ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 12, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

PREVALENCE OF GENERALIZED LIGAMENT LAXITY IN ADULT INDIAN POPULATION: A CROSS-SECTIONAL STUDY AND REVIEW OF LITERATURE

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Received: 10 October 2023, Revised and Accepted: 22 November 2023

ABSTRACT

Objective: Generalized ligament laxity (GLL) is defined as increased range of motion across multiple joints in an individual. Its prevalence has been reported to be between 5% and 15%. Although there has been implication of increased prevalence in Indian population, there are relatively few studies related to the prevalence of GLL in adult Indian population. There is also a dearth of literature on, which specialty outpatient department (OPD), these patients commonly present to, with their complaints. The objective of this study was to assess the prevalence of GLL in adult Indian population.

Methods: 5400 patients were selected from various OPDs of a tertiary care hospital after informed consent. After stratification for age and sex, Beighton's score assessment was done.

Results: Using the Beighton's score of four or more, to assess the prevalence of generalized ligament laxity, a total of 735 (13.61%) participants had GLL in the entire study population of 5400. Significantly higher number of patients were found to have GLL from the sample recruited from orthopedic OPD (p=0.013) as compared to other OPDs. The highest Beighton's score was 8/9, recorded in a 29-year female in the orthopedic OPD. It was observed that in all OPDs, the mean Beighton's scores were higher in female than in male participants in each subgroup; also, there was a decline in mean scores with increase in age in all OPDs which can be inferred as a decrease in GLL with age.

Conclusion: This study is the largest Indian study to investigate the prevalence of GLL in the adult population in India. The study found that there was a significant prevalence of GLL in the adult population especially in females compared to males in all ages, though prevalence of GLL reduced with age. This study has implications of prevention of injuries in people with GLL. Although orthopedic surgeons generally primarily manage the people with GLL, they do not have a high index of suspicion toward the same. Identifying these individuals and making a diagnosis regarding the same is problematic but doing so will help these individuals live a pain-free life.

Keywords: Generalized ligament laxity, Prevalence study, Beighton's score, Joint laxity.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i12.49933. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Ligamentous laxity causes increased movement at joints. It may occur in individuals with a connective tissue disorder or as a part of syndromes such as Trisomy 21, Marfans, and Ehler–Dahlos Syndromes [1]. In the individuals, where there is no readily identified genetic aberrancy; it has been labeled as generalized ligament laxity (GLL) [2].

GLL is associated with increased range of motion across various joints in an individual as compared to the general population. The prevalence of GLL in the western world has been reported to be between 5% and 15% [2]. GLL is traditionally believed to be the maximum in childhood and adolescents; and its prevalence decreases with increasing age. Females are more commonly affected as compared to males.

The collagen fibrils in individuals with GLL have been found to be thinner than the rest of the population [3].

A large-scale study by Clinch *et al*. in 2011 surveyed a population of 6022 children. They found that the prevalence of GLL, defined using a Beighton's score cutoff of ≥4, with mean age 13.8 years was 19.2%. Male and female prevalence was 27.5% and 10.6%, respectively [4]. In a study of adult Danish population, Junge *et al*. using a self-reported online survey evaluating 989 adults reported an overall prevalence of 13.1% with significantly higher females (18.4%) than males (6.13%) having GLL [5].

Little evidence has emerged from the Asia-Pacific especially the Indian subcontinent regarding the epidemiology of GLL. In 2001, Kumar *et al*. reported an incidence of 20% among 2050 patients reporting to the rheumatology outpatient department (OPD) at AIIMS, New Delhi [6]. On the contrary, the study conducted by Mullick *et al*. in 2010 at army hospital (referral and research), Delhi, found hypermobility in 5.8% patients, with mean Beighton's score of 6/9 [7]. There was no large scale well-designed GLL prevalence study found in the Indian population.

