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DOROBAT SIMONA ELENA

**RECOVERY OF JUNIOR HANDBALISTS AFTER SHOULDER INJURIES
THROUGH KINETOTHERAPEUTIC MEANS**

Specialty: 533.04. Physical education, sport, physiotherapy and recreation

SUMMARY

the doctoral thesis in educational sciences

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Composition of the Commission for public defense of the doctoral thesis:

- 1. BUFTEA Victor**, doctor habil. of pedagogical sciences, university professor, State University of Physical Education and Sports – chairman of the commission
- 2. RACU Sergiu**, doctor in pedagogical sciences, associate professor, State University of Physical Education and Sport – scientific coordinator
- 3. AGAPII Eugeniu**, doctor in pedagogical sciences, associate professor, State University of Physical Education and Sport – official reference
- 4. ABĂLAȘEI Beatrice-Aurelia**, doctor in psychology, university professor, "Al.I. Cuza" University of Iasi, Romania – official reference
- 5. VIZITIU Elena**, doctor in pedagogical sciences, associate professor, "Ștefan cel Mare" University of Suceava, Romania – official reference

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The doctoral thesis and the summary can be consulted at the Library of the State University of Physical Education and Sports and on the ANACEC website.

Chairman of the public defence committee

Buftea Victor,

Dr. habil. in pedagogical sciences, university professor

Scientific coordinator

Racu Sergiu,

Dr. in pedagogical sciences, associate professor

Author

Dorobăț Simona Elena

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CONCEPTUAL MARKINGS OF THE RESEARCH

The topicality and importance of the topic addressed is argued by theoretical and practical premises.

The analysis of the specialized literature undoubtedly shows us that shoulder injuries in handball are of substantial interest among researchers, and the increased incidence of injuries forces the deepening of studies on medical recovery, which allow the return to sports activity as quickly as possible, without risks of relapse.

"The Journal of Bone & Joint Surgery" an orthopedic journal highly appreciated worldwide that allocates a significant study to injuries suffered at the level of the shoulder, places great value on research in the field, research carried out by authors with the title of doctor, which does nothing but confirms that in the last 10 years a major leap has been made in improving research and published articles on shoulder injuries. This study, which spanned between 2006 and 2016, precisely aims to analyze current characteristics in shoulder injury research, research based on "evidence-based medicine" (Gartsman, G.M. 2015) [1].

An extensive study carried out in Spain, published in the "International Journal of Environmental Research and Public Health" in 2022, aims to identify, locate and compare the most frequent injuries and injury mechanisms in handball practice. The study was conducted following the PRISMA (Preferred Informed Item for Systematic Reviews and Meta-analysis) guidelines. The source of data collection was the direct consultation of the PubMed and Medline databases and of the 707 studies retrieved, only 27 were considered suitable for review, and formed the basis of the conclusion of this study of high relevance to handball injuries.

It was found that the most frequent injuries in handball players are located at the level of the lower limbs (thigh, knee and ankle), and at the level of the shoulder and hand at the level of the upper limbs. In terms of playing position, athletes who play above the 6m line are most affected by injury compared to female players who are more likely to be injured, and most injuries appear to occur during competition compared to training (Aasheim, C. 2018) [2].

According to the latest data published by the International Olympic Committee (IOC) the injury rate in young players was set between 9.9 and 41.0 injuries per 1000 match hours and between 0.9 and 2.6 per 1000 training hours . In the case of elite senior players, this number is increased due to the occurrence of relapses, old injuries and overuse injuries. As a result, the IOC surveillance system classifies handball as one of the Olympic sports with the highest injury rates (82.2%) (Engebretsen, L. 2012) [3]. This is the reason why prevention, but even more so recovery injuries in young handball players is one of the researchers' priorities at the moment.

In the same sense, Bere T., concluded that 61.4% of injuries were caused by contact between players, the rest were non-contact (15.9%) and overuse (12.1%). However, another study found that

34% of accidents are caused by contact with another player, 2% by contact with the ball and 64% by non-contact (Bere, T. 2015) [4].

In the case of overuse injuries, Aasheim et al. state that this type of injury was higher in male juniors (39%), particularly in the shoulder and knee, finding a higher prevalence in each shoulder separately, over time which knee had a higher prevalence in the sum of both knees (dominant and non-dominant) [2].

Goes R.A. (2020), found that muscle injuries were the most prevalent, followed by joint injuries and finally tendinopathies. Within muscle injuries, the back of the thigh had the highest incidence (27.8%), followed by the shoulder and the anterior thigh (both 15.8%). In joint injuries, the most common were the knee (30.5%) and the ankle (33.3%). In tendinopathies, the knee had the highest incidence (42.9%) followed by the shoulder (33.3%) (Goes R. A. 2020 [5]).

Regarding gender, Akcay N. (2023) in the presented research points out that male players in the age group >18 years had a higher incidence of injury than female handball players in the same age group, there were significant differences in the incidence of injuries between male athletes (32.7%) and female athletes (20.1%), higher recurrent injuries were observed in women (66.7%) than in men (33.3%) (Akcay, N. 2023) [6].

Regarding injuries recorded during competition and training, in the study of Brazilian athletes, a higher number of injuries occurred in competition in female players (56.2%) compared to male players (46.3%), while during training the behavior was reversed (García, D. 2023) [7].

Luig E. (2018) conducts a more thorough study and makes correlations between playing position and mode of injury, finding that pivots (58.4%) and wings (56.9%) are the players with the highest proportion of injuries by the mechanism of direct contact with another player (51.4%), followed by the first line (56.9%) and finally the goalkeepers with 44.4%. Twenty-six percent of injuries are caused by indirect contact, with the front row being the most affected (31.5%). Finally, 22.6% of injuries were non-contact, with goalkeepers having the highest percentage of injuries (48.9%) (Luig, E. 2018) [8].

The degree of research of the problem. In the specialized literature, more attention is paid to the use of prevention means in shoulder traumatology, and less in the direction of improving recovery protocols specially developed and focused on optimizing the recovery plan, taking into account the characteristics of the game practiced, where there are isolated works, and the available literature does not present complete data on the techniques and methods of recovery used with the maximum success rate in case of recovery of shoulder injuries in junior handball athletes.

The actuality of this study derives both from the real situation, characterized by a very large number of injuries among junior handball players, injuries that keep them away from sports life for a long time, or in the worst case can lead to a permanent interruption of sports activity, as well as

from the need to strengthen the efforts of the interdisciplinary team by creating a recuperative program adapted to the current needs of performance sports. The specialized literature and the data to which we had access allow us to state that the actuality and interest in handball in the conditions of the post-industrial society is increasing among young people, and their desire to achieve competitive sports performances leads to a permanent increase of the number of injured athletes both at the competitive level and during training.

Approaching handball in conditions of exceeding the limit of physical resistance, however, sometimes leads to injuries with implications on different levels, and the pressures of the consumer society, determine that the age of those willing to practice handball is getting younger and younger. Faced with such an alternative, the age of puberty of the subjects can constitute the vulnerable side of handball practice with all the traumatological consequences that arise from it.

If we consider the factors predisposing to the installation of shoulder injuries, from the point of view of limiting their impact on the quality of the sporting act, attention must be focused on a group of controllable factors, combined with prevention and recovery programs adapted to junior athletes.

The motivation and premises of the choice of theme. Taking into account the mentioned, the importance of the addressed topic is highlighted by the need to update the results of the studies conducted in Romania, but also in the European context by presenting some modern approaches regarding the kinetotherapeutic recovery of shoulder injuries in junior handball athletes. The increasing number of high-severity injuries suffered by junior handball players and not only has become a global problem, as the demands of modern spectacle-consuming society are ever greater and the risks to which athletes are subjected in the pursuit of the sensational cause them to mistakes that lead to injuries that can keep them away from sports life for long periods of time destabilizing the team or even take them out of the world of performance sports forever.

According to international data, the injury situation in handball has escalated in recent years, thus turning handball into one of the team sports with the highest injury rate, in the last 10 years doubling the number of injuries and increasing their severity, The WHO thus classifies handball as one of the sports with the highest injury rate, respectively 82%.

The purpose of the research consists in the theoretical and experimental substantiation of a complex recovery methodology and the improvement of the kinetic program after shoulder injuries through kinetotherapeutic means.

Research objectives:

1. Analysis of the problem of the recovery of handball athletes after shoulder injuries according to the data from the specialized literature and the analysis of theoretical and methodological approaches regarding its solution.

2. Studying the incidence of handball sportswomen's shoulder injuries, based on the results of their own epidemiological study and comparing these data with official statistics from the country, but also from around the world.

3. Elaboration and implementation of the structure and content of the experimental recovery model adapted for shoulder injuries in junior female handball players.

4. Argumentation of the effectiveness of the experimental model recommended for the treatment of shoulder injuries in junior handball athletes.

