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# Prevalence of Wrist and Hand Pain in Gymnasts

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**ABSTRACT**

**BACKGROUND:** Wrist and hand pain are common complaints among gymnasts due to the high physical demands and repetitive stress placed on the upper extremities during training and performance. Gymnastics is a unique sport where athletes spend a large amount of time on their hands. Handstands, tumbling, rings, and bars require the athlete to place their entire body weight through the arms and into the hands.

**AIMS & OBJECTIVE:** This study aimed to investigate the prevalence of wrist and hand pain in gymnasts and to identify potential contributing factors.

**METHODOLOGY:** A cross-sectional study design was employed, including 120 gymnasts aged between 10 and 25 years. Data was collected using a structured questionnaire and clinical assessment.

**RESULT:** Results indicated a high prevalence of wrist and hand pain, with significant associations found between pain and training intensity, duration, and age. A survey study was conducted on 120 gymnasts with mean age of 16.8 ± 3.9 years to find out prevalence of wrist and hand pain in adolescent gymnasts. The study revealed a high prevalence of wrist and hand pain among gymnasts, with notable associations with increased training duration and age. General return to play principles is similar for all gymnast-related wrist injuries, including resolution of pain, restoration of normal wrist joint function, completion of a progressive rehabilitation program, and use of proper technique.

**CONCLUSION:** Preventive strategies and early interventions are recommended to mitigate the impact of wrist and hand injuries in gymnasts. The present study concluded that Wrist and hand pain are prevalent among gymnasts, particularly in those with intensive training schedules. Regular screening and targeted interventions are crucial in minimizing injury risk and enhancing athlete performance. It is essential that practitioners who provide care for gymnasts have a thorough understanding of the unique biomechanical demands of the sport on the wrist joint and the variety of significant overuse injuries associated with gymnastic participation.

**KEYWORDS:** wrist pain, hand pain, gymnasts.

## INTRODUCTION

Gymnastics is a sport in which the musculoskeletal system is exposed to extensive loads, which must be distributed through the elbow and wrist joints when the body is supported by the upper extremities[1]. Gymnastics is a unique sport where athletes spend a large amount of time on their hands. Handstands, tumbling, rings, and bars require the athlete to place their entire body weight through the arms and into the hands. Other sports do not place these heavy demands on the upper extremity. When tumbling, the

athlete puts not only their entire body weight through the hands but can have up to 16 times their body weight in force going across the wrist[2].

Gymnastics is a sport that demands high levels of strength, flexibility, and coordination. Due to the nature of the sport, gymnasts are susceptible to various musculoskeletal injuries, particularly in the upper extremities. Repetitive weight-bearing and impact activities can lead to overuse injuries in the wrist and hand[3].

Wrist and hand pain is highly prevalent among gymnasts, with studies indicating that a significant portion of gymnasts experience such pain, often during their growth and development. The prevalence rates range from 46% to 79%, with a notable 56-67% in high-quality studies. This pain is often linked to repetitive stress on the wrist joint, particularly the distal radial physis, and can be exacerbated by factors like increases in training volume or transitions to higher levels of gymnastics[4].

The Swiss statistics institute classified the gymnastics among the first 6 sports regarding the number of injuries, emphasizing the large percentage of traumas occurred at the first joint by 5.8% in 2003, and tripled in 2005 (19%), in comparison with other parts of the body.

Recent data published by the U.S. Centers for Disease Control and Prevention in their *Morbidity and Mortality Weekly Report* cited an injury rate for women's collegiate gymnastics of 10.4 (9.5–11.2) per 1000 athletic exposures, second only to wrestling (13.1 per 1000). In fact, gymnastics injury rates ranked higher than the rate found for contact sports such as football (9.2 per 1000) or women's and men's ice hockey, 6.1 and 9.5 per 1000, respectively[11].

**Westermann et al.** reported injury rates of 8.78 per 1000 male gymnasts and 9.37 per 1000 women gymnasts in their study of division 1 gymnasts. They further categorized the injuries according to body part and found the wrist and hand to be the most injured body part in men, and the sixth most commonly injured body part in women. In female gymnasts, the upper extremity is weight bearing and therefore absorbing direct force in tumbling, balance beam, uneven bars, and vault. General return to play principles are similar for all gymnast-related wrist injuries, including resolution of pain, restoration of normal wrist joint function, completion of a progressive rehabilitation program, and use of proper technique[12].

