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Prevalence of Generalized Joint Hypermobility and Predictive Factors for Ligamentous Laxity Among Young Adults in a Nigerian Community

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ABSTRACT

Background and Objective: Joint hypermobility is a condition in which the joint stretches beyond the normal range of motion (ROM). This study investigated the gender point prevalence of joint hypermobility among undergraduates of the College of Health Sciences, Nnamdi Azikiwe University, Nnewi Campus and its predictions for the future occurrence of ligamentous laxity. **Materials and Methods:** A cross-sectional study was employed with a stratified random sampling technique on 368 willing participants. A universal goniometer was used to check for joint ROM and the Beighton scoring was used to estimate the prevalence of joint hypermobility with the Beighton criteria to further distinguish those with the syndrome. Data was analyzed using descriptive statistics of mean, standard deviation, frequency and percentage. Mann Whitney U and Chi-square test was used to test the hypothesis with the significance level pegged at 0.05. Bivariate multiple regression was used to show how their sociodemographic and clinical features can predict the future occurrence of ligamentous laxity. **Results:** It was revealed that the majority of the participants had a normal BMI with a mean score of 23.79±3.879. The majority indicated no joint pain (80.2%) and no family history of hypermobility (52.4%) majority had a high level of physical fitness (61.1%). The mean Beighton score was 3.86±2.293 and ranged from 0-9. **Conclusion:** Gender, age and body mass index had no significant correlation with the joint hypermobility status of the participants hence occurrence of ligamentous laxity cannot be predicted by gender, age and body mass index ($p>0.05$). However, a positive and significant relationship existed between joint pain, family history of physical fitness and the occurrence of ligamentous laxity ($p<0.05$).

KEYWORDS

Joint, hypermobility, ligamentous laxity, BMI, sociodemographic, clinical features

INTRODUCTION

Hypermobility, defined as the ability of a joint to move beyond its normal range of motion, has garnered increasing attention in healthcare and medical research[1]. Peripheral Localized and Generalized Joint Hypermobility (GJH) are the terms used to describe this excessive movement, which might be restricted to the hands and feet, a single joint (for the former) or numerous joints (for the latter). This condition, often called “double-jointedness”, allows the joints to extend beyond the typical physiological limits. Several causes and risk factors contribute to joint hypermobility.

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As individuals age, the health implications of hypermobility become more evident. It was opined that age influenced hypermobility only on the left knee among school children[2]. Excessive movement in the knee joint can lead to an increased risk of injury, chronic pain and, in some cases, degenerative joint conditions, highlighting the importance of understanding the prevalence and potential consequences of joint hypermobility.

To comprehend the global prevalence of hypermobility, it is crucial to investigate this phenomenon across various regions and demographics. Studies have shown that the prevalence of hypermobility varies across different parts of the world. In the United States, for instance, research has indicated that a significant portion of the population exhibits some knee hypermobility. The prevalence of localized joint hypermobility was found in 21.5 and 57.5% of participants, respectively, in the United States of America. Similarly, in Asia and Europe especially in Turkey has received detailed documentation. Generalized, peripheral, localized asymptomatic joint hypermobility and hypermobility spectrum disorders were found to be 13.1, 4.2, 21.5, 12.8, 7.5 and 18.2%, respectively[3].

The epidemiology of generalized joint hypermobility and hypermobility in a general context makes it apparent that this condition affects both males and females and it can manifest in individuals at a young age as well as in adults. This gender and age-related variability highlight the need for a more in-depth investigation into the prevalence and potential gender-specific differences in knee hypermobility. Two narrative reviews of the literature have discussed the influence of age, sex and ethnicity on the occurrence of generalized joint hypermobility. These evaluations indicate that generalized joint hypermobility is more common in infants but declines quickly in younger age individuals and more slowly in adulthood. Caucasians have demonstrated a tendency toward a lower prevalence of generalized joint hypermobility than African Americans, Asians and Arabians and females have a higher prevalence of generalized joint hypermobility than males. Remarkably, certain research has not discovered any variation in the frequency of generalized joint hypermobility based on gender[4].

There is an established association between hypermobility and the future occurrence of ligamentous laxity[5]. This study seeks to contribute to our understanding of these phenomena, shedding light on the potential gender-specific differences and the long-term implications of hypermobility on joint health. This research hopes to uncover the prevalence of hypermobility and also to predict future ligamentous laxity, ultimately advancing the knowledge in this area of study. To determine the prevalence of generalized joint hypermobility among young adults in a Nigerian community and assess its potential for predicting future occurrences of ligamentous laxity, this study aimed to identify risk factors and inform preventive strategies.

MATERIALS AND METHODS

Study location: The study duration was one year, spanning from July, 2023 to July, 2024 and conducted at Nnamdi Azikiwe University, Nnewi Campus, Houses the College of Health Sciences and Technology, which comprises the Faculties of Medicine, Health Sciences and Technology and Basic Medical Sciences. Nnewi Town is located 46 km from Awka and 26.6 km from Onitsha. The college is located in the village of Okofia in Otolo, Nnewi North Local Government Area of Anambra State.