Research hypothesis: we assume that the recuperative duration will decrease, if the Experimental Model (ME) will be implemented within the recuperative program, adapted for the recovery of shoulder injuries in junior handball athletes, to increase the level of sports performance and decrease the re-injury rate.

The theoretical significance of the paper consists in expanding the knowledge base of the theoretical-methodical conceptions regarding the methodology for implementing the recovery process addressed to shoulder injuries in junior handball athletes, with the goal of a recovery in the shortest possible time, without pain and an improvement of sports performance that does not lead to re-injury over time.

The scientific problem solved in the researched field results from the results obtained in the thesis, which demonstrate from a scientific and methodological point of view the effectiveness of the use of kinetotherapeutic means in the treatment of shoulder injuries in junior handball athletes.

The applied value results from:

- ✓ Arguing the effectiveness of the special kinetotherapeutic means included in the experimental model adapted for the recovery of shoulder injuries in female handball athletes;
- ✓ The possibility of using the developed model in order to optimize the recovery process and prevent the risk of re-injury;
- ✓ The use of research results in order to improve the qualification of future physiotherapists and last but not least for the purpose of continuous training and education of specialists in the field of medical recovery;
- ✓ Methodological landmarks can be used in the process of developing kinetotherapeutic programs intended for the recovery of shoulder injuries of handball athletes.

Implementation of scientific results.

The content of the Experimental Model adapted for the recovery of shoulder injuries in junior handball athletes was applied, using special combined kinetotherapeutic techniques and means, aimed at shortening the recovery time and reducing the risk of re-injury. It was implemented during

the physical therapy sessions held with the female handball athletes from the "LPS Vaslui" High School and the "Virgil Madgearu Iași" Economic High School.

Summary of the sections of the thesis.

The research is structured in three chapters, one theoretical and two dedicated to the pedagogical study, the work containing annotations (in Romanian, Russian and English), the list of tables, the list of figures and the list of abbreviations, introduction, three chapters, conclusions and recommendations, bibliography, appendices and being perfected on 145 pages of basic text.

In the Introduction, the topicality and importance of the problem addressed, the need for scientific research, the purpose and objectives of the study are formulated, the scientific novelty, the theoretical importance and the applied value of the work are described, related to the results obtained from the experiment.

Chapter 1 of the thesis "Theoretical aspects regarding shoulder injuries in handball and the recovery methods used in their recovery" includes a synthesis of the specialized literature on the incidence of shoulder injuries in handball athletes at the world and national level. Pathogenesis and risk factors that lead to injury in handball athletes are described. Data on the anatomy and physiology of the injured joint are presented, and emphasis will be placed on the important role of the physiotherapist in the interdisciplinary team and of physiotherapy as a basic method in the rehabilitation of shoulder injuries, with the aim of the fastest possible reinsertion of the athlete into competitive life and the prevention of relapses .

In Chapter 2 "Research methods and stages" the basic stages and directions of the study, the research methodology, the inclusion and exclusion criteria that formed the basis of the study group are presented. The survey data of the subjects included in the study were analyzed (DASH questionnaire -Disabilities of Arm, Shoulder and Hand, VAS-Visual Analogue Scale, pain assessment and quantification, shoulder functional balance) which allowed us to formulate the objectives and select the combined kinetherapeutic techniques and means can significantly shorten the recovery period in the case of junior handball athletes, while also increasing the level of performance. After formulating the objectives and establishing the techniques and means, we were also able to appreciate the number of hours required for MEARUH – experimental model adapted to shoulder recovery in handball.

For the assessment of MEARUH, we used a series of methods such as anthropometric, motor, functional and psychomotor tests, being presented the methodology of application and interpretation of the tests used in the battery of diagnosis and determination of the degree of disability.

A significant concern of Chapter 2 is the description of the methodological milestones used in the development of MEARUH – an experimental model adapted to shoulder recovery in handball,

which is centered on stages and phases of recovery with minimal relapse rates, combined with increasing the level of sports performance for LE subjects.

In *Chapter 3 "Argumentation of the effectiveness of the experimental model adapted for the recovery of shoulder instability in junior female handball athletes through special combined kinetotherapeutic means"* the results of the own study are presented with the estimation of the incidence of shoulder injuries in handball at the national and international level. At the same time, a comparative analysis of the functional indices and the level of psychomotor training of the study participants was carried out.

Based on the results obtained, the effectiveness of the Experimental Model implemented for the recovery of shoulder injuries in junior handball athletes was argued.

THESIS CONTENT

THEORETICAL ASPECTS OF SHOULDER INJURIES IN HANDBALL AND RECOVERY METHODS USED IN THE RECOVERY OF THESE

(basic content of chapter 1)

According to the latest data published by the International Olympic Committee (IOC), the injury rate in handball players was established between 9.9% and 41.0% injuries per 1000 match hours and between 0.9 and 2.6% per 1000 training hours (Bergeron, M. F. 2015) [9]. As a result, the IOC surveillance system classifies handball as one of the Olympic sports with the highest injury rates (82.2%) (Raya-González, J. 2020) [10].

The World Health Organization (WHO) sounds the alarm about the weight of injuries suffered in the game of handball, which in the last ten years has doubled, reaching worrying percentages, and highlights the fact that the shoulder is the joint most affected by injuries both during training and in the game and involves the longest rehabilitation period. Among the injuries produced at this level are strains (38.9%), contusions (28.1%), dislocations (11.7%), tendon ruptures (4.3%), muscle damage (14.6%), and others. As for microtraumas, they are caused by overuse, in 38% of cases they appear in the acute period and up to 49.6% appear progressively, with worsening and persistent symptoms (Vogel, R. 2021) [11].

In 2022, the National Institutes of Health publishes a study based on systematic searches of PubMed, MEDLINE, CINAHL, Proquest, SPORTDiscus, Web of Science, EMBASE and Scopus for articles published between 1995 and 2019 where the investigation of at least one factor was sought of potentially modifiable and/or non-modifiable risk for shoulder injuries, particularly in handball players. Only papers published after 1995 were included. 1849 studies were identified, of which 8 were included. A total of 2536 participants (1354 men, 1182 women) were included, of which 2522 were handball athletes. Four of the eight studies were assessed as studies of high

methodological quality (> 85%), while the rest were assessed as medium (50-85%) (Vila, H. 2022) [12].

Philippe Landreau, Matthias A. Zumstein, Przemyslaw Lubiowski, and Lior Laver studied shoulder injuries in handball in 2018. Of all injuries sustained by athletes while playing handball, up to 37% occur in the shoulder, and most of these injuries are caused by repetitive overhead movements that lead to overuse injuries to the tissues in the joint. Repetitive throwing motion can cause changes in soft tissue as well as bone that lead to increased range of motion for external rotation and limited range of motion for internal rotation. These can cause the phenomenon of internal impingement, tears of the rotator cuff muscles, tears of the articular labrum, accompanied by scapular dyskinesia (Landreau, P. 2018) [13].

Terrance A. Sgroi writes in his thesis on shoulder instability rehabilitation and return to sports activity that the glenohumeral joint places great strain on both static and dynamic shoulder stabilizers. The labrum nearly doubles the depth of the glenoid fossa and provides multidirectional stability to the shoulder joint. Laxity or damage to the capsulo-labral complex may require surgical repair. Surgical stabilization of the shoulder by arthroscopy has been shown to be an effective procedure to help athletes return to as advanced a level of play as possible (van Dyk, N. 2019) [14]. Special attention is given to improving range of motion and of muscle strength during the rehabilitation treatment.

This progressive training is based on well-established criteria to ensure the smooth progress of the procedure. During the postoperative recovery treatment, it is important to follow a few principles, such as: effective communication of the entire medical team dealing with the patient is essential for the fastest and best result; the procedures that the patient follows must be progressive and individualized during the recovery program according to the athlete's evolution; the physiotherapist must pay special attention to the recovery of the range of motion and the active movement of the joint in order to obtain the best possible healing of the joint capsule and labrum; the restoration of scapular stability and the rehabilitation of the rotator cuff is done before the start of the increase in global muscle strength at the shoulder level; rehabilitation of dynamic stability and neuromuscular control is achieved through progressive and pain-free therapeutic exercises (Maniar, N. 2023) [15].

Understanding these principles and their proper application can lead to the fastest healing and most effective rehabilitation of the joint, so that the athlete can return to the field of play and reach the level of performance before the injury (Fritz, B. 2020) [16].

According to the hypothesis put forward by us, in this pedagogical experiment, if we introduce you to a kintotherapeutic program, elaborated according to international protocols with stability exercises. toning, mobility and strength development and a complex of exercises specific to

handball, will allow us to increase the recuperative prognosis for handball athletes and will facilitate their return to sports activity in the shortest possible time, with a minimal relapse rate .2.