Despite the known risk, limited data exist on the prevalence of wrist and hand pain in gymnasts, especially in different age groups and training levels. Understanding the prevalence and associated factors is crucial for developing targeted preventive measures.

There is no such study of findings done before to find the prevalence of wrist and hand injuries in gymnasts so far. Because this is an important aspect for gymnasts to help prevent wrist and hand injuries during gymnastic activities.

Therefore, this study aims towards finding the prevalence of wrist and hand pain in Indian Gymnasts and difficulties they face in following activities of daily living due to this pain. This study will help us in making appropriate treatment protocol and injury prevention strategies once we know specific trends in difficulties faced by the gymnasts and help them follow their day-to-day activities as well as training smoothly.

## MATERIALS AND METHOD

### STUDY DESIGN

This investigation employed *A survey study design* to find out prevalence of wrist and hand pain in adolescent gymnasts

**STUDY SUBJECTS**

120 gymnasts were recruited for this investigation.

**STUDY DURATION**

The intervention period encompassed twelve weeks.

**STUDY CENTRE:**

The investigation was conducted at department of physiotherapy, JRNRV University, Udaipur, following institutional ethical committee approval.

**Participant preparation:**

120 gymnasts were randomly selected according to inclusion and exclusion criteria.

Informed consent will be taken. Past Medical/ Surgical History will be taken.

PRWE will be explained to participants in detail. Participants will have to fill PRWE accordingly.

**Inclusion Criteria**

Inclusion criteria encompassed male and female Gymnast with age group of 10-25 yrs. Gymnast with minimum 1 yr. of experience

**Exclusion Criteria**

Exclusion criteria eliminated participants with Presence of shoulder pathologies, Presence of wrist pathologies like CTS, dequerian's syndrome etc., Presence of Neurological disorders, Presence of Neck Pathologies, Presence of systemic illness.

**Study Materials**

Study materials included written consent forms, general assessment forms, Pen, Paper, Pre participation assessment form, PRWE Scale

**OUTCOMES MEASURES**

Structured questionnaire (demographics, training details, pain history)

The Patient Rated Wrist/ Hand Evaluation Score (PRWE):

It is self-administered by the patient. The score consists of two domains – pain and function – both of which carry equal weight. There are five items in the pain domain and ten items in the function domain. The response to each item is scored on a scale of 0–10. The pain score is the sum of five items, a worse score of 50; the disability (function) score is the sum of ten items, divided by 2. Thus, the total function on the PRWE scale ranges from 0 (normal wrist) to 150 (worst possible score).

Scoring

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Construct validity

The change in the disability over time was evaluated in 101 patients with wrist fractures. A statistically significant improvement was found ($p<0.0001$), with the amount of improvement being 74% as compared to the SF-36 score, which reported an improvement of 14% ($p<0.0001$).

Criterion validity

The PRWE score was correlated with the SF-36 score and with an impairment score that was based on an assessment of physical functions, such as range of movement of wrist joint, grip strength and dexterity. The PRWE score showed a correlation with the SF-36 score of between 0.33 and 0.73. There was a low correlation with the SF-36 mental summary score and a high correlation with bodily pain score and physical function score. The PRWE score correlated poorly – 0.52 (weak to moderate correlation) – with an impairment score (score for the measurement of function impairment in patients, which raises questions over the validity of this score, as an impairment score is the aspect which corresponds to the function of the PRWE scale, an important aspect when evaluating outcome in patients with distal radius fractures.

Test–retest reliability

This was tested on three groups of patients. Groups 1 and 2 comprised patients with distal radius fractures currently undergoing physiotherapy and having completed physiotherapy, respectively, while Group 3 patients had scaphoid fracture non-union and were tested for long-term retest reliability. A short-term retest reliability testing was performed on the first two groups. An excellent intra-class correlation (ICC; >0.90) was found for pain subscales for all three groups. The function subscales showed an excellent reliability in the distal radius fracture group (ICC > 0.85) but only moderate reliability over the long term in Group 3 (ICC > 0.61). No appropriate testing for internal consistency and responsiveness was performed, which makes the PRWE score rather weak in terms of overall reliability.

**PROCEDURE AND INTERVENTIONS**

After collecting the written consent from the gymnasts selected by inclusion and exclusion criteria.

The demographic and clinical data will be collected from each gymnast at the time of commencement of the study.

Participants willing to participate will be screened for inclusion and exclusion criteria.

