

Comparison and Prevalence of Generalized Joint Hyper-mobility in Iranian Students

Abstract

Background: An increase in the movement of one or more joints beyond the normal range of motion is known as hyper-mobility. However, in most cases, joint hyper-mobility is observed as a confined phenomenon referred to as generalized joint hyper-mobility (GJH). The present study aims to compare and evaluate the prevalence of GJH among Iranian students.

Methods: The present cross-sectional and retrospective study enrolled both male and female students aged 8 to 18 years who were willingly enthusiastic to participate in this study. For this, 1225 students (726 girls and 499 boys) were chosen through the convenience and targeted sampling method. The research tool was a self-assessment 5-part questionnaire for identifying GJH (5PQ; Sensitivity: 80-85%; Specificity: 80-90%) (Hakim & Grahame). Due to the Covid-19 pandemic and no direct access to students, the questionnaire was designed in Google Forms Survey Administration software and distributed online among sports teachers or students through social networks. The data gathered from completed questionnaires were analyzed in SPSS version 22 using the two-way chi-square test.

Results: The prevalence of GJH among female students (41.2%) was higher than that among male students (30.7%). The two-way chi-square test revealed a significant difference in the rate of GJH between female and male students ($p=0.001$, $\lambda=13.97$). According to the results, "gender" accounted for 10% of the prevalence of hyper-mobility in students. The statistical tests revealed that "age" causes no significant difference in the rate of hyper-mobility among students ($p=0.54$, $\lambda=10.79$).

Conclusion: The present study revealed a high prevalence of GJH among Iranian students. The prevalence of GJH among female students was higher than that among male students. Thus, these results entail paying more attention to this phenomenon, as it may provoke physical and psychological complications in the future for students affected by GJH.

Keywords: Student, generalized joint hyper-mobility, ligament laxity

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Introduction

An increase in the mobility of one or more joints beyond the normal range of motion is known as joint hyper-mobility ⁽¹⁾. Joint hyper-mobility may be asymptomatic or symptomatic ⁽²⁾. Ligamentous laxity is the main cause of joint hyper-mobility ⁽³⁾. Ligament laxity is among the cardinal features of genetic disorders such as Marfan syndrome, Ehlers-Danlos syndrome, or osteogenesis imperfect ⁽⁴⁾. However, in most cases, joint hyper-mobility is observed as a confined phenomenon referred to as generalized joint hyper-mobility (GJH) ⁽⁴⁾. According to studies, the reported occurrence of GJH in children aged 6–15 years varies between 8.8% and 64.6% ^(5, 6). The prevalence of GJH is high in girls and decreases with age ⁽⁷⁻¹¹⁾. A likely reason for this discrepancy between the results reported by various studies is targeting different populations and races with different age groups. Earlier researchers have reported the impact of ethnic background on GJH. Specifically, GJH is more prevalent among Asian and African populations compared to the Western population ⁽¹²⁻¹⁵⁾. Furthermore, there is no consensus on whether the incidence of GJH is the same or different in the joints of both sides. This way, some reports are confirming the differences, and some emphasize the similarity of the involvement of both sides ^(16, 17). Although there is a consensus that younger children are more likely to exhibit JH than teens and