RESEARCH METHODOLOGY AND STAGES

(basic content of chapter 2)

Research in the field of medical recovery of shoulder injuries in handball athletes is of particular importance in the context of modern society when, governed by the century of speed, the expectations of athletes and coaches are very high, sometimes unrealistic, regarding the kinetotherapeutic approach intended to recover injuries at the level the shoulder.

The dynamics of the game of handball, the hardness of this sport, the overload imposed by the achievement of competitive goals, the lack of recovery time due to the busy competitive calendar, the athlete's indiscipline and his disordered schedule, are also aspects that we consider worth taking into account as causes of occurrence of shoulder injuries.

The research methods used in the pedagogical study

In order to objectify the research process, but also in order to identify aspects regarding the need to improve the recovery program for shoulder injuries in junior handball athletes, we used the following research methods:

- Theoretical analysis and generalization of specialized scientific literature;
- the pedagogical observation method;
- the survey or questionnaire method;
- the method of evaluation tests and measurement;
- statistical-mathematical method;
- graphic and tabular method.

The pedagogical study of this work was carried out in the period 2017-2021 and includes four stages:

Stage I took place during 2017-2018 and was based on the study and analysis of specialized literature published at the national and international level regarding the research topic and the current situation regarding recuperative approaches in the treatment of shoulder injuries in junior handball athletes. It was also during this period that we conceptually developed the purpose of the study, the research and evaluation methods in the case of shoulder injuries were selected, and the study sample was also selected.

The 2nd stage took place during the 2018-2019 academic year when I conducted the confirmatory study on a group of 337 handball athletes from 2 pre-university institutions in Iași and Vaslui. In the constatative study, the observation sheets of the handball athletes were analyzed, we evaluated motor and functional indices, we concluded that most problems in the recovery act are

caused by injuries that require arthroscopic surgery or a conservative approach in the orthosis and at the same time a period long-term recovery, that the higher incidence is among women and thus we identified the target group - junior handball players with shoulder instability.

Stage III took place during 2019-2020 and included the actual experiment that lasted from October 2019 to July 2020. The study included 50 athletes (n=25 junior handball athletes in the experimental group – LE and n=25 junior handball athletes in the control group – LM). Accordingly, within the study we performed a comparative analysis of the functional, anthropometric and goniometric indices of the junior sportswomen included in the study, obtained following the evaluation with the help of tests: motor, functional, anthropometric and goniometric.

Stage IV, in the period 2020-2021, we analyzed the results obtained, formulated conclusions and recommendations for physiotherapists, coaches and handball players, in order to significantly improve the recovery process, with the aim of reinsertion as quickly as possible into sports activity and reducing costs regarding recovery.

Following the analysis of the batch, we can conclude that in the period 2018 - 2019, the incidence of shoulder injuries in junior handball athletes aged between (14-19 years) from pre-university institutions in Iasi varies from 19% to 68.4% in depending on age and sex.

The cumulative incidence of handball athletes who suffered shoulder injuries and benefited from surgery and physical therapy is higher in girls – 91.4% compared to 84.8% in male handball athletes.

Following the application of the questionnaire regarding the limitation of activities at the level of the shoulder injured, we can say that a significant number of junior handball athletes, respectively 46%, faced a permanent limitation of training activities due to pain present in the shoulder joint, while for 50% of the junior handball athletes investigated there is limitation in lifting objects due to shoulder pain. Moreover, 66% of the junior handball athletes claim that they have sleep disturbances due to pain in the shoulder joint, and 40% of them report that they face difficulties in throwing the ball and the running potential has decreased for 28% of the respondents, having difficulties caused by pain induced by instability.

We consider that the limitation of activities at the level of the injured shoulder is significant, which brings serious imbalances in the sports activity of the investigated junior handball players and the implementation of effective recovery programs aimed at rehabilitating shoulder injuries in handball is impetuously necessary.

Analysis of shoulder instability pain assessment questionnaire and its induced functional impotence – case frequency by response

Question 1. In the last year have you suffered from instability in the shoulder joint?

When asked about the presence of instability in the sample of junior handball athletes

studied, the frequency of instability in the shoulder joint in the last year was 86%, respectively 43 female handball athletes answered that in the last year they presented instability compared to 14% (7 junior handball athletes), who have not experienced such an episode in the last year (Fig. 2.1).

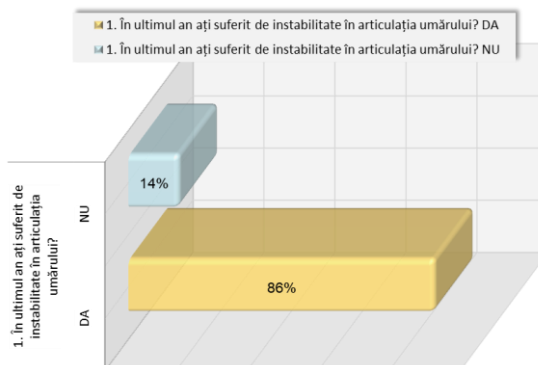


Fig. 2.1 Assessment of shoulder joint instability over the past year

Question 2. Are you in your first episode of instability, or have there been other episodes in last?

Regarding the recurrence of instability at the level of the shoulder, 36% (18 female athletes) of junior handball athletes stated that they are at their first episode of instability, while 64% (32 female athletes) claim that they have experienced such episodes in the past, going through a relapse (Fig.2.2)

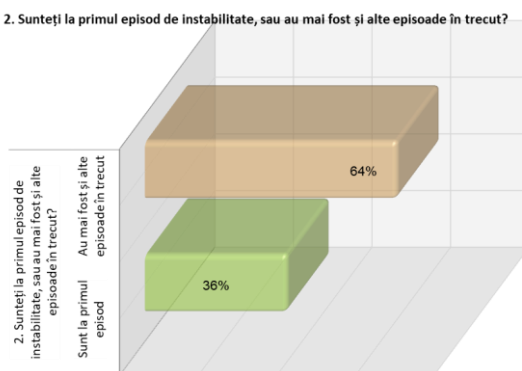


Fig. 2.2. Evaluation of shoulder joint instability status

Question 3. Have you resorted to immobilization in an orthosis or surgery after accident?

The use of orthotic immobilization by the junior handball players in the studied group was 72% (36 sportswomen), while 28% (14 sportswomen) claimed to have benefited from arthroscopic surgery to overcome the episode of instability (Fig. 2.3).

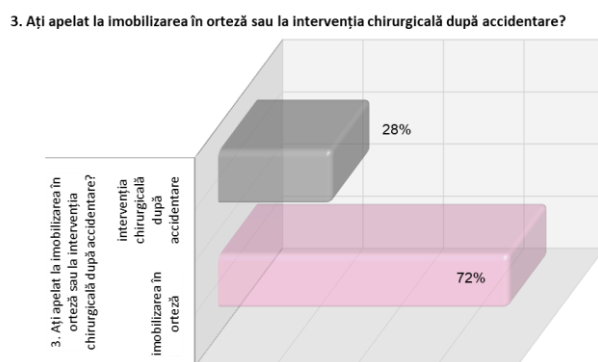


Fig. 2.3 Orthotic or surgical treatment of shoulder joint instability

Question 4. Did the pain in the shoulder joint occur during a handball match?

According to the results obtained from the investigation of the female handball athletes participating in the study, 82% of the cases (41 female athletes) claim that the pain occurred during a handball match, compared to 18% (9 female athletes) who state that the pain occurred outside the match period (Fig. 2.4).

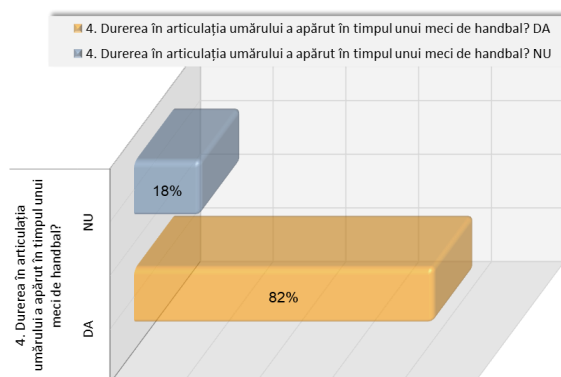


Fig. 2.4 Occurrence during the game (handball) of pain and instability at the level the shoulder joint

Question 5. Did the pain in the shoulder joint appear during training?

The obtained results demonstrated that for 42% (21 sportswomen) the pain in the shoulder joint appeared during training, compared to 58% (29 sportswomen) who identify the appearance of pain at a different time during the training period (Fig. 2.5).