The Beighton's score is used to assess the presence of GLL. The score ranges from 0 to 9, and a greater score suggests more laxity [8]. Some discrepancy exists regarding the cutoff score; however, a score of ≥4 is generally considered to indicate increased joint laxity. The Beighton's Score has high intra- and inter-rater reliability and reproducibility [9] and, hence, has been chosen to identify GLL in this study.

The objective of this study was to assess the prevalence of GLL in adult Indian population and to assess which specialty OPDs, patients with GLL were reporting to most frequently.

METHODS

This cross-sectional study was done at Armed Forces Medical College, Pune between 2019 and 2022. Patients between the age 15 and 60 years presenting to different OPDs such as orthopedics, medicine, and surgery were informed of the nature of the study and consenting

individuals were included in the study. Patients outside of this age range, pregnant females, and patients with genetic disorders such as Marfans and Ehler–Dahlos syndromes were excluded from the study.

A total of 6654 subjects were approached for the study which included 2128 from orthopaedic OPD, 2301 from Medical, and 2225 from Surgical OPD. 1254 patients were not included in the study as they did not meet the inclusion criteria and the requisite number for their age group was already achieved the study. Finally, a total of 5400 patients, across the three departments were included in the study.

Ethical clearance for the study was obtained from the Institutional Ethical Committee. Informed written consent of all participants was taken. Parents' consent was taken in case of minors and patients were stratified based on age and sex.

Two clinician observers performed the tests to assess the Beighton's scores. A score of four or more was considered to be indicative of GLL. The results were compared based on age, sex, and distribution across various departments.

RESULTS

Out of the 5400 subjects included in the study, 2700 were male and 2700 were female. The average age of the population under study was 37.26 years with a standard deviation of 13.8. The distribution of demographic information of the study groups is provided in Table 1. No significant differences were found in the number of participants, sex, and age between various OPDs ($p>0.05$ in all groups and subgroups).

Using the Beighton's score of ≥4/9 to assess the prevalence, a total of 735 (13.61%) participants had GLL in the entire study population of 5400. The distribution of mean GLL, as per age, and sex is given in Table 2.

Distribution according to Beighton's score across various OPDs is given in Table 3.

The highest Beighton's score was 8/9, recorded in a 29-year female in the orthopedic OPD. The highest Beighton's score recorded in other OPDs was 7/9 in an 18-year female. Females had a greater number of participants with GLL (61.37%) and a higher Beighton's score in every age group.

In all OPDs, majority of the participants had no lax joints; 33.88% of orthopedic patients and 56.11% other patients had Beighton's score of 0/9. There were 2235 participants (41.38%) with ligament laxity in one, two, or three joints (Beighton's score ≤3/9) in combined in all three OPDs.

It was observed that in all OPDs, the mean Beighton's scores were higher in female than in male participants in each subgroup; also, there was decline in mean scores with increase in age in all OPDs which can be inferred as the decrease in GLL with age in, with females having more cases of GLL than males in every age.

It is also clear from Tables 2 and 3, that a significantly higher ($p=0.032$) number of patients recruited from orthopedics OPD (18.44%) had GLL compared to patients recruited from Medicine (9.27%) and Surgery (13.11%) OPDs.

DISCUSSION

GLL is a condition in which most of an individual's synovial joints move beyond the normal limits; with the age, gender, and ethnic background of the individual taken into account. As described earlier the definition of GLL remains arbitrary, and hence, one of the easiest methods of defining GLL is by utilization of various clinical scoring systems for measuring joint laxity in individuals with pre-defined cutoff scores. Beighton's score is one such score which is commonly used to assess the presence of GLL. Although other systems are also available, they are time-