Participants meeting the inclusion criteria will be explained about the study.

Informed consent will be taken.

Past Medical/ Surgical History will be taken

PRWE will be explained to participants in detail.

Participants will have to fill PRWE accordingly.

**RESULTS AND STASTICAL ANALYSIS:**

The present study was carried out to find out prevalence of wrist and hand pain in adolescent gymnasts. In this study 120 gymnasts were included with age distribution between 10 to 25 years.

**Table 1: Demographic Characteristics of Gymnasts**

| Variable | Frequency (n=120) | Percentage (%) |
|---|---|---|
| Age (Mean ± SD) | 16.8 ± 3.9 years | - |
| Age Group | | |
| 10-14 years | 42 | 35% |
| 15-19 years | 50 | 41.7% |
| 20-25 years | 28 | 23.3% |
| Gender | | |
| Male | 52 | 43.3% |
| Female | 68 | 56.7% |
| Training Frequency | | |
| 3-5 days/week | 46 | 38.3% |
| 6-7 days/week | 74 | 61.7% |

| Training Duration per Session | | |
|---|---|---|
| <1 hour | 18 | 15% |
| 1-2 hours | 64 | 53.3% |
| >2 hours | 38 | 31.7% |

**Table 2: Pain Prevalence by Training Hours per Week**

| Training Hours/Week | Pain Present (n=82) | Pain Absent (n=38) | Total (n=120) |
|---|---|---|---|
| <6 hours | 14 | 20 | 34 |
| 6-10 hours | 24 | 10 | 34 |
| 11-15 hours | 28 | 6 | 34 |
| >15 hours | 16 | 2 | 18 |

**Graph 1: Bar Graph of Pain Prevalence by Training Duration**

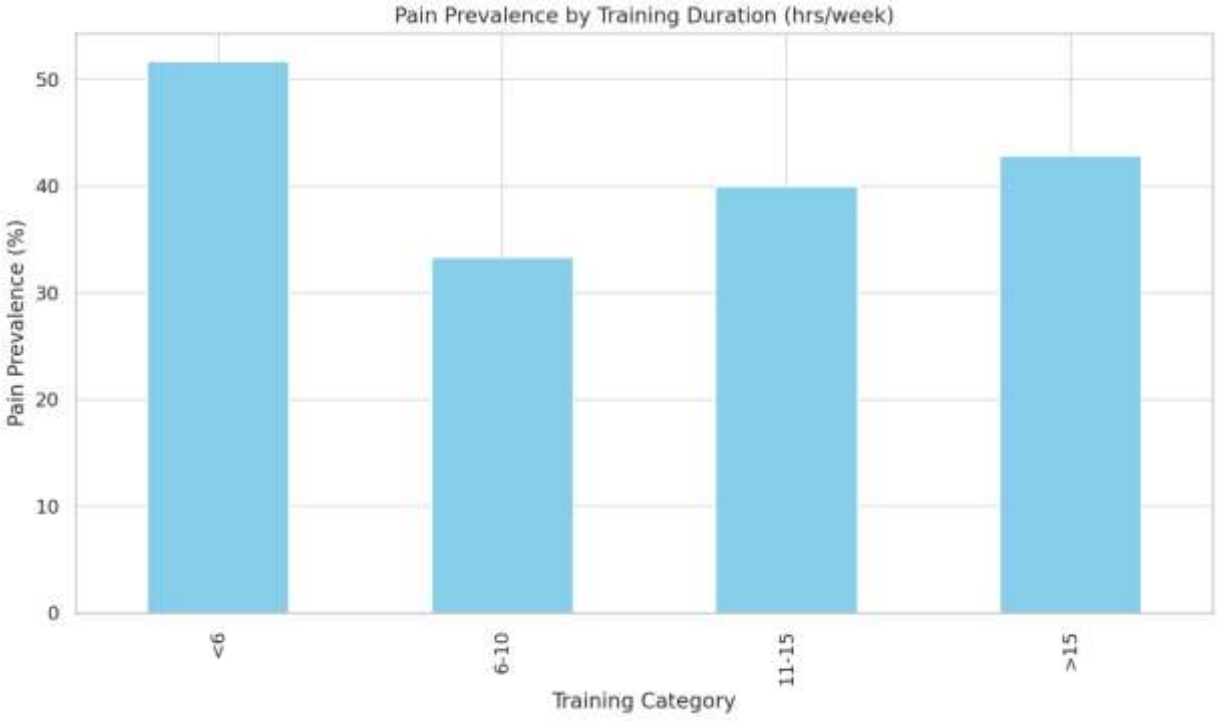


**Table 3: Cross-tabulation of Pain by Age Group and Gender**

| Age Group | Male (Pain %) | Female (Pain %) | Total Pain Prevalence (%) |
|---|---|---|---|
| 10-14 | 40% | 50% | 45% |
| 15-19 | 60% | 68% | 64% |
| 20-25 | 72% | 75% | 73% |

