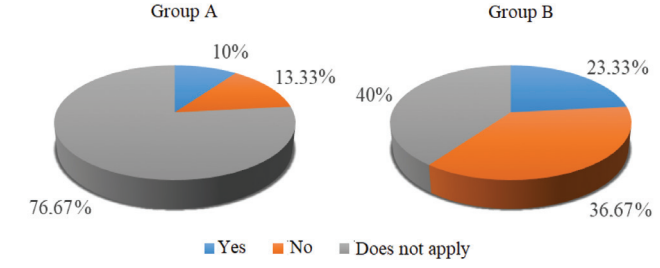

Fig. 14. Renewing injuries.

The area of renewed injuries concerned mainly overloads: wrist joints, sprains of the ankle joint, or inflammation of the Achilles tendon.

The players were also asked whether warm-ups are performed before training. For comparison, in both groups, both A

and B, a warm-up is performed before starting the main training or tournament game on the court.

The difference is in the length of the warm-up. In group A, 43.33% need up to 20 minutes of warm-up, and 23.33% need up to 30 minutes, and few need more than 30 minutes of warm-up (13.34%). Group B gets into the game faster and spends less time warming up before class. 36.67% of participants in group B warm up up to 20 minutes, 13.33% up to 30 minutes and 3.34% over 30 minutes of warm-up (Figure 15).

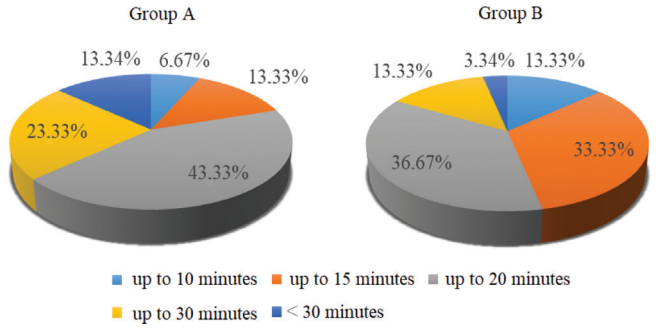

Fig. 15. Amount of time spent warming up before training.

The trainees were also asked what activities they perform during the warm-up. Respondents could choose several answers from all available in the survey. The most frequently indicated answers at the level of 100% in group A were mobilizing, running, shaping exercises as well as mini games and activities. Group B used running and shaping exercises as well as mini tennis games at the same level. Other types of warm-up activities used by players are shown in Figure 16.

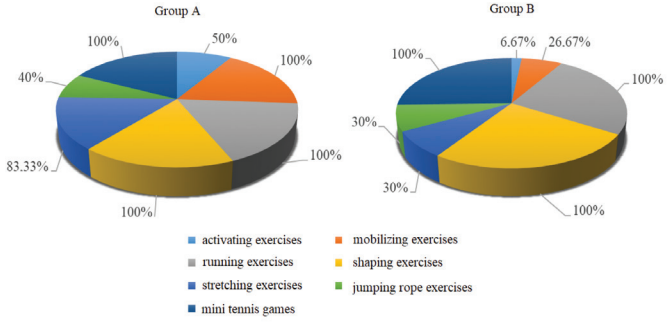

Fig. 16. Actions taken during the warm-up.

Discussion

The activity of athletes, especially at the professional level, can cause various types of sports injuries. The intensity of this phenomenon is so common that it is sometimes said that professional sport is a kind of „breeding ground" for injuries and overloads of the musculoskeletal system [3, 5]. However, it cannot be assumed that only competitive athletes are at risk of injury. There are diseases of the musculoskeletal system that are associated with the lack of movement or sedentary lifestyle [3, 4, 14].

In tennis players, the shoulder, knee and elbow joints are most exposed to overload, followed by the athlete's spine, because these areas of the body are asymmetrically loaded during training [7]. Studies by Presta have shown that in approximately 50% of athletes, initially cyclical and then chronic shoulder disease is caused by unnatural and frequent overhead movements performed during strike training. On the other hand, Williams noted a high frequency of knee osteochondromalacia, knee synovitis, and knee cartilage damage [8]. These injuries in adult players require breaks in training, as well as appropriate treatment and rehabilitation.

In the group of young tennis players, the severity of injuries was slightly varied. Screening studies conducted on German 10-12-year-olds have shown that large problems with asymmetric muscle development lead to many postural defects, namely scoliosis. In young tennis players, overload injuries of the spine and muscles predominate - 52%, sacroiliac joint injuries - 30% and injuries of the articular process - 9% [16].