Table 1: Patient demographics: number and ages of participants

Description	Ortho OPD	Med OPD	Surg OPD	p-value
Total number of participants	1800	1800	1800	1.0
Total males	900	900	900	1.0
Total females	900	900	900	1.0
Mean age in years (±SD)	37.64 (13.84)	36.93 (13.75)	36.94 (13.75)	0.626
15–30 years males	20.90 (4.29)	22.23 (4.82)	21.92 (4.65)	0.264
15–30 years females	22.40 (4.88)	20.40 (4.08)	21.20 (4.33)	0.091
31–45 years males	37.77 (4.48)	37.63 (3.79)	36.94 (3.94)	0.896
31–45 years females	37.93 (5.42)	35.27 (5.19)	36.76 (4.65)	0.059
46–60 years males	53.70 (5.15)	53.03 (4.33)	52.93 (4.56)	0.588
46–60 years females	53.13 (4.28)	53.00 (4.66)	54.04 (4.45)	0.937

OPD: Outpatient department

Table 2: Presence of GLL in ortho OPD versus other OPDs: Odds ratio

Beighton's	Ortho OPD	Med OPD	Surg OPD	OR (95% CI)	p-value
≥4/9	332	167	236	2.301 (1.217–4.352)	0.013
≥5/9	191	83	78	2.537 (1.081–5.958)	0.044
≥6/9	116	41	47	2.864 (0.895–9.170)	0.111
≥7/9	45	1	0	4.068 (0.450–36.76)	0.105
≥8/9	1	0	0	3.017 (0.122–74.54)	0.501

OPD: Outpatient department

Table 3: Distribution of GLL arithmetic mean: age and sex comparison

Description	Females			Males			p-value
Mean Beighton's score (±SD)	1.77 (2.13)			0.92 (1.47)			0.018
Mean Beighton's score (±SD)	Ortho	Med	Surg	Ortho	Med	Surg	
15–30 years	2.20	2.04	2.08	1.69	1.19	1.10	0.027
31–45 years	1.67	1.63	1.65	1.26	0.91	0.83	0.030
46–60 years	0.83	1.09	1.06	0.73	0.57	0.43	0.101

consuming and are not commonly used [10,11]. The main advantage of the Beighton's system includes measuring a limited number of joints, and hence, a quick OPD examination. It has good to excellent reliability in screening individuals and does not require complicated equipments except a goniometer. No specialized knowledge or training is required for the assessment. It was for this reason that the Beighton's score was used to define generalized ligamentous laxity in this study.

There has been a tendency to use varying cutoff scores by different authors for diagnosing GLL. As there is no consensus in using higher scores and because majority of the studies that used a higher cutoff were done in populations that have higher than usual hypermobility like younger children, known racial preponderance and hypermobility types of EDS; the decision was taken to use the cutoff score of ≥4/9 as suggested by the original paper by Beighton *et al*. [6-8,10,12,13]. This cutoff has also been recommended in the Brighton's score by the special interest group of the British society for rheumatology.

A total of 5400 participants were examined over the course of this study with a mean age of 37.26 years (SD±13.8). No significant difference was present between the cases and controls in number, sex, mean ages, BMI, and physical activity levels. Out of the 5400 participants, 735 (13.61%) were found to have a Beighton's score ≥4/9.

As these participants were randomly selected from a large population and were equitably distributed over age (15–60 years) and both sexes; it can be extrapolated that a prevalence of GLL between 15 and 60 years is 13.61 per hundred in the general population. A prevalence of 10% (271/2700) in males and 17.22% (465/2700) in females was present in the study population, which was significantly high.

Most of the literature mentioning prevalence of GLL which has been reported are in studies involving children and young adults as they are certainly more involved. The studies had a prevalence range between 6.7% in the UK and 43% in Nigeria [14]. In large scale review studies, GLL was supposedly present in 2–35% of males and 5–57% of females. Extrapolated to the general populations, it would seem that overall GLL has a prevalence of 10–20% [15].

A comparison of the adult prevalence of GLL in the present study with two large scale studies by Clinch *et al*. [4] and Junge *et al*. [5], one study in Pakistani adult population and two Indian studies in adults [6,7] is as depicted in the Fig. 1.

It was found that the prevalence found in the present study corresponded closest with the study by Junge *et al*. which was lower than the study by Clinch *et al*. On comparison with the Indian studies, it was lower than Kumar *et al*. and higher than Mullick *et al*. The differences can be probably due to age differences with Clinch *et al*. and racial and regional differences in case of the other studies with similar mean age of participant [4-7].