**Graph 2: Line Graph Showing Pain Prevalence Across Age Groups**

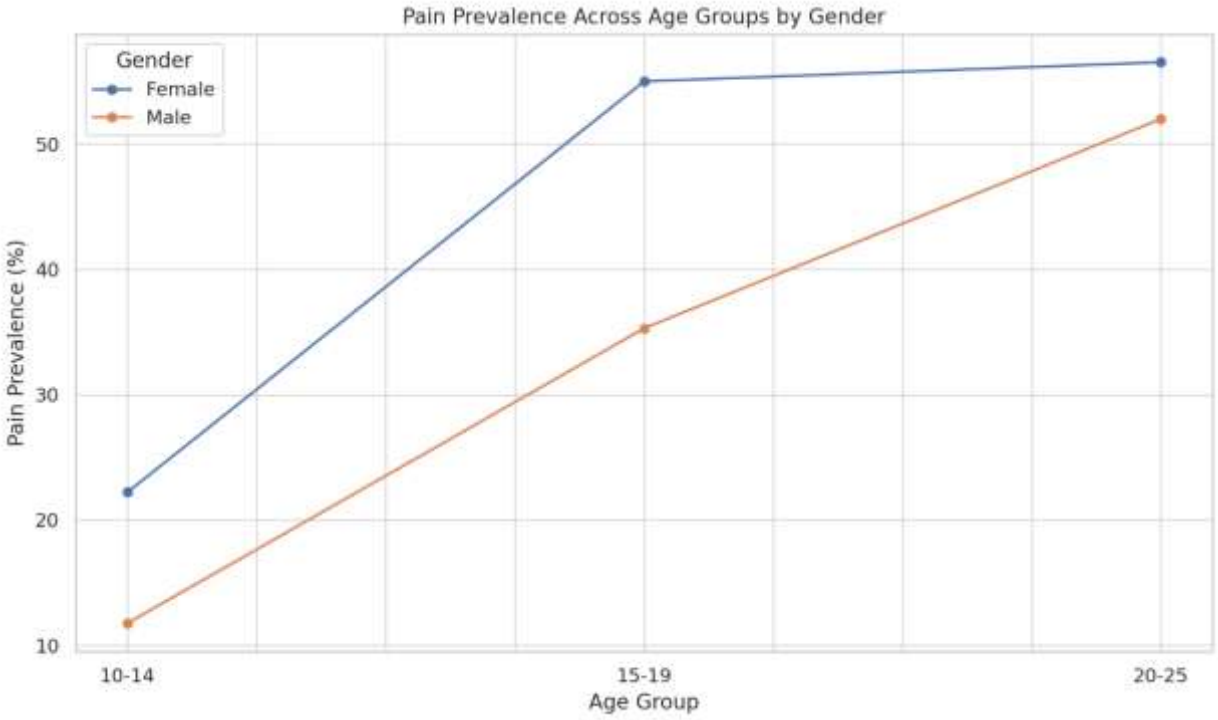


**Table 4: Logistic Regression for Risk Factors Associated with Wrist/Hand Pain**

| Variable | Odds Ratio (OR) | 95% Confidence Interval | p-value |
|---|---|---|---|
| Age (per year) | 1.12 | 1.02 - 1.24 | 0.015 |
| Gender (Female) | 1.35 | 0.89 - 2.03 | 0.16 |
| Training >10 hours/week | 2.75 | 1.45 - 5.20 | 0.001 |
| Training >2 hours/session | 1.85 | 1.05 - 3.23 | 0.032 |

## DISCUSSION

A survey study was conducted on 120 gymnasts with mean age of 16.8 ± 3.9 years to find out prevalence of wrist and hand pain in adolescent gymnasts.

The study revealed a high prevalence of wrist and hand pain among gymnasts, with notable associations with increased training duration and age. These findings are consistent with previous research indicating overuse as a primary mechanism of injury. The logistic regression analysis highlighted that gymnast training more than 15 hours per week had significantly higher odds of developing pain. Preventive measures such as proper technique training, adequate rest, and early rehabilitation are essential to reduce the burden of these injuries.

