The Annals of the "Ştefan cel Mare" University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131

THE EVOLUTION OF SHOULDER INJURIES IN JUNIOR HANDBALL PLAYERS

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Keywords: physical therapy, handball, injury rate, shoulder

Abstract: The prevalence of shoulder trauma in handball underscores the importance of medical rehabilitation for these injuries, making it a priority for researchers. This study aims to analyze and correlate data regarding the frequency of shoulder injuries, the age of injured athletes, the degree of disability, and the impact of the injury on their quality of life. We selected 40 athletes with instability injuries from 337 handball athletes, and they were distributed in two lots: LE= 20 athletes and the LC=20 athletes. We initially evaluated both groups using the DASH questionnaire, and the Burckhardt and Anderson quality of life questionnaire. The athletes in the LE group followed a rehabilitation plan structured into five phases, combining kinetic rehabilitation techniques with handball-specific exercises. Meanwhile, the athletes in the LC group followed a standard rehabilitation plan. We re-evaluated both groups using the same methods at the final program. The results emphasize that athletes in the LE group recorded significant improvements in both the DASH score and the quality of life score, indicating that the specialized rehabilitation plan had a positive effect on the handball players who followed it.

Introduction: The World Health Organization (WHO) has issued a warning regarding the alarming increase in the percentage of trauma suffered by the handball players over the past decade, which has tripled, and necessitates longest length of rehabilitation. Dislocations (12.3%), strains (37.5%), contusions (27.9%), tendon ruptures (5.2%), muscle damage (13.9%), and other injuries are among the injuries that are produced at this level. Handball has experienced an increase in injury rates in recent years, as evidenced by recently published international data. In the last decade, the incidence of trauma has tripled, and the gravity of these injuries has also increased. There has been a substantial rise in the expenses associated with medical rehabilitation for athletes on the national team over the past five years. This is due to an increase in the number of injuries and the lengthening of the rehabilitation period, which has led to an imbalance in team composition and a decline in competitive performances [1,2]. Achieving sports performance is the ultimate goal, and for exceptional results the presence of an interdisciplinary team comprising a coach, physiotherapist, nutritionist, psychologist, and sports medicine doctor is indispensable. Additionally, effective communication among team members forms

the foundation of a perfect medical system [3, 4]. The research was conducted by Langevoort, G. investigated shoulder injuries that transpired during the competitive handball program. In comparison to the training period, shoulder injuries are more prevalent during handball competitions, as a result of the increased burden and demand on the players, as indicated by international studies. Consequently, there are 108 injuries per 1000 game hours per player or 1.5 injuries per match. The upper extremities, head, ankle, and knee were the primary sites of injury. Kinetic training is essential for the generalization of sports, but it is particularly important for the game of handball, as it stimulates the body's main functions to facilitate the faster adaptation of the specific efforts required for this sport [5,6,7,8]. The conclusions of Bezuglov's study (2022) claim that physical training is one of the aspects that produce an increase in the body's functional capacity, the development of motor qualities, and specific game schemes for the certainty of victory. The primary goal of athletes' physical training is to enhance their physical skills in handball, emphasizing these skills during training to achieve optimal performance and minimize injury risk. be as small as possible [9]. The alarming increase in shoulder injuries among juvenile handball athletes, both nationally and globally, requires a comprehensive analysis of risk factors. We must take into account the influence of these factors and their interactions in this study, as they are contributing to an expanding number of handball injuries. Understanding the location of injuries is essential from a practical perspective to make informed decisions during the rehabilitation process.. Particularly, the knee and ankle seem to be the most severely affected regions as a result of their participation in the specific patterns of the most prevalent handball actions (jumping or landing). Nevertheless, certain authors have demonstrated a high level of shoulder overuse injuries (44%), which are attributed to the repetitive tossing gestures that are imposed in this sport [10,11,12]. Gender differences revealed that female handball players sustained more shoulder injuries (38% vs. 14% during a track season) than their male counterparts. Research indicates that handball players sustain shoulder injuries significantly more frequently. This is due to the importance of the upper arm position, which leads to increased brachial retrotorsion in the dominant arm and an increased incidence of shoulder overuse syndrome in handball players. The retrotorsion angle in the handball player's dominant "throwing" or "pulling" arm relative to the non-dominant one increases by 9.4 [13, 14, 15]. WHO defines rehabilitation as a complex process that aims to restore abilities for daily and professional activities, and the emotional and social stability of individuals who have partially or completely lost these abilities due to disease or injury. This process raises alarms about the increasing number of seriously injured athletes who remain out of sports for extended periods or even never participate in performance sports [16]. Based on the aforementioned information, we can infer that