A comparison of prevalence of few recent studies with adult population between 15 and 30 years especially with Middle and Southeastern Asian adult populations are depicted graphically below Fig. 2.

The prevalence of GLL in the 15–30 age groups in the present study was 23.33% (females 28.33%; males 18.33%) which concurred with the prevalence in studies with similar aged population in studies by Russek and Errico [16] and Al-Jarallah *et al.* [17].

All six studies which recorded separate sex-wise prevalence mentioned above had higher prevalence in females compared to males, which was the case in this study also. The present study had higher prevalence of females with GLL in each age group; however, significance could not be established.

Joint hyper laxity is found to peak in children. It continues to diminish throughout adult life. This observation has been confirmed in earlier studies and confirmed in the present study also.

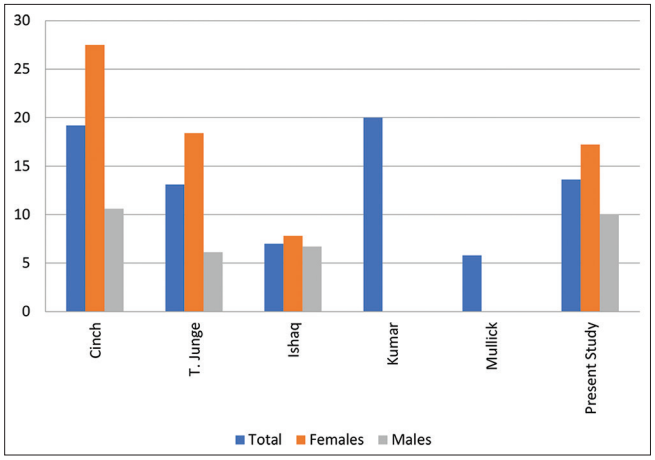

Fig. 1: Comparison of the total and sex-wise prevalence of generalized ligament laxity in adults

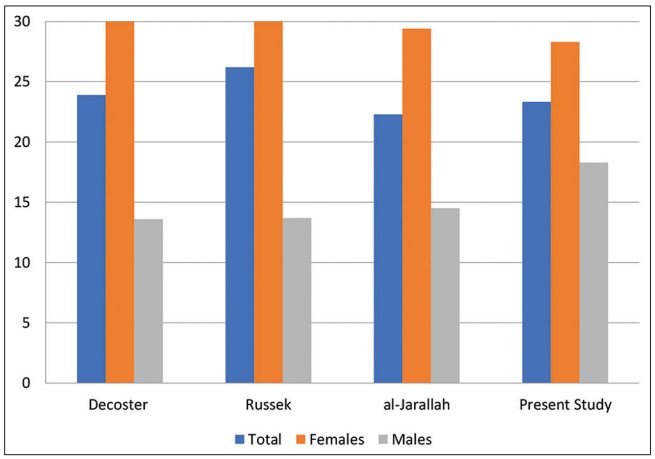

Fig. 2: Comparison of the prevalence of generalized ligament laxity in young adults (15–30 years)

Often the general impression is that GLL is a positive attribute, which might enable enhanced participation in a wide variety of physical activities and performing arts [18]. However, GLL has been found to be associated with many problems in the affected individuals.

GLL is associated with fragile musculoskeletal tissues, caused by defects in collagen formation and folding. The musculoskeletal system in such individuals is at a greater risk of mechanical failure. This leads to increased incidence of musculoskeletal injuries in such patients. Due to the absence of stability, such individuals are more vulnerable to the effects of injury from trauma and overuse. Individuals with GLL also suffer more frequently with pain and dysfunction [19].

There is considerable evidence to suggest that GLL plays a role in the development of injuries in many sports; such as anterior cruciate ligament (ACL) injuries [9,20], and recurrent patellar dislocation [21], as well as in the ankle sprains. In the upper extremity, GLL in sportsmen has been associated with multidirectional instability of the shoulder, and premature osteoarthritis of the thumb carpometacarpal joint.