young people, there is little evidence in this regard⁽¹⁸⁾. For instance, a study on 1845 Swedish children and adolescents revealed that in all age groups, girls experience higher levels of JH than boys. Additionally, JH in boys decreased with age, whereas this trend was quite the opposite in girls⁽¹⁹⁾. By contrast, some studies have not reported the relationship between age and the severity of JH⁽²⁰⁾. Importantly, identifying GJH in school-aged children would facilitate the monitoring of early changes and planning for early rehabilitative intervention⁽⁶⁾. There are numerous tools to identify and measure GIH. One of these tools is the Beighton Scoring System (BeS) which measures joint hypermobility on a 9-point scale. In addition, the self-assessment five-part questionnaire on GJH (5PQ; Hakim & Grahame) offers a more practicable way to identify GJH and encompasses five aspects regarding past or present information on joint hypermobility⁽²¹⁾. The BeS to work requires direct access to participants, whereas 5PQ does not necessarily entail direct access to participants and can be used virtually, in particular for situations such as the lockdown restrictions due to the Covid-19 pandemic, and can deliver valid and reliable results. Earlier studies have reported a sensitivity of 80-85% and a specificity of 80-90% for 5PQ^(21, 22). Previous studies have also shown that the self-reported 5PQ (with a cut-off level of 2/5) is a valid and reliable instrument to identify GJH, compared with the BeS (with a cut-off level of 4/9 or 5/9)^(23, 24). According to the previous studies and considering the high prevalence of GJH and its subsequent complications such as pain, arthritis, and dislocations, it is crucial to reflect and carry out fundamental research on this phenomenon. Taking note of very rare studies carried out on the prevalence of GJH among Iranian students, it is crucial to conduct a comprehensive study in this regard. Thus, the present study is the first case of investigating a large population of Iranian male and female students with GJH. Due to the Covid-19 pandemic and no direct access to students, this study utilizes the widely used 5PQ, which its content validity and reliability have been

confirmed compared to other instruments. The results of the present study are presumed to represent the prevalence of GJH among Iranian male and female students and allow better management of this phenomenon.

Methods

This was a cross-sectional retrospective study targeting male and female students aged 8 to 18 years living in Qazvin, Fars, Kerman, Tehran, and Isfahan provinces (Iran) who were willingly enthusiastic to participate in this study. A total of 1225 students (726 girls and 499 boys) were chosen through the convenience and targeted sampling method. The inclusion criteria were falling in the age range of 8 to 18 years (school age), feeling no pain during movements, and studying in a school. Students who were out of the above age range and were not studying, those feeling pain during movements, and those who did not complete the 5PQ were excluded from the study. All students were voluntarily eager to participate in this study and completed the questionnaire.

In this study, the research tool was a self-assessment 5-part questionnaire for identifying GJH (5PQ; Sensitivity: 80-85%; Specificity: 80-90%) (Hakim & Grahame)^(21, 24). Due to the Covid-19 pandemic and no direct access to students, the questionnaire was designed in Google Forms Survey Administration software and distributed online among sports teachers or students through social networks such as Telegram and WhatsApp. The questions in the 5PQ include the following:

1. Can you now (or could you ever) place your hands flat on the floor without bending your knees?
2. Can you now (or could you ever) bend your thumb to touch your forearm?
3. As a child, did you amuse your friends by contorting your body into strange shapes or could you do the splits?
4. As a child or teenager, did you dislocate your shoulder or kneecap on more than one occasion?
5. Do you consider yourself double-jointed?

As instructed by the questionnaire, answering “yes” to two or more of these questions suggests joint hyper-mobility. The researchers gave full guidance to the students on how to complete the questionnaire. The students were allowed to complete the online version of the questionnaire from April 30 to June 20, 2021. The collected data were analyzed in SPSS version 22. For this, descriptive tests were first used to classify and observe frequency. The two-way chi-square test was then used to measure the prevalence of hyper-mobility and its frequency in male and female students as well as different ages. In

all the tests, the results with $p \leq 0.05$ were considered to be statistically significant.

Results

The present study investigated the prevalence of hyper-mobility in adolescent girls (n: 726) and boys (n: 499) aged 8 to 18 years (Table 1). All the participants answered the 5PQ for the diagnosis of hyper-mobility. As instructed by the questionnaire, answering “yes” to two or more of these questions suggests joint hyper-mobility (Table 2).