the issue of shoulder injury rehabilitation in junior handball athletes continues to be a pressing, acute, and insufficiently comprehensive problem. This necessitates the exploration and application of innovative, complex, and specialized treatment techniques and methods tailored to each injury. This approach ensures a swift and comprehensive recovery process, enabling athletes to return to their sports activities with the highest possible success rate. Aim of the study: This study aims to examine the prevalence of shoulder injuries among handball athletes, taking into account their age, gender, injury type, and degree of disability. Additionally, the investigation endeavors to assess the efficacy of the rehabilitation strategy implemented to address these shoulder injuries and its influence on the athlete's quality of life and "using a kinetic program will relieve pain, inflammation" [22].

Material-method: The research, conducted over three years, involved 337 junior handball athletes from two high schools in Iași and Vaslui. The study aimed to analyze the frequency of injuries relative to the athletes' ages, the degree of disability incurred, and the risk of these trauma on the quality of life of the evaluated players. We selected 40 athletes with instability injuries and dividing them in 2 lots (LE=20 athletes, LM= 20 athletes).

The kinetic rehabilitation methodology for shoulder instability trauma in handball players consists of a combination of specific rehabilitation methods and techniques. This includes a proposed kinetic program, incorporating a battery of recuperative physical exercises, handball-specific exercises, therapeutic massage, neuromuscular bandages, and physiotherapy. The creation and use of the kinetotherapeutic program required the creation of a recuperative treatment block. This block is made up of interdependent factors, that are necessary for assessing, diagnosing, and treating shoulder instability injuries in junior handball players. The 60-minute rehabilitation program comprises three parts: The Introductory Program (5–10 minutes) includes mild and slow exercises, as well as muscle-relaxant massage techniques to warm up and prepare the muscles. Basic Program (25–35 minutes): This program is dedicated to the restoration mobility , the activation of the entire body's functions, the enhancement of endurance, and the integration of specific handball procedures. The concluding section, which spans 10–15 minutes, is dedicated to the body's rehabilitation and re-adaptation in the aftermath of physical exertion. We employ rehabilitation procedures to restore the functional parameters of the complete body and perform exercises at a decreasing pace. The kinetic program is divided into five subprograms, each of which corresponds to a distinct recuperative phase. We implement it in weekly sessions of one hour each during Subprograms I, II, and III, which are conducted from Monday to Friday. This results in a total of 20 hours of kinetic program per month. The program is executed six times per week during Subprograms IV and V, resulting in twenty-four hours of

kinetic program per month. The recuperative program was typically implemented for twenty-four weeks, with a total of ninety-four hours of the program and thirty-six hours of handball-specific recuperative exercises. Subprograms I, II, and III each require fourteen weeks of rehabilitation, with five sessions per week, totaling seventy hours of medical rehabilitation. Subprogram IV and V consist of a total of sixty hours of kinetic rehabilitation with handball exercises, which are conducted in one-hour sessions six times a week over ten weeks. In conclusion, 130 hours of physical therapy rehabilitation were administered.