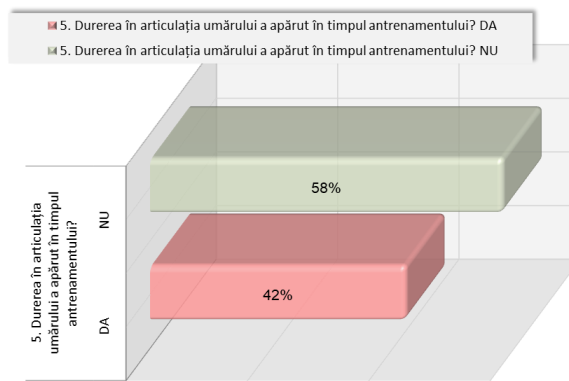


Fig. 2.5 Occurrence during training (handball) of pain and instability in the shoulder joint

Question 6. Pain in the shoulder joint prevents me from participating in training and matches?

The results of the application of the questionnaire highlighted the fact that for 74% of sportswomen (37 sportswomen) pain prevents them from participating in training and handball matches, thus affecting their sports activity (Fig. 2.6).

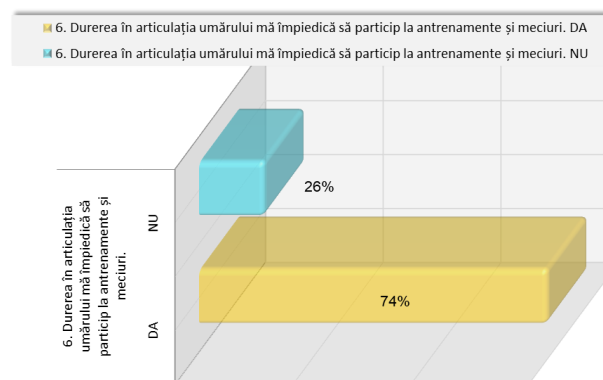


Fig. 2.6 Participation in training and matches influenced by pain and instability in the shoulder joint

Question 7. There is pain in my shoulder almost all the time, my quality of life is affected?

The quality of life of the sportswomen interviewed was affected in a proportion of 76% (38 sportswomen) claim that the pain is present in the shoulder joint for a long enough time so that their life is affected compared to a percentage of 24% (12 sportswomen) who accuse pain but without having discomfort that can lead to disturbances in the quality of life (Fig. 2.7).

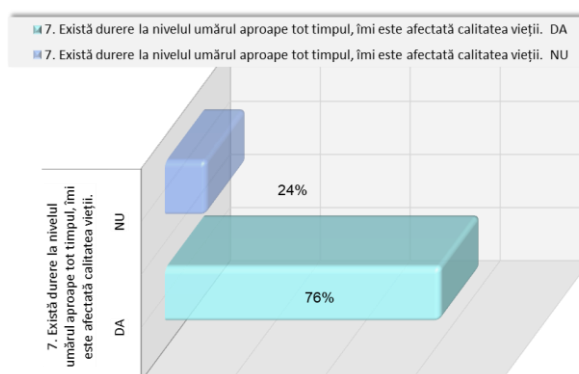


Fig. 2.7 Permanent manifestation of pain and instability in the shoulder joint

Question 8. Due to the pain in the shoulder joint my performance as an athlete had to suffer?

For 88% of cases (44 female athletes), the sports performances of the junior handball players in the analyzed sample were negatively influenced by the presence of pain and instability in the shoulder joint, compared to 12% (6 female athletes) who believe that their sports performance was not affected by pain and instability (Fig.2.8).

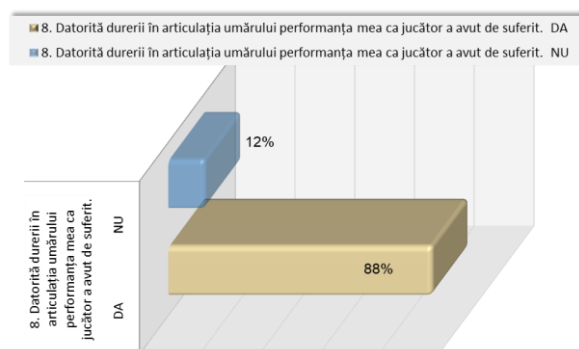


Fig. 2.8 Impairment of sports performance due to pain and instability in the shoulder joint

Question 9. How long after the injury did you return to sports activity?

The resumption of the sports activity of the investigated junior handball players shows that the return was possible approximately 6 months after the injury in 68% of the cases (34 athletes) and in 32% (16 athletes) after 5 months from the time of injury (Fig. 2.9).

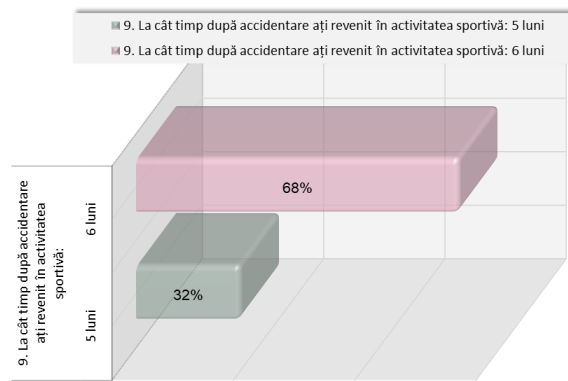


Fig. 2.9 The timing of resumption of sports activity after treatment of pain and instability in the shoulder joint

Question 10. How long have you been playing handball (years)?

When asked about the duration of practicing the handball game, the playing experience of the junior handball athletes in the analyzed sample presented an average of 5 years with a standard deviation of 1.34 years and minimum values of 3 years and maximum values of 7 years.

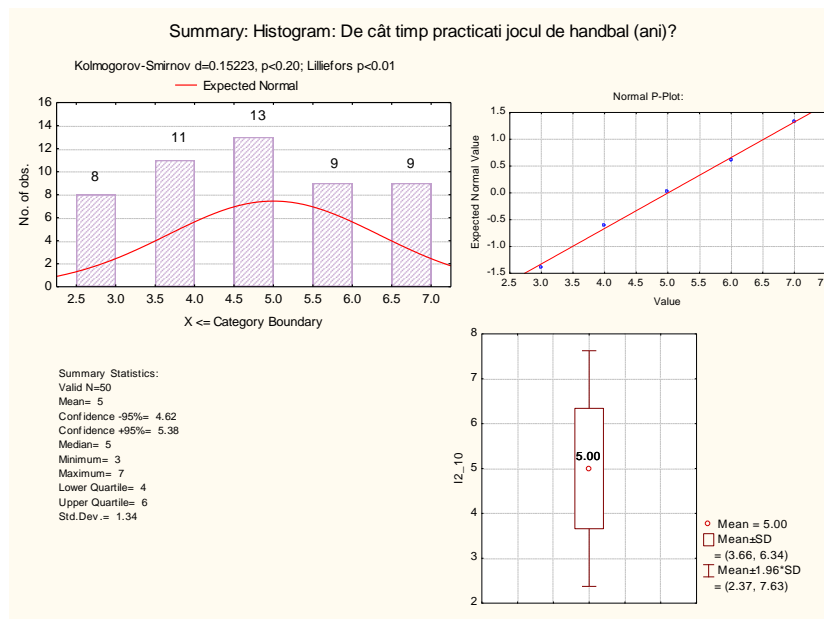


Fig. 2.10 Time interval of practicing handball (years)

According to the answers received from the junior handball athletes who completed the questionnaire regarding the assessment of the pain caused by shoulder instability and the functional impotence induced by it, we can conclude that a very large number of junior handball athletes have experienced an episode of instability in the last year, respectively 86%, that the recidivism rate is also increased by 64%. Although the contemporary approach refers to the reduction of instability arthroscopically for a total recovery, the very high costs and the lack of specialists in state hospitals, specialized in sports traumatology, make more and more sportswomen resort to the conservative treatment of immobilization in an orthosis - 72% of sportswomen investigated junior handball players. The rate of occurrence of pain and instability in the shoulder joint clearly indicates to us

that the increasing demands during matches, the lack of recovery periods and an inadequate level of training are factors that highlight an increased incidence of injury during the competitive period, respectively 82%, with 0 affecting sports performance in proportion to 88% and with very long periods of inactivity of approximately 6 months for 68% of the respondents, which produce imbalances in the composition of the teams, by destabilizing the team, involving high costs for treatment and recovery.

The analysis of the results of the questionnaires developed and applied to junior handball athletes allowed us to draw a complete picture regarding the degree of disability, the vulnerable points that can lead to injuries and also helped us to lay the foundations of the experimental model adapted for the recovery of shoulder injuries in athletes junior handball players (MEARUH), its stages and objectives that will have to be achieved, but not least the setting of a minimum period of complete recovery with the aim of reinserting the handball athletes participating in the study in the sports activity as quickly as possible.

At the same time, the investigation allowed us to establish the battery of kinetotherapeutic techniques and means necessary for the formation of the recuperative program adapted for the recovery of shoulder injuries in junior handball athletes, with the aim of complete recovery, in the shortest time and with a minimum relapse rate.