Table 1: The demographic information of the participants

Gender	Age (mean \pm SD)	Participants (n)	Hyper-mobility	
			Yes	No
Males	14.50 \pm 3.54	499	153 (30.7%)	346 (69.3%)
Females	15.29 \pm 2.77	726	298 (41.2%)	428 (58.8%)
Total	14.97 \pm 3.12	1225	454	771

Table 2: The frequency of “Yes” and “No” responses to the questions of the 5PQ for diagnosing hyper-mobility

Question	Girl			Boy		
	Yes	No	Total	Yes	No	Total
Can you now (or could you ever) place your hands flat on the floor without bending your knees?	343 (47.3%)	383 (52.7%)	726	245 (49.1%)	254 (50.9%)	499
Can you now (or could you ever) bend your thumb to touch your forearm?	215 (30%)	511 (70%)	726	109 (21.8%)	390 (78.2%)	499
As a child, did you amuse your friends by contorting your body into strange shapes or could you do the splits?	60 (9.1%)	666 (90.9%)	726	31 (6.2%)	468 (93.8%)	499
As a child or teenager, did you dislocate your shoulder or kneecap on more than one occasion?	261 (36.2%)	465 (63.8%)	726	115 (23%)	384 (77%)	499
Do you consider yourself double-jointed?	145 (20.5%)	581 (79.6%)	756	62 (12.4%)	437 (87.6%)	499

The chi-square test results revealed a significant difference in the rate of hyper-mobility between boys and girls ($p=0.001$, $\lambda=13.97$). According to the results, "gender" accounted for 10% of the prevalence of hyper-mobility in students. Furthermore, the statistical tests revealed that "age" causes no significant difference in the rate of hyper-

mobility among students ($p=0.54$, $\lambda=10.79$). It was found that "increasing age" accounts for 9% of the occurrence of hyper-mobility in students (Table 3). Also, the distribution of the frequency of people with hyper-mobility can be seen in terms of age and gender (Figures 1 and 2).

Table 3: The results of the statistical tests

Variable	Chi-square	p-value	Effectiveness
Gender	13.97	*0.001	0.106
Age	10.79	0.54	0.09

* The results with " $p \leq 0.05$ " are considered to be statistically significant.