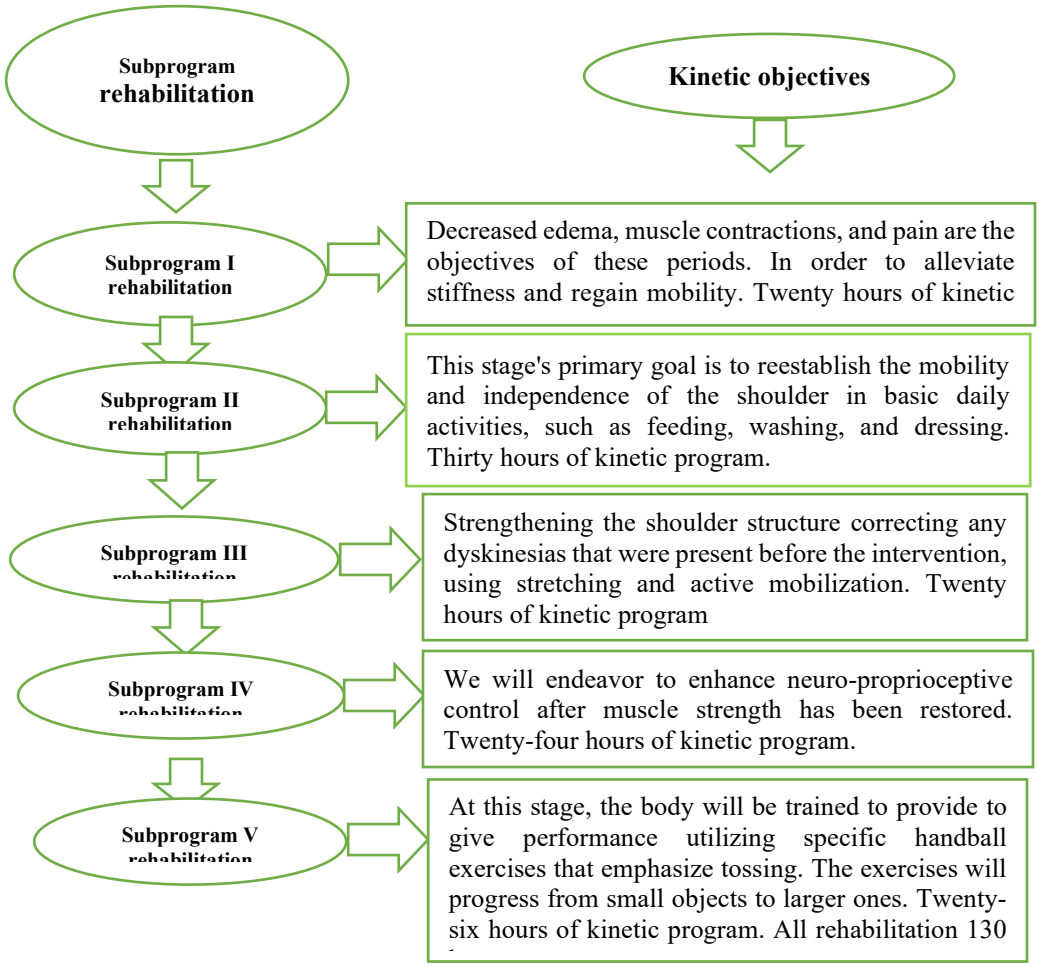

Fig. 1 Kinetic program for the rehabilitation of shoulder instability trauma to handball athletes

Results: Among the analyzed cases, it is evident that the most significant challenges in rehabilitation arise from injuries requiring either arthroscopic surgery or a conservative approach with orthotic support, coupled with extended rehabilitation periods. Notably, female athletes exhibit the highest incidence of such issues. Therefore, this study identifies junior handball players with shoulder instability as the target group.

Table 2. Frequency of shoulder injuries in junior handball athletes (n=337)

Junior handball players	n	Procent
No injury	41	12.17
With immobilized injury	192	56.97
With operated injury	104	30.86
Total	337	

Regarding the distribution by gender, the greater share is among female spotives. All groups of handball players included in program was homogeneous both in terms of age and gender. The average age of junior female handball athletes is (17.32±1.09DS) and did not show statistically significant differences compared to the average age of male handball players (17.29±1.01DS) (P = 0.698).