The experimental model for the recovery of shoulder instability injuries in junior handball athletes through kinetotherapeutic means

The objectives of creating this model were the following:

- regaining the capacities and motor skills lost as a result of the injury suffered at shoulder level;
- educating the spirit of discipline and conscious attitude regarding dosage training and regular use of rest and recovery programs to decrease the risk of injury and recurrence.
- maintaining positive motivation throughout the recovery process;
- developing the psychomotor skills of juniors to cope with the demands of the sport performance.
- ***The structure and content of the recovery program.*** According to our recommendation, the duration of the recuperative program intended for the recovery of shoulder instability injuries in junior handball athletes lasts 60 minutes.
- ***According to the structure, each recovery session includes:***
- ***the introductory or beginning part*** (10 – 15 minutes) – will include massage techniques muscle relaxant with the aim of warming up and preparing the muscles along with light, slow, amplitude exercises that will respect the principle of gradualness and dosage of effort.

- *the basic part* (30 – 40 minutes) – is aimed at solving the tasks of restoring mobility and regaining muscle strength, activating the functions of the whole body, increasing resistance to effort and with the use of specific handball procedures at a sustained pace.

- *the final part* (5 – 10 minutes) is aimed at recovery and re-adaptation the body after exertion,

exercises are performed at a decreasing pace and recovery procedures are used aimed at restoring the functional parameters of the whole body.

The recuperative program includes a number of 5 subprograms, one for each recuperative phase and will be applied in sessions of 1 hour per week in phase I, II, III, from Monday to Friday (5 days per week) with effective work of 20 hours per month, and in phase IV and V, 6 sessions per week with effective work of 24 hours per month.

The average recuperative duration was 24 weeks with an average number of 94 hours of implemented recuperative program and 36 hours of recuperative exercise program specific to the game of handball.

Phases I, II and III will be assigned a number of 14 work weeks, recovery se will do 5 times a week, thus resulting in a number of 70 hours of medical recovery.

Phases IV and V will have an assigned number of 10 weeks of recovery, duration the recovery program will be 1 hour 6 times a week, resulting in 60 hours of medical recovery and exercises specific to the game of handball.

A total of 130 hours of physical therapy recovery will be worked.

Table 2.1 Recovery plan for the recovery of shoulder instability injuries in junior handball athletes

Phases recovery	Objectives of the program recuperator	No. of weeks	No. hours	Total hours
Phase I postoperative	The goals of these periods are to reduce edema, muscle contractions, and pain. After the first 2 weeks, the orthosis will be gradually removed and mobilization, passive, passive/active and active-assisted exercises will be started with the aim of reducing stiffness and regaining mobility.	4	5	20
Phase II Mobility recovery	The main objective of this stage is to restore shoulder mobility, to regain independence in daily activities (eating, washing, dressing, etc.).	6	5	30
Phase III Strength recovery	With the regaining of mobility, the next objective will be focused on increasing the muscle strength of the entire structure of the shoulder joint, correcting even the dyskinesias present before the intervention, by increasing the strength of the upper limbs with the help of stretching exercises assisted by the physiotherapist, but also by using a vast arsenal of active exercises.	4	5	20

Phase IV Reacquisition of proprioception	After muscle strength has been restored, we will aim to improve neuro-proprioceptive control, the shoulder will be worked on in all its directions of movement, preparing the joint for the next stage	4	6	24
Phase IV Propriocepti on recovery	In this stage, specific handball exercises will be used, focusing on throwing exercises, progressing from small objects to larger ones, the body will be trained to give the best performance in training and playing with minimal future recidivism rate.	6	6	36
TOTAL RECOVERY HOURS				130

**ARGUMENTATION OF THE EFFICIENCY OF THE ADAPTED EXPERIMENTAL
MODEL FOR THE RECOVERY OF SHOULDER INSTABILITY IN JUNIOR
HANDBALL ATHLETES THROUGH SPECIFIC PHYSIOTHERAPY MEANS
(basic content of chapter 3)**

In order to argue the effectiveness of the experimental model adapted for the recovery of shoulder instability injuries in junior handball athletes by means of kinetotherapeutic means, indices regarding activity limitations, DASH score, quality of life, pain assessment by VAS analysis, functional balance, muscle strength, perimeter were evaluated and compared . arm/forearm, grip strength and range of motion examination at the level of the injured shoulder of the junior handball players included in the study, between the control group - LM (athletes who followed a standard medical recovery program) and the experimental group - LE (handball players who had followed the Experimental Model within the medical recovery sessions).

As a result of the interpretation of the results obtained in the constatative study, the incidence of shoulder instability injuries prevails in young female athletes, respectively 16 - 17 years old, for this reason both LE and LM were included only handball sports. that presented values of the initial score regarding the degree of limitation in the range of 10 – 16.

The results for both the control group and the experimental group indicate a high proportion of cases that presented low values of the initial score regarding the limitation of activities at the level of the injured shoulder, with a value of $p > 0.05$, which demonstrates the presence of homogeneity in both groups . included in the study.

Evaluation of the evolution of the total score regarding the limitation of activities (Appendix 3) at the level of the injured shoulder shows that the evolution of the junior handball athletes from the experimental group was significant from 14.36 ± 3.50 initially to 29.68 ± 0.63 in the final analysis and for the control group the values of the initial averages from 13.92 ± 4.26 to 27.72 ± 4.26 thus in the final analysis 1.40 . that the average value for the experimental group of junior handball players

was significantly better compared to the evolution of the control group with a value of $P < 0.05$ and otherwise the null hypothesis is contradicted ($P = 0.0024$). (Table 3.1)

Table 3.1 Statistical indicators of the score regarding the limitation of activities at the level of the injured shoulder – comparative analysis in evolution

	Group:	Media Score	Confidence interval		Dev. std	Min	Max	Q25	Median	Q75
			-95%	-95%						
INITIAL	experimental	14.36	12.92	15.80	3.50	9	22	12	13	16
	control	13.92	12.16	15.68	4.26	7	23	11	14	16
FINAL	experimental	29.68	29.42	29.94	0.63	28.00	30.00	30.00	30.00	30.00
	control	27.72	27.14	28.30	1.40	26.00	30.00	27.00	27.00	29.00

Test statistic: ANOVA, $F(1, 48) = 17.255, p = 0.0024$
Levene Test of Homogeneity of Variances: $F = 1.879, p = 0.3415$

The comparative evaluation of the evolution of the quality of life in the experimental group and the control group of junior handball athletes was significantly better in the experimental group starting from initial average values of 62.64 ± 15.72 to values of 104.00 ± 4.73 , compared to the junior handball players in the control group who . they went from initial mean values of 60.04 ± 18.14 and reached 87.28 ± 5.85 , registering progress but not as high as in the case of LE handball players. At the final moment there are significant differences between the experimental group and the control group ($P = 0.0013$), which contradicts the null hypothesis that there are no significant differences and there is no correlation (Table 3.2).

Table 3.2 Evolution of the statistical indicators of the quality of life score and DASH – comparative analysis

	Group:	Media Quality Life	Confidence interval		Dev. std	Min	Max	Q25	Med.	Q75
			-95%	-95%						
INITIAL	experimental	62.64	56.15	69.13	15.72	25	88	50	64	75
	control	60.04	52.55	67.53	18.14	26	82	44	63	74
FINAL	experimental	104.00	102.05	105.95	4.73	97	111	101	103	109
	control	87.28	84.87	89.69	5.85	76	101	85	87	89

Test statistic: ANOVA, $F(1, 48) = 22.31, p = 0.0013^$*
Levene Test of Homogeneity of Variances: $F = 1.5479, p = 0.6241$

	Group:	Media DASH	Confidence interval		Dev. Std.	Min	Max	Q25	Med.	Q75
			-95%	-95%						
INITIAL	experimental	61.73	55.81	67.66	14.35	32.54	92.73	50.64	62.31	69.71
	control	57.60	53.77	61.44	9.29	34.84	78.30	51.41	58.16	63
FINAL	experimental	2.16	1.74	2.58	1.03	1.00	4.00	1.00	2.00	3.00
	control	19.36	7.19	31.53	9.49	2.00	28.00	10.00	12.00	28.00

Test statistic: ANOVA, $F(1, 48) = 23.871, p = 0.00018^$*
Levene Test of Homogeneity of Variances: $F = 1.3908, p = 0.2116$

The comparative evolution regarding the dysfunctions of the arm, shoulder and hand, by analyzing the DASH Questionnaire, indicates that the average DASH values evolved in both groups

indicating the alleviation of the dysfunctions, but in the experimental group the junior handball players presented significantly lower values with $P = 0.00018$ and thus the improvement in this lot being significantly better. In LE, it started from an initial average DASH of 61.73 ± 14.35 and corrections were made up to an average value of 2.16 ± 1.03 , and for LM – it started from initial average values of 57.60 ± 9.29 and reached values means of DASH of 19.36 ± 9.49 (Table 3.2).

The evolution of the pain score values (VAS - Visual Analog Scale) in the analyzed groups indicates a very good evolution of the athletes from the experimental group from the perspective of the VAS score.

