

Research on Sports Injuries in Competitive Aerobics

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Abstract. As a branch of gymnastics, competitive aerobic gymnastics has not received the same attention as artistic gymnastics, rhythmic gymnastics, trampoline and acrobatic gymnastics. So, although aerobic gymnasts also face a variety of sports injuries, relatively little research has been done on them. This study searched relevant literature from two electronic databases (SPORTDiscus and PubMed) to integrate and analyze information related to sports injuries and treatment options for aerobic gymnasts. The study found that aerobic gymnasts suffered injuries mainly in the back, wrists and shoulders. There have been relatively comprehensive conservative and surgical treatment plans for the wrist and shoulder, among which the conservative plan for the wrist is mainly splinting or plaster fixation, and the conservative treatment of the shoulder injuries is rehabilitation training. There is no consensus on the most effective treatment for back injuries caused by isthmus. This study hopes to draw the public's attention to aerobic competitive gymnastics.

Keywords: aerobic gymnastics, sports injuries, injury treatment

1. Introduction

Competition aerobic gymnastics has evolved from traditional aerobics. It is a sport that requires high-intensity movement patterns and different elements of difficulty with music. The sport requires a combination of upper and lower body strength, which puts athletes at a high risk of injury during training. In recent years, research related to gymnastics has focused on artistic gymnastics and trampoline, and a small amount of research related to aerobic gymnastics has mainly focused on athletes' training performance, as well as improvements in training methods, and less research has been done on sports injuries, sports risks, and prevention related to competitive aerobic gymnastics. This reflects the lack of attention to competitive aerobic gymnastics in international sports activities and research, and in turn the neglect of aerobic gymnastics by academics and sports research scholars has made it difficult to increase the public's attention to aerobic gymnastics. This paper is a systematic review that searches and analyzes the research related to aerobic gymnastics in recent years, and summarizes the research on sports injuries related to aerobic gymnastics, which also fills the research gap in the field of aerobic gymnastics.

This paper will discuss the sports injuries faced by competitive aerobics athletes, including common injury sites and injury levels; then it will analyze the causes of sports injuries and integrates the existing treatment methods according to the previous literature.

It is hoped that this paper will provide some training references for aerobic gymnastics athletes and coaches.

2. Method

This systematic review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [1]. A literature search was conducted from their origin to September 19, 2022 from two relevant electronic databases (SPORTDiscus and PubMed). In this search, the following keywords were used in the database: aerobic gymnast, OR gymnast, and risk factor.

Eligible studies should meet the following conditions: First, the research object includes aerobic gymnastics. Second, they are peer-reviewed. Third, they are available in English. The following three types of studies were excluded from the scope of this study: First, the study subjects did not include aerobic gymnastics. Second, the research object is non-professional gymnastics team competitors. Third, the subjects of the study were children or adolescents under the age of 18.

3. Analysis

Competitive aerobic gymnastics requires gymnasts to perform with music for continuity of skillful performance, in which individual movements include balance, dynamics (lifts, throws, complex somersaults and twists) and combination. Gymnastics group also includes many collaborations and lifts [2]. The motion characteristic of the technical elements can produce a bigger impact load on the gymnasts' bodies, and therefore they are more susceptible to injuries and strains. A 2005 review of 16 studies of child-age gymnasts concluded: "Body parts particularly affected by injury vary by gender and include the ankle, knee, wrist, lower back, and shoulder." [3]

For aerobic gymnasts, the lower limbs and back are the most common injury sites, among which spondylolysis is a common cause of back pain in adolescent gymnasts [4, 5, 6]. The pain can occur when gymnasts overstretch or spin during training. Other movements that increase pain include the back walkover, back handspring, front walkover, front-handspring, etc. There are many ways to treat spondylolysis, but there is no consensus on the most effective treatment for spondylolysis because of the variety of cases and the success of bone healing with or without brace therapy, regardless of which type of brace is used [7].