This study also concluded that patients with GLL most often visit the orthopedics OPD for their complains. However, GLL has received less attention in the orthopedics fraternity, and the same is reflected in the dearth of literature on GLL in orthopedics journals. However, people with hypermobility syndrome are often first referred to or seen by orthopedic surgeons for acute and chronic musculoskeletal injuries.

Patients with GLL usually present with chronic complaints with no history of any direct injury. If the presence of GLL is overlooked in such patients, it may lead to incorrect diagnosis and treatment and subsequently, poor outcomes and patient dis-satisfaction.

The key to successfully treating a patient with GLL is early identification and initiating prompt treatment. A high degree of clinical suspicion should be maintained, especially in patients that present with chronic musculoskeletal symptoms. In such individuals, focused physiotherapy for the early rehabilitation should be advised.

Since the tissues are weak, surgeons should be very careful while performing reconstructive procedures in such individuals. In the shoulder, very rarely balanced arthroscopic or open capsular shift is recommended. Studies suggest that both in primary and revision ACL reconstruction in the presence of generalized ligamentous laxity an autogenous graft may not be the best choice. An allograft tendon may be a better alternative when available [19,20].

Patient self-help and support groups provide information and support for patients with GLL. The coalition of the heritable disorders of connective tissue, an umbrella organization, which has three groups: the Ehlers–Danlos support group, the Hypermobility Syndrome Association, and the Marfan association. All three maintain contact with organizations in other parts of the world. In India, the India's Ehlers–Danlos syndrome/hypermobility syndrome community provides information and support.

CONCLUSION

This study is the largest Indian study to investigate the prevalence of GLL in the adult population in India. The study found that there was a significant prevalence of GLL in the adult population. A screening evaluation of individuals desirous of leading such an active lifestyle, to identify those with generalized ligamentous laxity using the Beighton's score could be beneficial. In these individuals, specific training techniques, aimed at core strengthening, specific muscle, and proprioceptive training, can be employed to prevent injuries.

Although orthopedic surgeons generally primarily manage the people with GLL, they do not have a high index of suspicion toward the same. Identifying these individuals and making a diagnosis regarding the same is problematic, but doing so will help these individuals live a pain-free life.