Thus, the final pain assessment indicated significantly lower values in the experimental group compared to the control group ($P = 0.00037$). If in the initial analysis we found VAS averages for LE of 8.12 ± 1.48 and at the final evaluation we had averages of 0.68 ± 0.80 , while for LM the initial average values were 8.24 ± 1.45 and at the end 3.24 ± 2.37 . (Table 3.3).

If at the initial evaluations we found minimal pain threshold values of 4 on the VAS scale, indicating a moderate pain in the injured area with maximums of 10 that highlight the presence of a very high degree of pain, at the limit of unbearableness, in the final evaluation both in the group experimentally as well as in the control group of junior handball players we found minimums of the VAS scale equal to zero - no pain in the injured area and with maximums of 3 for LE, indicating mild pain, and for LM a maximum of 7 - respectively severe pain and we found it in the case of a single junior handball player with an injury treated conservatively, towards the end of the recuperative program she suffered a relapse.

Table 3.3 Evolution of the VAS pain score – comparative analysis

Lot:	Media VAS	Confidence interval		Dev. std	Min	Max	Q25	Mediane	Q75	
		-95%	-95%							
INITIAL	experimental	8.12	7.51	8.73	1.48	5.00	10.00	7.00	9.00	9.00
	control	8.24	7.64	8.84	1.45	4.00	10.00	7.00	8.00	9.00
FINAL	experimental	0.68	0.35	1.01	0.80	0.00	3.00	0.00	1.00	1.00
	control	3.24	2.26	4.22	2.37	0.00	7.00	1.00	2.00	5.00

Test statistic: ANOVA, $F(1, 48) = 58.74, p = 0.00037^$*
Levene Test of Homogeneity of Variances: $F = 1.6311, p = 0.0874$

The comparative analysis of the evolution of the functional balance of the shoulder highlights results that indicated a significantly better evolution ($P = 0.00019$) in the case of junior female handball athletes from the experimental group, thus contradicting the null hypothesis. The comparative analysis of the functional balance of the junior handball athletes participating in the study indicated a significantly higher functionality in the experimental group compared to the control group. In LE there was an initial average of the values of the functional balance of 47.00 ± 7.66 which indicates a serious damage to the shoulder and in the final evaluation we find average values of 98.00 ± 2.06 which shows a significant improvement for the junior handball players in this batch. In LM, the initial average values for the evaluation of the functional balance

were 50.48 ± 7.72 and at the final evaluation we find average values of 76.12 ± 3.81 , clearly showing a good correction for the junior handball players in the control group, but in this group the handball players even and at the final assessment they experienced pain, reduced mobility in certain areas of motion, and mild strength deficits.

The somatofunctional evaluation shoulder range of motion exam in the range of motion: flexion, extension, abduction, internal rotation and external rotation is a very important one in the recuperative process intended for the recovery of instability injuries and not only, from the shoulder level of junior handball athletes.

The analysis of the evolution of the initial and final parameters obtained in the somatofunctional assessment regarding the range of motion of the shoulder indicated a significant improvement in the experimental group of junior handball athletes, compared to the evolution of the junior handball players in the control group participating in the study, but this from the latter being considerably lower (Table 3.4).

As can be seen in Table 3.4, the comparative analysis regarding the flexion evolution of the injured limb indicates a significant increase for the experimental group of junior handball players, where it started from an average of 158.28 ± 5.69 and a recovery of the range of motion was achieved up to an average of 169.20 ± 0.87 , while in the control group the dynamics of flexion recovery started from an average of 159.80 ± 5.47 and reached an average of 161.28 ± 5.98 , which shows a favorable evolution for the junior handball players from LM as well, but the significant increase returns junior handball players from the experimental group with a value of $P=0.00022$ which cancels the null hypothesis, the difference between means not being random but statistically significant.

Regarding the comparative analysis for the evolution of the extension in the experimental group of junior handball players, it started from an average value of 46.72 ± 3.52 and we recorded an increase up to the average value of 59.33 ± 0.42 , and in the control group of junior handball players the increase was from the mean value of 47.00 ± 3.83 to 51.33 ± 0.42 , thus resulting in a significant increase for LE compared to LM with a value of $P=0.00011$ which only refutes the null hypothesis and confirms the significant recovery of extension for the experimental group of junior handball players participating in the study.

The comparative analysis in the case of the evolution of amplitude recovery in the movement sector intended for abduction for the experimental group of junior handball athletes shows a significant progress from the average value of 148.00 ± 4.38 to 169.76 ± 0.44 compared to the control group of junior handball athletes where the initial average was 147.52 ± 4.31 and in the final analysis we found an average of the amplitude for abduction of 158.00 ± 0.82 and a value of the confidence coefficient $P=0.00011$ which proves that the difference between the averages is significant, and the recovery program applied to the experimental group produced very good corrections in the case of

the junior handball players from its composition, against the female handball players from the control group.

In order to show the effectiveness of the experimental model adapted to the recovery of shoulder injuries in junior female handball athletes - MEARUH using kinetotherapeutic means, we also made a comparative analysis in the case of the evolution of recovery environments for internal and external rotation. The average value from which we initially started for the internal rotation movement in the experimental group of junior handball athletes was 45.80 ± 3.61 and reached an average value of 69.80 ± 0.50 and in the control group of junior handball athletes the initial assessment of the average for the internal rotation movement was 47.00 ± 3.28 and a correction was reached indicating a mean internal rotation of 61.80 ± 0.50 , with a value of $P= 0.00054$ showing a significant recovery of the range of motion in terms of internal rotation in junior handball athletes from the experimental group. In the case of the analysis of the external rotation movement, the value of $P= 0.00054$ shows a significant recovery for the junior handball players of the experimental group where progress was made from 94.80 ± 3.94 to 89.56 ± 0.51 and for the control group from 93.36 ± 4.13 to an average of 80.20 ± 0.91 .

The somatofunctional assessment regarding the range of motion of the shoulder revealed a significant improvement for handball athletes from the experimental group compared to the athletes from the control group participating in the study, thus concluding that the implemented recuperative program was a real success.

The occurrence of shoulder instability injuries in junior female handball athletes can lead to inactivity for more than 6 to 8 months in certain cases when the recuperative approach is not correct and effective, in certain cases when another injury can be superimposed on top of this injury, which represents a real imbalance for the performance sports activity of the young handball player.

Table 3.4 Evolution of flexion, extension, abduction, internal and external rotation at shoulder level – comparative analysis

	Group:	Media Flexia	Confidence interval		Dev.s td	Min	Max	Q25	Med.	Q75
			-95%	-95%						
INITIA L	experimental	158.28	155.93	160.63	5.69	151	168	154	156	163
	control	159.80	157.54	162.06	5.47	151	168	155	160	165
FINAL	experimental	169.20	168.84	169.56	0.87	168	170	168	169	170
	control	161.28	158.81	163.75	5.98	152	169	156	163	167
<i>Test statistic: ANOVA, $F(1, 48) = 57.3414, p=0.00022^*$</i>										
<i>Levene Test of Homogeneity of Variances: $F=1.8897, p=0.7894$</i>										
	Group:	Media Extensiei	Confidence interval		Dev. Std.	Min	Max	Q25	Mediana	Q75
			-95%	-95%						
INITIA L	experimental	46.72	45.27	48.17	3.52	42	53	44	46	50
	control	47.00	45.42	48.58	3.83	42	53	44	46	51
FINAL	experimental	59.33	59.15	59.50	0.42	59	60	59	59	60
	control	51.33	51.15	51.50	0.42	51	52	51	51	52
<i>Test statistic: ANOVA, $F(1, 48) = 26.5412, p=0.00011^*$</i>										
<i>Levene Test of Homogeneity of Variances: $F=1.8965, p=0.1478$</i>										

	Group:	Media Abd.	Confidence interval		Dev std	Min	Max	Q25	Med.	Q75
			-95%	-95%						
			INITIAL	experimental						
L	control	147.52	145.74	149.30	4.31	141	155	145	147	151
FINAL	experimental	169.76	169.58	169.94	0.44	169	170	170	170	170
	control	158.00	157.66	158.34	0.82	157	161	158	158	158
<i>Test statistic: ANOVA, F(1, 48) = 57.216, p=0.00011*</i> <i>Levene Test of Homogeneity of Variances: F=1.6687, p=0.2374</i>										

	Group:	Media rotație internă	Confidence interval		Dev std	Min	Max	Q25	Med.	Q75
			-95%	-95%						
			INITIAL	experimental						
	control	47.00	45.65	48.35	3.28	41	53	45	47	49
FINAL	experimental	69.80	69.59	70.01	0.50	68	70	70	70	70
	control	61.80	61.59	62.01	0.50	60	62	62	62	62
<i>Test statistic: ANOVA, F(1, 48) = 64.2121, p=0.00054*</i> <i>Levene Test of Homogeneity of Variances: F=1.9425, p=0.3571</i>										

	Lot:	Media Rotație externă	Interval de confidență		Dev. std	Min	Max	Q25	Med.	Q75
			-95%	-95%						
			INITIAL	experimental						
	control	93.36	87.65	94.07	4.13	84	96	86	90	96
FINAL	experimental	89.56	89.35	89.77	0.51	89	90	89	90	90
	control	80.20	79.82	80.58	0.91	78	81	80	80	81
<i>Test statistic: ANOVA, F(1, 48) = 57.417, p=0.00054*</i> <i>Levene Test of Homogeneity of Variances: F=1.6641, p=0.2054</i>										

One of the very important comparative analyzes addressed between the two groups of junior handball athletes participating in the experimental study was related to the recovery period necessary for the complete recovery of mobility, strength, stability, motor skills specific to handball and the reintegration of athletes into competitive activity at the highest standard, eliminating as much as possible the risk of recurrences that are common in cases of shoulder instability, especially where the restorative approach is conservative and not surgical.