Słoniewski draws attention to the problem of asymmetry in sport, specifically in sport archery but also in other sports, that every person has innate preferences to use the limbs of one side of the body to a large extent, the so-called dominant limbs. According to the authors, these include such disciplines as tennis, table tennis, badminton, and among the disciplines that require the use of more specialized equipment: archery, vaulting, javelin throwing and shooting. Concentric and eccentric work performed by the muscles of the upper limb leads to asymmetric development of the shoulder girdle, which is the result of the adaptation of the fibers to the increased load, and as a result, the appearance of disproportions and impairment of the capacity of the shoulder joint.

An analysis of own research conducted on a group of 60 young tennis players practicing tennis showed the occurrence of contusions and injuries. The most common traumatic areas in both groups were: ankle, knee, elbow and shoulder. Occasionally there were overloads of the wrist joint and pain in the lumbar section. There were also fractures of the phalanges of the hands and overloading of the Achilles tendon. The respondents distinguished their injuries before the start of tennis classes, and injuries acquired during training. The purpose of this division was to observe the evaluation of injuries in the group attending classes with a physiotherapist and in the group without implemented physioprophylaxis activities. The number of injuries to the body area before the start of training in both groups was at a similar level, in group A it was 6.67%, and in group B it was 13.33%. The situation changed dramatically when the respondents began to participate in tennis training. The injury rate in group A increased to 23.33%, while group B recorded a significant increase, up to 60%. It is worth noting that 67% of the injuries and contusions of the musculoskeletal system concerned the training group without the supervision of a physiotherapist. By comparison, the physio-training group had a score of 33% of all injuries. The number of injuries sustained during training was much higher and involved a larger number of body areas among group B (72% of all injuries). However, in group A, the start of tennis training together with physiotraining reduced the percentage of injuries (28% of all injuries). The magnitude of the injury was mainly related to pain due to peripheral joint overload, muscle strain and ankle sprain.

The injuries acquired require interruption of training. In group A, 16.67% of injuries required rest during training, compared

to 43.33% of cases in group B. Thus, it can be concluded that injuries in the group without physiotraining are more serious. This situation is determined by the implementation of rapid diagnostics and treatment, and at a later stage of preventive measures in order to quickly return to sport in group A.

The research shows that group B suffers more injuries, because it does not carry out activities aimed at strengthening the ligament and muscle system, which would have improved the stability and feeling of the body. An important element is the education of young tennis players on the prevention of injuries and possibly their treatment (application of the PRICE principle). The body at those developmental age requires daily physical activity, which is conducive to harmonious development, health promotion and shapes the player's character, which affects his approach to health care in the future.

In modern sport, the essence of sports competition is the pursuit of maximizing results. In addition, the intensive training process also contributes to the risk of injury. The number of injuries in the sport of that time is constantly increasing. Therefore, there is no doubt that the most important is the prevention of injuries, the provision of professional first aid, and then appropriate treatment and rehabilitation [9, 14, 15, 17].

There is a consensus in the tennis injury literature on the need to incorporate appropriate exercise into training programs to prevent sports injuries. However, it has not been definitively established which exercise routine is most effective. Królak emphasizes that due to the growing number of injuries in modern tennis, it is necessary to prepare and implement an effective tennis training program with a physiotherapist at the early stages of training. Professional proprioceptive training, which improves joint stability and motor sensation, will reduce the number of sports injuries, while allowing the player to maintain training continuity [1, 2, 5, 6].

After a year of work with thirty tennis players training in clubs in the Podlaskie Voivodship, the positive effects of the methods used as part of physiotherapy training can be noticed. It can be said that the physiotherapeutic training included in the training program for juvenile tennis players is extremely valuable for the health of a young athlete and will bear fruit in the subsequent years of his sports career. It will certainly help maintain the continuity of the training process and ensure survival in modern sport.

Conclusions

1. The group of tennis players covered by the physiotraining program was less sensitive to sports injuries.
2. A group of tennis players not undergoing training with a physiotherapist showed increased sensitivity to sports injuries.
3. In order to optimize the process of training young tennis players, medical training with a physiotherapist should be implemented, as it reduces the risk of sports injuries.
4. Athletes covered by the physiotraining program are characterized by a higher awareness of pro-health behaviors aimed at preventing injuries in sport.

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