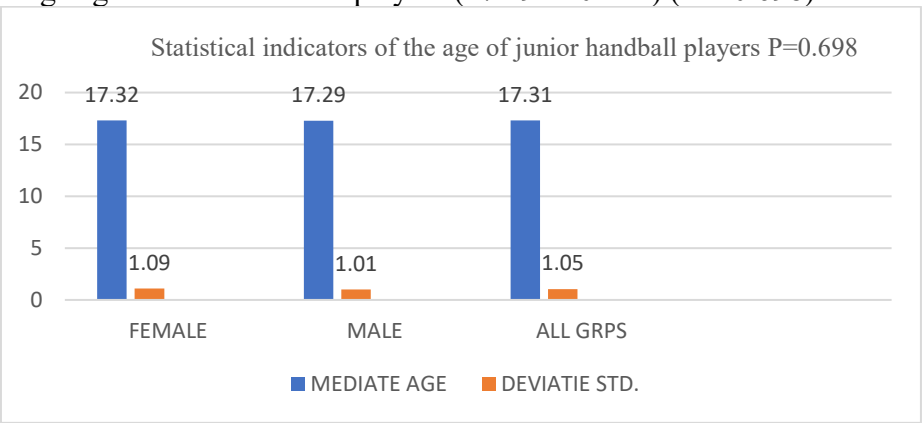

Fig. 1 Average age of junior handball players with shoulder trauma according to gender

The age and school class of the patients were correlated with the presence of lesions. A descriptive analysis of the shoulder trauma in the handball players in the kinetic program showed a significant relation between age (P < 0.001) and injury status. Younger ages were associated with injuries treated with immobilization in an orthosis and physical therapy, as well as lesions treated surgically in conjunction with physical therapy. The athletes' school grades were significantly correlated with the presence of injuries treated conservatively through immobilization with orthoses and physical therapy, as well as injuries managed surgically in combination with physical therapy (p = 0.0022). In comparison to their peers in the 11th and 12th grades, junior handball athletes in the 9th and 10th grades were substantially more

subject to shoulder injuries. A comparative assessment of the quality of life in the LE and LC demonstrated that the experimental group achieved substantially superior results. Initially, the LE average quality of life scores were 62.64 ± 15.72, but they increased to 104.00 ± 4.73. In contrast, the control group began with a mean score of 60.04 ± 18.14 and subsequently improved to 87.28 ± 5.85. The LC made less progress than the LE. The null hypothesis, which predicted no significant differences or correlations, was defied by the final assessment, which revealed significant differences between the lots (p = 0.0012).

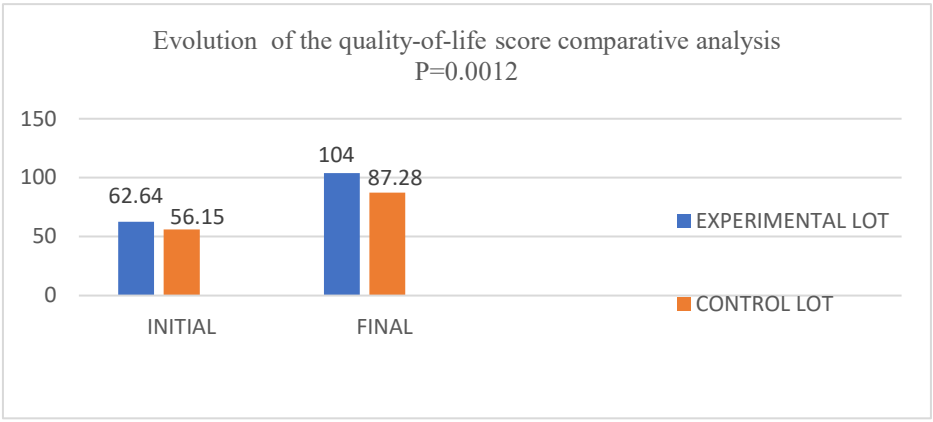

Fig. 2 Evolution of the quality-of-life score

The DASH Questionnaire was employed to compare arm, shoulder, and hand dysfunctions. The results indicated small values DASH scores increased in both lots, highlights that the dysfunctions had improved. Nevertheless, the LE exhibited substantially lower DASH scores, with P= 0.00018, indicating a significantly better improvement than the control group. The DASH score in the LE increased from an initial value of 61.73 ± 14.35 to a final score of 2.16 ± 1.03, specifically. The DASH scores of the LC increased from an initial average of 57.60 ± 9.29 to a final average of 19.36 ± 9.49.