So, following the centralization of the sheets with the final results and the conclusion of the recuperative program, we found that the junior handball players from the control group had an average of 24.6 weeks of recovery, while the junior handball athletes from the experimental group had an average of the recuperative program of 21 ,3 weeks. Given the fact that usually the recovery period after shoulder instability injuries is on average 24 weeks, and we obtained a significantly lower recovery process average, it once again argues the effectiveness of the experimental model - MEARUH implemented in the study.

At the same time, in the pedagogical study carried out, the MEARUH experimental model demonstrated its effectiveness by addressing and solving the recuperative tasks faced by the junior handball athletes, and allowed, through the complex recuperative program of kinetotherapeutic

techniques and means, a quick recovery, without relapses and a reinsertion of junior handball athletes in the sports activity in the shortest possible time.

As I have indicated in the previous chapters, a recuperative approach as early as possible, the use of recovery and prevention programs, training programs adapted and discussed by the coach and physiotherapist in which emphasis is placed on the development of muscle mass and the stabilization of joints with the use of physiotherapeutic means to prevent shoulder injuries, but also compensatory musculoskeletal imbalances.

The study showed that the developed method of recovery of shoulder instability injuries in junior handball athletes contributes to the development of strength, mobility in the shoulder joint and provides a complete and effective rehabilitation of the athletes, in a considerably shorter time.

Physiotherapy and in this case physical exercise is, without a doubt, the most effective tool of therapeutic and preventive care, which is available to athletes, trainers, physiotherapists who, through a joint, interdisciplinary approach, can favorably influence the recuperative process intended for incapacitating injuries and not only . It is clear that many principles of physical education can be used in physical therapy, but it is essential that the physical therapist takes into account the characteristics of the injured area, the pathology of physical performance, the altered reactivity of the athlete presenting the injury/injury, etc.

Taking into account these aspects, I introduced in the adapted recovery program complexes of stretching, breathing, mobility, stability, proprioception, strength-building exercises, applied sports exercises specific to handball, the duration and intensity of which I gradually increased, respecting the prohibitions and the recommendations of each stage of recovery, until we reached the intensity and duration specific to the training period and the competitive period. Thus, during the entire recovery program, I respected the principle of gradualness and dosage of effort, without forcing or loading above the recommended load.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

1. Based on the analysis of the scientific and methodological literature, as well as the evaluation of the results of our research, it is demonstrated that the injury rate in handball is very high and up to 80% of injuries suffered by athletes are associated with damage to the musculoskeletal system, and shoulder injuries occupying a special place. In studies, more attention is paid to the recovery of athletes after ankle injuries, knee joint injuries, spine injuries, hand fractures, but the issue of handball athletes' recovery after shoulder injuries remains poorly studied both nationally and internationally. From the total number of 337 junior handball athletes, 56.97% went through an episode of injury with immobilization and 30.86% went through an episode of injury with arthroscopic surgery followed by physical therapy.

2. The distribution of cases according to gender clearly shows that female handball athletes juniors are more prone to shoulder injuries than their male counterparts. The ratio being 57.24% in the case of injuries with immobilization for junior athletes compared to 56.76% for male handball athletes, in the case of operated injuries the higher proportion is also maintained for female players being 34.21% compared to 28.11% in the case of representatives of the male gender, aspects that confirm that the number of shoulder injuries is very high, which endangers the sports career, unbalances the composition of the teams and brings changes regarding the quality of their lives.

3. The lack of prevention programs, recovery programs, recovery programs specifically intended for juniors, with high load periods in training and matches, unsuitable playing surfaces, lack of equipment are the triggering factors that favor the occurrence of injuries in juniors in handball. An injury, especially those of instability at the level of the shoulder, also entails long periods of sports inactivity, imbalances in the team and high costs regarding the entire recovery process.

4. The use of physical therapy in the recovery of shoulder injuries of junior handball athletes, involves the use of specific means of physical education in complex with therapeutic recovery exercises that together will contribute to treating the injury in the shortest possible time, with minimal risks of recurrence and with a return of athlete in competitive life to pre-injury standards. The use of recovery exercises combined with physical exercises specific to handball are intended to recover the athlete from a medical point of view without neglecting the sports performance component.

5. An adapted experimental Model for the recovery of shoulder injuries in handball – MEARUH was developed that includes the use of stages of physical and recovery exercises for flexibility, endurance, resistance to force, coordination skills, exercises close to sports specialization, in combination with neuro-proprioceptive taping, massage, mechanotherapy, biomechanical stimulation, physiotherapy, hydrotherapy. The proposed tools and methods are applied sequentially on recovery phases, depending on the recovery status, in which work was done on average 5 times a week, in 60-minute sessions, reaching an approximate number of 130 hours of implemented recuperative program.

6. The results obtained during the initial evaluations regarding the degree of disability and the functional limitations imposed on it both in the experimental group and in the control group showed homogeneity between the groups, without significant differences $P > 0.05$, but nevertheless the junior handball athletes from LE at the final evaluation managed to record significant correction values for both strength, mobility, trophicity with values of $P < 0.001$.

7. The comparative analysis of the results obtained in the evaluations of the indices regarding the degrees of disability and limitations in the shoulder joint of the junior handball athletes showed

an increased frequency of values in the range of 45-50, an aspect that indicates a poor functionality, in both groups, with a value of $P > 0.05$, at the initial assessment in LM it started from an average of the functional balance of 50.48 ± 7.72 and we reached 76.12 ± 3.81 and in LE we started from an average of 47.00 ± 7.66 and we reached average values of of the functional balance of 98.00 ± 2.06 with a value of $P < 0.001$ which proves that the progress is not accidental, that it is statistically significant and underlines the effectiveness of the experimental model adapted for the recovery of the shoulder in handball – MEARUH elaborated and implemented within the recovery sessions held with the spotives junior handball players from the experimental group.

8. The effectiveness of the proposed methodology for the recovery of junior handball athletes after shoulder injuries is confirmed not only by positive dynamic functional changes, but also by a reduction in rehabilitation time with their reinsertion into the team at the level of performance they had before the injury.

9. We conclude that the need for a recuperative program applied gradually and phased by recovery phases in the case of shoulder injuries in junior female handball athletes is confirmed by the fact that some shoulder injuries such as the instability we have referred to require the athlete to be removed from competitive activity or even determination of the athlete to give up the sports activity. The directed and combined influence in the application of handball-specific means with physical therapy-specific means, included in MEARUH, allowed us a recovery and a reinsertion in the sports activity in the shortest possible time for the junior handball players in the experimental group with a significant degree of correction regarding the functional indicators, of the parameters regarding muscle trophicity, strength, amplitude, but also with an improvement of the indicators regarding the quality of life.

- For the early diagnosis of shoulder injuries in handball athletes, a permanent monitoring and evaluation of the athletes by the physiotherapist and the sports medicine doctor is necessary;

- Implementation of prevention programs that emphasize awareness of risk factors but also the obligation to be involved in recovery programs after training and competitions;

- Introduction of specialized exercises for the development and stabilization of the muscles during training by the physiotherapist who must be in good communication and relationship with both the athletes and the coach and the team doctor. Communication in the interdisciplinary team having a fundamental role in the smooth running of things.

- Approaching the injuries as a whole, looking at the body as a whole, in order not to allow the appearance of functional imbalances or the installation of dyskinesias following the injury.

Suggestions for coaches

✓ the correct dosing of workload;

- ✓ avoiding over-training;
- ✓ compliance with recovery periods;
- ✓ resorting to the prophylactic prevention program, with an emphasis on warm-up periods before training and games.

Proposals for the educational institution

- ✓ employing a physiotherapist in the school, with the arrangement of a space equipped with the necessary equipment for the recovery of athletes, who can constantly evaluate the athletes, communicate with the coach and combine physical exercises specific to handball with recovery exercises in order to effectively improve sports performance and reduce costs with a view the necessary recovery documents.