Research design: This study was a cross-sectional research design.

Inclusion criteria: The participants included in this study were male and female undergraduate students of Nnamdi Azikiwe University, College of Health Sciences, Nnewi Campus, within the age bracket of 16 to 35 years. This age group fosters informed consent and predicts the occurrences of ligamentous laxity in the future early enough. Graduate and postgraduate students of Nnamdi Azikiwe University, College of Health Sciences, Nnewi Campus were excluded from the study.

Sample size: The sample size is calculated using the formula mentioned below[6]:

$$n = \frac{N}{1+N\,(e)^2}$$

Where:

n = Sample size
N = Finite population
e = Level of significance (usually 0.05)
1 = Unity (which is constant)

Applying the digits:

$$n = \frac{4533}{1+4533\,(0.05)^2}$$

$$n = \frac{4075}{1+(0.0025\times 4533)}$$

$$n = 368$$

Rounded up to the nearest whole number, the sample size for this study will be approximately 368.

Research instruments

Goniometer: A goniometer is a simple and indispensable clinical tool used to measure joint range of motion (ROM) in various anatomical joints[7,8].

Beighton scoring for joint hypermobility: The Beighton scoring system is a widely recognized clinical tool used to assess joint hypermobility, particularly in the context of conditions like Ehlers-Danlos syndrome and other connective tissue disorders[9]. The Beighton score assesses hypermobility in five major joint areas: The fifth finger's metacarpophalangeal joint, the thumb's metacarpophalangeal joint, the elbow, the knee and the trunk. Each joint is assigned a score of 0 or 1 based on the degree of hypermobility, with a maximum score of 9 points. Higher scores indicate greater joint hypermobility. The Beighton score is commonly used in clinical practice to screen for hypermobility and is part of the diagnostic criteria for some hypermobility-related disorders.

Bathroom weighing scale: The bathroom weighing scale is used often for self-reported weight measurement as well as for the calculation of BMI and has been reported to be consistent in weight measured[10].

Stadiometer or wooden height meter and tape measure: Height is defined as the measurement of an individual from head to foot while accounting for standard landmarks[11]. It is evaluated in various ways for various reasons and is used to calculate BMI. The accepted gold standard is the stadiometer; alternatively, a wooden height meter or wall height measured with a tape measure can be utilized[12]. The tape measure will be used to measure the thigh girth.

Body Mass Index (BMI): This metric helps identify particular body mass categories. It is now used to define the anthropometric height/weight characteristic in adults and to classify them[13]. The BMI of an individual is determined by taking their weight in kilograms and dividing it by their height in meters squared. The result of this calculation is their BMI:

$$\text{BMI (kg/m}^2\text{)} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

Procedure for data collection: The research instruments were explained to all the participants who took part in the study. The sociodemographic and clinical characteristics were obtained from the participants through a self-report sociodemographic data form featuring age, gender, level of physical activity, department, level or class of study and family history of hypermobility. Range of motion of the joint specific to Beighton scoring was measured using a standard goniometer while the Beighton scoring method was used to ascertain joint hypermobility, after which Beighton major criteria of Arthralgia for three months in four joints was used to determine hypermobility syndrome for those that had a hypermobility score of 4 and above.

Ethical approval collection/informed consent: The ethical approval was obtained from the Ethical Committee of the Faculty of Health Science and Technology, Collage of Health Sciences, Nnamdi Azikiwe University. Informed consent was obtained from participants at the point of administering the questionnaire and only those who gave consent and met the inclusion criteria were included in the survey. The instrument was researcher-administered.

Analysis of data: The obtained data during collection was encoded in a spreadsheet with a password accessible to only the data analyst. The data obtained was imported into and analyzed using Statistical Package for Social Sciences (SPSS) version 27 software. Descriptive statistics of frequency counts, percentage, mean and standard deviation will be used to summarize the participant's socio-demographic variables, clinical characteristics of the participants and Beighton scores of students of Nnamdi Azikiwe University, College of Health Science, Nnewi Campus. Mann-Whitney U-test was used to establish the differential gender point prevalence of generalized joint hypermobility among the participants. Bivariate multiple linear regression analysis was employed to determine the best predictors of future ligamentous laxity among students of Nnamdi Azikiwe University, College of Health Science, Nnewi. Pearson Chi-square test was employed to ascertain the association between hypermobility status and some socio-demographic variables as well as the association between joint hypermobility status and hypermobility syndrome amongst the different gender categories of the participants. The alpha level for the level of significance was set at 0.05.

RESULTS

The present study recruited a total of 368 participants (51.1% female). Nearly half of the participants (48.4%) captured in the study were between the ages 21 and 25 with the mean age of the participants being 22.43±3.214. A simple majority (20.1%) were students of the Department of Radiography (Table 1).