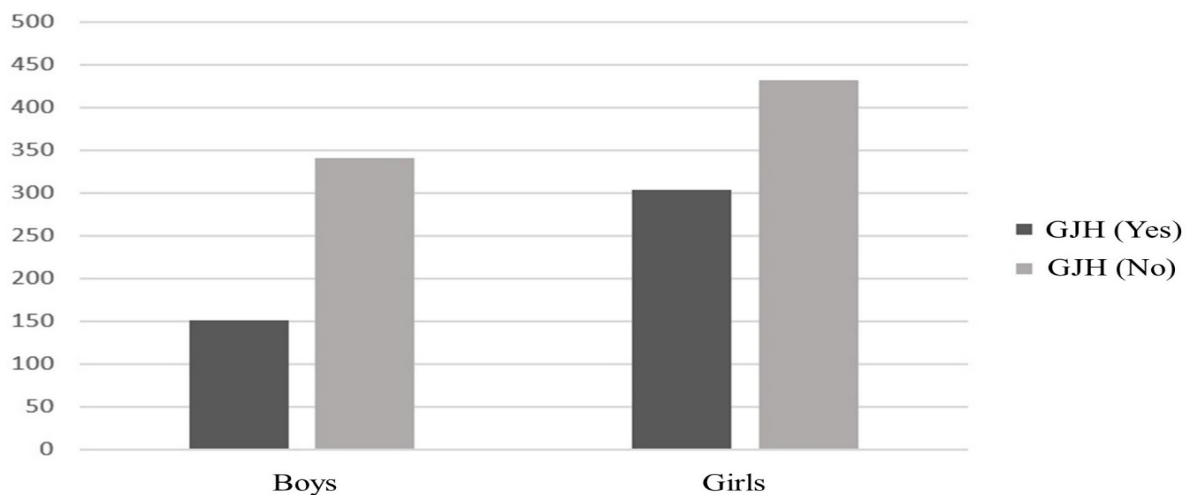


Figure 1: The frequency of students with joint hyper-mobility by gender

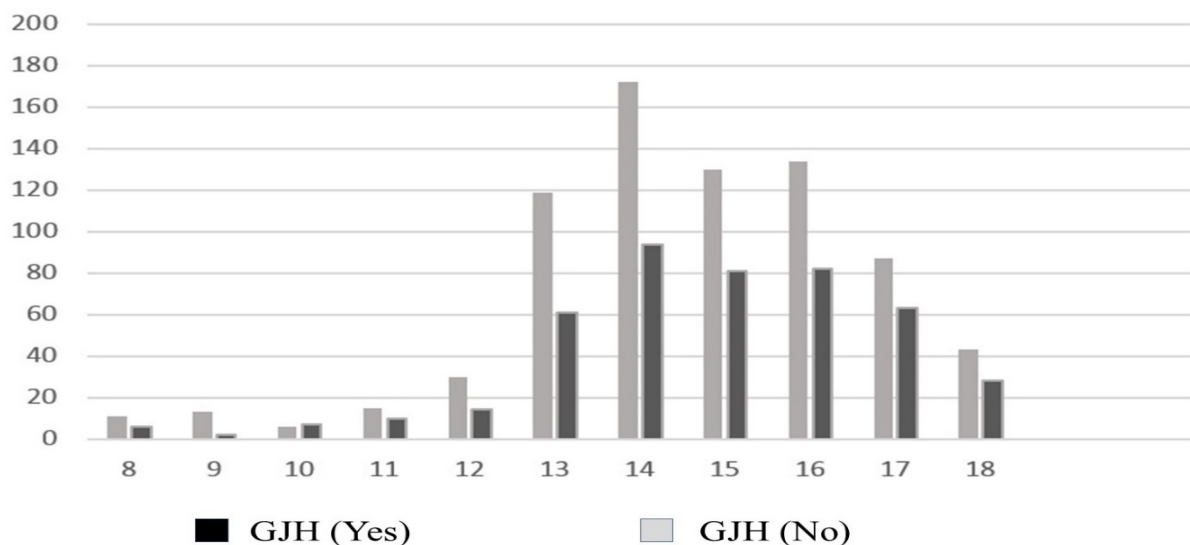


Figure 2: The frequency of students with joint hyper-mobility at different ages

Discussion

The present study aimed to compare the prevalence of GJH among Iranian students. In this study, the prevalence of GJH was found to be 30.7% in boys and 41.2% in girls. There was also a significant difference in the prevalence of GJH between male and female students, with the prevalence of GJH in girls being higher than that in boys. Regarding the prevalence (and comparison) of GJH in boys and girls, the results of the present study agree with those reported in previous studies. For instance, Jamshidi et al. (2004) investigated the prevalence of joint hyper-mobility syndrome among students in Tehran, Iran. Out of all 1,005 students, 240 (23.9%) had joint hyper-mobility (with a score of over 5 on the BeS scale). The prevalence of hyper-mobility syndrome was significantly higher in girls (33.7% in girls, compared to 14.1% in boys). In addition, hyper-mobility was more prevalent in the younger age groups (6-12 years) compared to the higher ages (13-19 years)⁽²⁵⁾.

Since the incidence and prevalence of hyper-mobility have been reported to vary greatly in different populations, with marked differences according to race and geographical region⁽²⁶⁾, we reflect on some of the relevant studies carried out worldwide. For instance, Butt Islam et al. (2014) investigated the percentage prevalence of joint hyper-mobility syndrome in students of a private school in the Islamabad-Rawalpindi metropolitan area in Pakistan. In this study, it was observed that 30.8% of students between 8 to 17 years of age are hyper-mobile. Although both genders were seen to be hyper-mobile, their percentage was higher in females than in males⁽²⁷⁾. In a similar study, Jarallah et al. (2014) investigated the prevalence of joint hyper-mobility among 390 young Kuwaiti students aged 18 to 29 years. The prevalence of joint hyper-mobility was 29.4% in males and 14.5% in females, indicating a significant difference between the two genders. In addition, the Beighton score was inversely correlated with age⁽²⁸⁾. Hortelan