Prompt evaluation and management is necessary to avoid the negative sequelae that can often accompany these injuries.

Because of the repeated forceful loading of the wrist and the use of the wrist and hand to support the entire body, wrist injuries are seen frequently. Fortunately, many of these injuries are treatable with activity modification, correction of improper biomechanics, soft bracing, and physical therapy. In addition to directed therapy for the injured wrist, physical therapy should incorporate core stabilization

exercises as well as mobility and stabilization exercises of the shoulder and elbow as this is felt to potentially minimize the load on the wrists during upper extremity activities.

General return to play principles is similar for all gymnast-related wrist injuries, including resolution of pain, restoration of normal wrist joint function, completion of a progressive rehabilitation program, and use of proper technique.

Fortunately, many of these injuries are treatable with activity modification, correction of improper biomechanics, soft bracing, and physical therapy. In addition to directed therapy for the injured wrist, physical therapy should incorporate core stabilization exercises as well as mobility and stabilization exercises of the shoulder and elbow as this is felt to potentially minimize the load on the wrists during upper extremity activities.

There is a significant body of evidence which demonstrates that modifiable risk factors such as occupation, workplace demands, and sporting activity are associated with wrist pain. This is consistent with the evidence relating to other sites of chronic musculoskeletal pain such as the shoulder and spine.

While Da Costa et al. have shown that heavy physical work, smoking, high body mass index, high psychosocial demands increase the risk of work-related musculoskeletal disorders. In this review only one study assessed predictive risk factors, demonstrating that workers who use power tools have a higher rate of wrist pain at 5 years, this is associated with high frequency impact tool use and the number of years in occupation. This points to the importance of the holistic approach in assessing and managing patients with wrist pain, as it may be useful to detect specific modifiable risk factors which can be incorporated into any potential treatment plan.

The studies by DiFiori et al. in young gymasts are the only ones within this review which have shown that a structural abnormality, abnormal physical morphology, is associated with wrist pain.

The prevalence of radiographic wrist osteoarthritis varies within scientific literature. Studies by Kellgren and Van Saase both demonstrated a prevalence of radiographic wrist osteoarthritis of around 5 to 10% in men women.

A lower prevalence was reported in the Framingham study of less than 2%. These differences may well relate to different radiographic thresholds used for determining the presence of radiographic osteoarthritis. While other structural abnormalities around the wrist have been shown to be highly prevalent in asymptomatic patients such as those relating to the TFCC, extensor carpi ulnaris tendon and ganglia.

## LIMITATIONS AND FUTURE SCOPE OF STUDY

### Study Limitations

This investigation presents several limitations that warrant consideration. UN equal male and female ratio, so Homogeneity is not maintained, Differentiation of unilateral and bilateral was not done, Only single blinding was done in present study.

### Future Research Directions

In future the study would be incorporated into the large sample size and large zone so the results obtained in the present study can be evaluated thoroughly and the uniformity in age distribution can be achieved, Study can be done specifically on specific gender, The other method should also be included in future study.

## CONCLUSION

The present study concluded that Wrist and hand pain are prevalent among gymnasts, particularly in those with intensive training schedules. Regular screening and targeted interventions are crucial in minimizing injury risk and enhancing athlete performance.

The biomechanical and physiological demands of gymnastics require highly functioning upper extremity joints, which are not generally accustomed to or necessarily designed for repetitive forceful impact and weight bearing. Because of the repeated forceful loading of the wrist and the use of the wrist and hand to support the entire body, wrist injuries are seen frequently. Fortunately, many of these injuries are treatable with activity modification, correction of improper biomechanics, soft bracing, and physical therapy. In addition to directed therapy for the injured wrist, physical therapy should incorporate core stabilization exercises as well as mobility and stabilization exercises of the shoulder and elbow as this is felt to potentially minimize the load on the wrists during upper extremity activities. It is essential that practitioners who provide care for gymnasts have a thorough understanding of the unique biomechanical demands of the sport on the wrist joint and the variety of significant overuse injuries associated with gymnastic participation.

Further research is needed to explore the effectiveness of commonly employed strategies of joint strengthening and stability in the upper extremity coupled with core strengthening and improvement in sport-specific biomechanic techniques in this youth-dominated sport.

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