Proposals for athletes

- ✓ compliance with the indications regarding the recovery protocol that you must follow at home;
- ✓ seriously treating prevention and recovery programs after training and matches;
- ✓ communication as soon as possible of the changes experienced in the body, the appearance of pain, in order to prevent or treat any injury from the early stage;
- ✓ 100% involvement in the recuperative process, with the maintenance of positive motivation throughout the program, following the instructions of the trainer, the physiotherapist and the sports medicine doctor for the success of the integral recuperative act.

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ADNOTARE

Dorobăț Simona Elena. "Recuperarea sportivelor handbaliste junioare după leziuni la umăr prin mijloace kinetoterapeutice": teză de doctor în științe ale educației, Chișinău, 2024.

Structura tezei: Lucrarea cuprinde adnotări în limba română, rusă și engleză, lista tabelelor, figurilor și abrevierilor, introducere, 3 capitole, concluzii generale și recomandări, bibliografie din 133 titluri, 145 pagini text de bază, 30 tabele, 53 figuri, 14 anexe. Rezultatele obținute sunt publicate în 5 lucrări științifice.

Cuvinte-cheie: kinetoterapie, leziune, instabilitate, umăr, handbaliste junioare, recuperare medicală, Model experimental.

Scopul cercetării: Constă în fundamentarea și perfecționarea metodologiei procesului recuperator destinat recuperării leziunilor umărului la sportivele handbaliste junioare.

Obiectivele lucrării:

Analiza problemei recuperării sportivelor handbaliste după leziuni la umăr conform datelor din literatura de specialitate și analiza abordărilor teoretice și metodologice privind soluționarea acesteia. Studiarea incidenței accidentărilor sportivelor handbaliste la nivelul umărului, pe baza rezultatelor propriului studiu epidemiologic și compararea acestor date cu statisticile oficiale din țară, dar și din întreaga lume. Elaborarea și implementarea structurii și conținutului Modelului experimental de recuperare adaptat pentru leziuni la umăr la sportivele handbaliste junioare. Argumentarea eficienței Modelului experimental recomandat pentru tratarea leziunilor umărului la sportivele handbaliste junioare.

Noutatea și originalitatea științifică a tezei rezidă în elaborarea și implementarea unui model recuperator kinetic complex, adaptat pentru recuperarea leziunilor umărului sportivelor handbaliste junioare. În cadrul acestui model experimental au fost utilizate exerciții tip bloc algoritmat și exerciții specifice jocului de handbal, care au contribuit la recuperarea leziunii într-un timp cât mai scurt și cu rată de recidivă minimă.

Problema științifică soluționată în domeniul cercetat rezultă din rezultatele obținute în teză, care demonstrează din punct de vedere științific și metodologic eficacitatea utilizării mijloacelor kinetoterapeutice în tratarea leziunilor umărului la sportivele handbaliste junioare.

Semnificația teoretică a lucrării constă în extinderea plajei de cunoaștere a conceptelor teoretice și metodologice privind aplicarea modelului recuperator axat pe metode și tehnici combinate în vederea recuperării leziunilor umărului handbalistelor junioare pentru o reinserție rapidă în activitatea sportivă competițională.

Valoarea aplicativă a lucrării o constituie oportunitatea utilizării rezultatelor cercetării pentru îmbunătățirii protocoalelor recuperatorii destinate sportivilor handbaliști.

Implementarea rezultatelor științifice Conținutul Modelul experimental a fost aplicat cu scopul optimizării procesului recuperator, acesta a fost implementat în cadrul ședințelor de recuperare avute cu elevii din Liceul LPS Vaslui și Liceul Economic Virgil Madgearu Iași.

АННОТАЦИЯ

Доробэц Симона Елена. «Восстановление юных гандболистов после травм плеча кинетотерапевтическими средствами»: докторская диссертация в области педагогических наук, Кишинев, 2024.

Структура диссертации: Работа состоит из аннотации на румынском, русском и английском языках, списка таблиц, рисунков и сокращений, введения, 3 глав, общих выводов и рекомендаций, библиографии из 133 наименований, 145 страниц основного текста, 30 таблиц, 53 рисунки, 14 вложений. Полученные результаты опубликованы в 5 научных статьях.

Ключевые слова: физиотерапия, травма, нестабильность, плечо, юные гандболисты, медицинское восстановление, Экспериментальная модель.

Цель исследования: Заключается в обосновании и совершенствовании методики восстановительного процесса восстановления после травм плеча у юных гандболистов.

Цели работы: Анализ проблемы восстановления гандболисток после травм плеча по данным специализированной литературы и анализ теоретико-методических подходов к ее решению. Изучение заболеваемости травмами плеча у гандболисток на основе результатов собственного исследования и анализа данных официальной статистики страны, а также всего мира. Разработка и внедрение структуры и содержания экспериментальной модели восстановления, адаптированной при травмах плеча у юных гандболистов. Обоснование эффективности рекомендованной экспериментальной модели лечения травм плеча у юных гандболистов.

Новизна и научная оригинальность: диссертации заключаются в разработке и внедрении комплексной модели кинетического восстановления, адаптированной для восстановления после травм плеча у юных гандболистов. В данной экспериментальной модели использовались алгоритмизированные упражнения блочного типа и упражнения, специфичные для игры в гандбол, что способствовало восстановлению травмы в кратчайшие сроки и с минимальной частотой рецидивов.

Научная задача, решаемая в исследуемой области, вытекает из результатов, полученных: в диссертации, которые с научной и методической точки зрения демонстрируют эффективность применения кинетотерапевтических средств в лечении травм плеча у юных гандболистов.

Теоретическая значимость работы заключается в расширении круга знаний теоретико-методических представлений относительно применения восстановительной модели, построенной на алгоритмизированных кинетических методах и приемах, с целью восстановления травм плеча у юных гандболистов для быстрой реинтеграции в соревновательные виды спорта. активность.

Прикладная ценность: работы обусловлена возможностью использования результатов исследования для совершенствования протоколов восстановления, предназначенных для спортсменов-гандболистов.

Внедрение научных результатов. Содержание Экспериментальная модель была применена с целью оптимизации восстановительного процесса, она была реализована во время восстановительных занятий, проведенных со студентами средней школы ЛПС Васлуй и Экономической средней школы Вирджила Маджеару в Яссах.

ANNOTATION

Dorobăț Simona Elena. *"Recovery of junior handball athletes after shoulder injuries through kinetotherapeutic means"*: Phd. thesis in educational sciences, Chisinau, 2024.

Thesis structure: The work consists of annotations in Romanian, Russian and English, list of tables, figures and abbreviations, introduction, 3 chapters, general conclusions and recommendations, bibliography of 133 titles, 145 pages of basic text, 30 tables, 53 figures, 14 attachments. The obtained results are published in 5 scientific papers.

Keywords: physical therapy, injury, instability, shoulder, junior handball players, medical recovery, Experimental model.

The purpose of the research: It consists in substantiating and perfecting the methodology of the recuperative process intended for the recovery of shoulder injuries in junior handball athletes.

Research Objectives: Analysis of the problem of the recovery of female handball athletes after shoulder injuries according to the specialized literature and the analysis of theoretical and methodological approaches regarding its solution. Studying the incidence of handball sportswomen's shoulder injuries, based on the results of their own study and data analysis of official statistics from the country, but also from around the world. Development and implementation of the structure and content of the experimental model of recovery adapted for shoulder injuries in junior handball athletes. Arguing the effectiveness of the recommended experimental model for the treatment of shoulder injuries in junior handball players.

The novelty and scientific originality: of the thesis lies in the development and implementation of a complex kinetic recovery model, adapted for the recovery of shoulder injuries of junior handball athletes. In this experimental model, algorithmized block type exercises and exercises specific to the handball game were used, which contributed to the recovery of the injury in the shortest possible time and with minimal recurrence rate.

The obtained results that contribute to the solution of an important scientific problem: The results obtained in the thesis, which demonstrate from a scientific and methodological point of view the effectiveness of the use of kinetotherapeutic means in the treatment of shoulder injuries in junior handball athletes.

Theoretical significance: consists in expanding the range of knowledge of theoretical and methodological concepts regarding the application of the recuperative model built on algorithmized kinetic methods and techniques, in order to recover shoulder injuries of junior handball players for a quick reinsertion in competitive sports activity.

The applicative value: results from the possibility of using the research results in order to improve the recovery protocols intended for handball athletes.

Implementation of the scientific results: The experimental model was applied with the aim of optimizing the recuperative process, it was implemented during the recuperative sessions held with students from LPS Vaslui High School and Virgil Madgearu Economic High School Iasi.

DOROBAT SIMONA ELENA

**RECOVERY OF JUNIOR HANDBALISTS AFTER SHOULDER INJURIES
THROUGH KINETOTHERAPEUTIC MEANS**

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SUMMARY

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