et al. (2018) studied the prevalence of hyper mobility among volunteer university students aged 18 to 25 years old. For this, the prevalence of joint hyper-mobility was assessed using the Beighton score and the 5PQ. In this study, localized hyper-mobility was more frequent than generalized hyper-mobility in the population of youngsters, predominantly women⁽²⁹⁾. Reuter and Fichthorn (2019) investigated the prevalence of GJH, musculoskeletal injuries, and chronic musculoskeletal pain among American university students. For this, they examined young adults, including 482 females and 172 males aged 18 to 25 years. The prevalence of GJH in a university-aged population was estimated at 12.5%. However, women did not have higher rates of GJH than men⁽³⁰⁾. Sherif Sirajudeen et al. (2020) investigated the prevalence of GJH among 311 school-aged male and female children aged 8-16 years in the Majmaah region, Saudi Arabia. The Beighton score was used to assess GJH. It was found that 15.2% and 7.6% of the school children are diagnosed with GJH, respectively, using the Beighton score cut-off ≥ 4 and ≥ 6 . The prevalence of GJH was higher among females (16.8%) than among males (13.4%), but the difference was not statistically significant⁽³¹⁾. Schlager et al. (2020) evaluated the validity of the self-reported 5PQ as an assessment of GJH in early pregnancy. The results revealed a moderate correlation between the self-report 5PQ and the Beighton score as a reference test. They further reported the highest combined sensitivity (84.1%), as well as specificity (61.9%) on 5PQ cut-off level ≥ 2 ⁽²²⁾. Kashif et al. (2020) investigated the prevalence of joint hyper-mobility among high school and university students. A total of 1749 students, with an average age of 16.96 (range 14–26), were examined. The prevalence of JH was 61.9% in female students studying in high school and 58.4% in female university students⁽³²⁾. In a recent systematic review and meta-analysis, Sobhani Eraghi et al. (2020) investigated the

prevalence of hyper-mobility in children and adolescents. The total prevalence of JH was equal to 32.5% in girls and 8.1% in boys. According to the meta-analysis, the prevalence of JH among children and adolescents was 34.1% in total, whereas it was higher in girls and lower in older ages⁽²⁶⁾. Except for the study carried out by Reuter and Fichthorn (2019), indicating that the prevalence of hyper-mobility in girls is not higher than that of boys, other studies advocate that the prevalence of hyper-mobility in girls is higher than that of boys. The difference between the results of the former (Reuter and Fichthorn, 2019) and those reported in previous studies and the present study is investigating older participants (18 to 25 years) by Reuter and Fichthorn (2019). Earlier research has shown that the prevalence of hyper-mobility is inversely correlated with age, with a higher prevalence of GJH that is observed in lower ages. Thus, the reason why the prevalence of GJH in girls was not higher than in boys could be attributed to the higher ages of girls compared to boys. Furthermore, although the prevalence of hyper-mobility was higher in girls than in boys in the study by Sherif Sirajudeen et al. (2020)⁽³¹⁾, no significant difference was observed between girls and boys, presumably due to the study's small population (n: 311). Joint hyper-mobility is observed as a confined phenomenon known as GJH⁽⁴⁾. GJH is easily evaluated using the Beighton score and the 5PQ and needs to be assessed in individuals with musculoskeletal complaints. GJH may represent joint laxity or instability that can predispose the person to mechanical injury, though it may be asymptomatic. Joint hyper-mobility is often compensated by muscle tension, which can lead to spasms, pain, and fibromyalgia-like symptoms. Individuals with a higher rate of GJH are prone to higher mechanical problems such as pain in multiple joints, but not necessarily hyper-mobile joints⁽³³⁾. Due to the lockdown restrictions imposed by the Covid-19 pandemic and no access to participants, this study used the online version of the 5FQ. However, future studies are recommended to use both 5FQ and the Beighton score

simultaneously to evaluate the prevalence of GJH among the participants.

Conclusion

The present study revealed that GJH is highly prevalent among Iranian male and female students. The prevalence of GJH in girls was higher than that in boys. Thus, the GJH phenomenon is an issue worth exploring, as in the future it may cause physical and psychological complications for individuals affected by this condition. An important factor to consider is the contribution of other factors to this phenomenon, necessitating carrying out more additional and precise studies in this regard. The present study merely reported the prevalence of GJH among school-age girls and boys and can demonstrate the status of this phenomenon for therapists to allow them to fix or prevent the progress of this phenomenon among school-age students.

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