REFERENCES

1. Bird HA. Joint hypermobility in children. Rheumatol (Oxf Engl) 2005;44:703-4. doi: 10.1093/rheumatology/keh639, PMID 15827037
2. Juul-Kristensen B, Røgind H, Jensen DV, Remvig L. Inter-examiner reproducibility of tests and criteria for generalized joint hypermobility and benign joint hypermobility syndrome. Rheumatol (Oxf Engl) 2007;46:1835-41. doi: 10.1093/rheumatology/kem290, PMID 18006569
3. Kobayasi T. Dermal elastic fibres in the inherited hypermobile disorders. J Dermatol Sci 2006;41:175-85. doi: 10.1016/j.jdermsci.2005.10.002, PMID 16326076
4. Clinch J, Deere K, Sayers A, Palmer S, Riddoch C, Tobias JH, *et al*. Epidemiology of generalized joint laxity (hypermobility) in fourteen-year-old children from the UK: A population-based evaluation. Arthritis Rheum 2011;63:2819-27. doi: 10.1002/art.30435, PMID 21547894
5. Junge T, Henriksen P, Hansen S, Østengaard L, Golightly YM, Juul-Kristensen B. Generalised joint hypermobility and knee joint hypermobility: Prevalence, knee joint symptoms and health-related quality of life in a Danish adult population. Int J Rheum Dis 2019;22:288-96. doi: 10.1111/1756-185X.13205, PMID 29076645
6. Kumar A, Wadhwa S, Acharya P, Seth S, Khokhar S, Singh R, *et al*. Benign joint hypermobility syndrome: A hospital-based study from northern India. Indian J Rheumatol 2006;1:8-12. doi: 10.1016/S0973-3698(10)60515-8
7. Mullick G, Bhakuni DS, Shanmuganandan K, Garg MK, Vasdev V, Kartik S, *et al*. Clinical profile of benign joint hypermobility syndrome from a tertiary care military hospital in India. Int J Rheum Dis 2013;16:590-4. doi: 10.1111/1756-185x.12024, PMID 24164848
8. Hootman JM, Macera CA, Ainsworth BE, Addy CL, Martin M, Blair SN. Epidemiology of musculoskeletal injuries among sedentary and physically active adults. Med Sci Sports Exerc 2002;34:838-44. doi: 10.1097/00005768-200205000-00017, PMID 11984303
9. Krivickas LS, Feinberg JH. Lower extremity injuries in college athletes: Relation between ligamentous laxity and lower extremity muscle tightness. Arch Phys Med Rehabil 1996;77:1139-43. doi: 10.1016/s0003-9993(96)90137-9, PMID 8931525
10. Beighton P, Solomon L, Soskolne CL. Articular mobility in an African population. Ann Rheum Dis 1973;32:413-8. doi: 10.1136/ard.32.5.413, PMID 4751776
11. Carter C, Wilkinson J. Persistent joint laxity and congenital dislocation of the hip. J Bone Joint Surg Br 1964;46:40-5. doi: 10.1302/0301-620X.46B1.40, PMID 14126235
12. Remvig L, Flycht L, Christensen KB, Juul-Kristensen B. Lack of consensus on tests and criteria for generalized joint hypermobility, Ehlers-Danlos syndrome: Hypermobile type and joint hypermobility syndrome. Am J Med Genet A 2014;164A:591-6. doi: 10.1002/ajmg.a.36402, PMID 24464988
13. Vallis A, Wray A, Smith T. Inter- and intra-rater reliabilities of the Beighton score compared to the Contompasis score to assess generalised joint hypermobility. Myopain 2015;23:21-7. doi: 10.3109/10582452.2016.1140255.
14. Murray KJ. Hypermobility disorders in children and adolescents. Best Pract Res Clin Rheumatol 2006;20:329-51. doi: 10.1016/j.berh.2005.12.003, PMID 16546060
15. Hakim AJ, Cherkas LF, Grahame R, Spector TD, MacGregor AJ. The genetic epidemiology of joint hypermobility: A population study of female twins. Arthritis Rheum 2004;50:2640-4. doi: 10.1002/art.20376, PMID 15334479
16. Russek LN, Errico DM. Prevalence, injury rate and, symptom frequency in generalized joint laxity and joint hypermobility syndrome in a "healthy" college population. Clin Rheumatol 2016;35:1029-39. doi: 10.1007/s10067-015-2951-9, PMID 25930211
17. Al-Jarallah K, Shehab D, Al-Jaser MT, Al-Azemi KM, Wais FF, Al-Saleh AM, *et al*. Prevalence of joint hypermobility in Kuwait. Int J Rheum Dis 2017;20:935-40. doi: 10.1111/1756-185X.12556, PMID 25529052
18. Grahame R, Jenkins JM. Joint hypermobility-asset or liability? A study of joint mobility in ballet dancers. Ann Rheum Dis 1972;31:109-11. doi: 10.1136/ard.31.2.109, PMID 5016858
19. Tingle A, Bennett O, Wallis A, Palmer S. The links between generalized joint laxity and the incidence, prevalence and severity of limb injuries related to physical exercise: A systematic literature review. Phys Ther Rev 2018;23:259-72. doi: 10.1080/10833196.2018.1481626
20. Ramesh R, Von Arx O, Azzopardi T, Schranz PJ. The risk of anterior cruciate ligament rupture with generalised joint laxity. J Bone Joint Surg Br 2005;87:800-3. doi: 10.1302/0301-620X.87B6.15833, PMID 15911662
21. Rünow A. The dislocating patella. Acta Orthop Scand 1983;54:1-53. doi: 10.3109/17453678309154170