However, upper limb injury can be more severe. One of the common types of shoulder injuries is multidirectional shoulder instability (MDI) and musculotendinous injuries, especially in female gymnasts, with supraspinatus tendinitis and subacromial bursitis accounting for the highest proportion of shoulder injuries [8,9,10,12]. Subluxation of the shoulder is also a common shoulder injury, Saluan et al. and Marshall et al. both reported about 20% of this type of shoulder injuries [10, 11]. The conservative treatment of shoulder injury is mainly to use rehabilitation protocols to strengthen proprioception and the stability of the scapular and rotator cuff. Surgical treatments include open or arthroscopic capsular shift. In general, targeted rehabilitation programs can improve shoulder flexibility and help gymnasts effectively recover their athletic performance, while surgery may make it difficult for gymnasts to return to their original athletic level [13].

The wrists of gymnasts are the site of another higher incidence of injuries, as aerobic gymnastics often involves movements that transfer power through the wrists and other parts of the upper limbs. In order to perform the lifting motion, the joints of both the flyer and the bases are at risk of experiencing overloads of force. An investigation has shown that wrist pain in gymnasts is predominantly dorsal, due to the fact that the pressure on the wrist during training can be up to 16 times their body weight, thus leading to a negative ulna mutation and damage to the epiphysis of the distal radius. This injury is manifested in pain in the back of the wrist [14]. For this type of injury, the usual conservative treatment is splinting and reduced movement. The condition of the gymnasts' wrists should be assessed regularly. Surgery can also be used to treat injuries to the distal radius epiphysis, but there are few related studies and surgical cases [15].

In addition, scaphoid stress fractures of the wrists are another injury that can occur in high-level gymnasts. Some studies suggest the injury is caused by muscle weakness in the wrists and fingers of athletes [16]. Treatment of stress fractures of the scaphoid can be performed with plaster fixation, and wrist weight bearing should be avoided during fixation. Screw fixation is the surgical treatment for this injury [17]. The recovery period for stress fractures typically ranges from 15 weeks to 8 months. Lumbar

spondylolisthesis is also a potential cause of lower back pain in gymnasts. Such lesions are rare, have a low probability of worsening symptoms, and are usually detected by CT scans or X-rays.

4. Conclusion

This paper conducts a comprehensive search and screening of the literature in the two major databases, summarizes the common injury types of aerobic gymnastics athletes, and explores the factors of these injuries based on existing studies and cases, as well as the treatment methods adopted at the present stage.

Spondylolysis caused by excessive stretching and rotation during aerobic gymnasts' training make back pain a major sports injury. Due to the large number of cases, there is no consensus on the most effective treatment for isthmus. Common injuries in the upper extremities occur in the shoulder joint and include multidirectional shoulder instability (MDI), muscle and tendon injuries, and shoulder subluxation. Although both rehabilitation protocols and surgical treatment can be used for the treatment of shoulder injuries, rehabilitation treatment is more recommended. In addition, the wrist is also a high-risk area for gymnasts' injuries. The reason for this is not only the extra strain on the wrist caused by the training exercise, but also the gymnasts' own wrist and finger muscle weakness. For wrist injuries, the main treatment methods include splinting or plaster fixation, and surgical screws.

The literature searched and analyzed in this paper mainly focuses on the period from 2005 to 2019, and the relevant literature before and after that is also rare. This makes it impossible for this paper to comprehensively understand the differences and commonalities of sports injuries caused by long-term training and competition of aerobic gymnastics athletes in different generations, so it is difficult to provide favorable data support for future aerobic gymnastics research. This to some extent reflects the fact that aerobic gymnastics is less valued and less regulated than other gymnastics.

Compared to artistic gymnastics, rhythmic gymnastics, trampoline and acrobatic gymnastics, aerobic gymnastics still has its own way, so in order to perfect the related research on aerobic gymnastics, future research can focus on exploring aerobic athlete training action and the correlation of sports injury, sports injury prevention and rehabilitation of aerobic gymnastics athletes. This study also hopes to draw the public's attention to aerobic gymnastics.

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