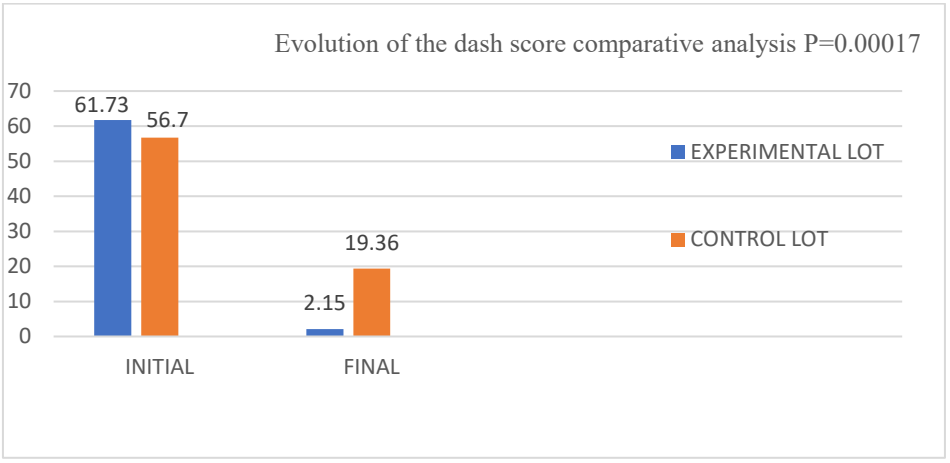

Fig. 3 Evolution of the DASH

The DASH Questionnaire's comparative analysis of arm, shoulder, and hand dysfunctions reveals that the average DASH scores of both lots improved, suggesting a decrease in dysfunctions. Nevertheless, the LE exhibited substantially lower DASH scores, with P=0.00017, indicating a significantly greater improvement than the control group. The DASH score in the experimental group decreased from an initial average of 61.73 ± 14.35 to a final average of 2.16 ± 1.03. By contrast, the DASH scores of the LC decreased from an initial average of 57.60 ± 9.29 to a final average of 19.36 ± 9.49 [18].

Discussions: The significance of shoulder injury rehabilitation in handball athletes is emphasized in a number of national and international studies, emphasizing its status as a top priority in sports traumatology. The incidence of shoulder trauma in handball has consistently increased over the past two decades, with the International Olympic Committee reporting a recent injury rate of 82.2%. This positions handball among the sports with the highest trauma rates. Analysis of publications from the past decade in both national and international specialized journals indicates that the injury rate has increased from 7.8% to 28% per 1,000 match hours and from 0.5% to 1.3% per 1,000 training hours. An imbalance that is challenging to rectify during athletic activities and, in severe instances, may prematurely conclude the athlete's career may result from inadequate or incorrect treatment of a shoulder injury [19,20]. Developing a kinetic program that prioritizes short rehabilitation times, minimal relapse rates, and lower medical service costs is critical for shoulder injury rehabilitation. The adoption of physical therapy programs for prevention and rehabilitation, along with a balanced lifestyle and a well-coordinated interdisciplinary team, forms the foundation for a sports activity with minimal injury risk and high rehabilitation rates. Physiotherapy rehabilitation is

essential for reintegrating handball athletes, whether amateur or professional, back into sports and society. Early treatment of shoulder trauma in handball players involves prompt intervention by the physiotherapist to prevent the onset of compensatory processes and imbalances that are difficult to correct. An effective physiotherapy plan, incorporating a range of techniques and combined recuperative methods, is crucial for treating shoulder injuries and aims to facilitate a rapid return to sports activities without the risk of recidive due to inadequate or incomplete rehabilitation.

Conclusions: The analysis of the results reveals that junior handball athletes in both groups, despite having similar levels of disability, demonstrated a positive and stable improvement in the functional state of the upper limb. Notably, this improvement was significantly more pronounced in the experimental group, where progress was markedly superior. Therefore, the observed outcomes state that the applied recovery plan effectively achieved all its intended objectives. "By applying functional re-education programs, the recovery time can be considerably reduced" [21].

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