The body mass index of the majority (57.6%) was normal with a mean score of 23.79±3.879. Also, the majority of the participants indicated they had no joint pain (80.2%) and no family history of hypermobility syndrome (52.4%). Furthermore, the majority (61.1%) had a high level of physical fitness (Table 2). A significant proportion of the participants were hypermobile in both the left little finger (51.9%) and right little finger (54.6%). The study also revealed that the majority were non-hypermobile in both the right thumb (57.3%) and left thumb (60.1%). The right elbow (70.7%) and left elbow (70.1%) of the majority of the students were not hypermobile. Also, the right knee (52.7%) and left knee (51.6%) were both non-hypermobile. Additionally, the hip joint of the majority (57.3%) captured in the study was not hypermobile. The mean Beighton score of the study was 3.86±2.293 and ranged from 0-9 (Table 3).

Table 1: Participants' socio-demographic profiles

Parameter	Class	Frequency (n)	Percentage
Gender	Male	180	48.9
	Female	188	51.1
Age (years)	16-20	128	34.8
	21-25	178	48.4
	26 and above	62	16.8
Department	Medical rehabilitation	52	14.1
	Radiography	74	20.1
	Nursing	28	7.6
	EHS	36	9.8
	MLS	52	14.1
	Anatomy	51	13.9
	Physiology	50	13.6
	HDN	4	1.1
	Medicine	21	5.7

EHS: Environmental health science, MLS: Medical laboratory science and HDN: Human dietetics nutrition

Table 2: Clinical profile of the participants

Variable	Category	Frequency (n)	Percentage
Body mass index	Underweight	27	07.3
	Normal	212	57.6
	Overweight	105	28.5
	Obese	24	06.6
Joint pain	No	295	80.2
	Yes	73	19.8
Family history	No	193	52.4
	Yes	175	47.6
Physical fitness	High	225	61.1
	Low	143	38.9

Table 3: Point prevalence of hypermobility at the sites used in the Beighton score

Variable	Category	Frequency (n)	Percentage
Right little finger	Non-hypermobile	167	45.4
	Hypermobile	201	54.6
Left little finger	Non-hypermobile	177	48.1
	Hypermobile	191	51.9
Right thumb	Non-hypermobile	211	57.3
	Hypermobile	157	42.7
Left thumb	Non-hypermobile	221	60.1
	Hypermobile	147	39.9
Right elbow	Non-hypermobile	260	70.7
	Hypermobile	108	29.3
Left elbow	Non-hypermobile	258	70.1
	Hypermobile	110	29.9
Right knee	Non-hypermobile	194	52.7
	Hypermobile	174	47.3
Left knee	Non-hypermobile	190	51.6
	Hypermobile	178	48.4
Hip	Non-hypermobile	211	57.3
	Hypermobile	157	42.7
Beighton score	Mean±SD = 3.86±2.293	-	-
	Range = 0-9	-	-

Mann-Whitney U-test shows the differential gender point prevalence of generalized joint hypermobility among the participants and the Chi-square test shows the association between hypermobility status and some socio-demographic variables. The mean rank of generalized joint hypermobility among the female participants was higher than that of the male participants. No significant difference was found in the joint hypermobility status among male and female participants ($U = 16139.50$, $p>0.05$). Also, the majority of the male (56.1%) and female (52.1%) students captured in the study were not hypermobile. While the majority of participants aged 26 and above were hypermobile (51.6%), a higher proportion of those aged

Table 4: Mann-Whitney U-test showing the differential gender point prevalence of generalized joint hypermobility among the participants and Chi-square test showing the association between hypermobility status and some socio-demographic variables

	Mean rank (gender)			
Variable	Female	Male	U-statistic	p-value
JHS	188.65	180.16	16139.50	0.439
	Hypermobility status (f (%))			
Variable	Non-hypermobile	Hypermobile	Chi-square	p-value
Gender				
Male	101 (56.1)	79 (43.9)	0.588	0.443
Female	98 (52.1)	90 (47.9)		
Age				
16-20	76 (59.4)	52 (40.6)	2.495	0.287
21-25	93 (52.2)	85 (47.8)		
26 and above	30 (48.4)	33 (51.6)		

Table 5: Bivariate multiple regression analysis showing how participants' socio-demographic and clinical features can predict future occurrence of ligamentous laxity

Parameter	Unstandardized coefficients beta	Standardized coefficients beta	T-statistic	R	R^2	F-statistic	p-value
Model	-	-	-	0.359	0.129	8.893	<0.001
Gender	0.185	0.040	0.822				0.412
Age	0.019	0.027	0.548				0.584
BMI	0.041	0.069	1.384				0.167
Joint pain	0.646	0.113	2.241				0.026
FH	0.895	0.195	3.883				<0.001
PF	0.971	0.207	4.028				<0.001

BMI: Body Mass Index, FH: Family history, PF: Physical fitness, T-statistic: Hypothesis testing, R: Correlation coefficient (Pearson's r, a measure of the strength and direction of a linear relationship between two variables), R^2: Coefficient of determination (indicates how well data fit a statistical model, typically used in regression analysis), F-statistic: Used in the analysis of variance, compares model fits and p-value: Probability value, used to determine the statistical significance of a result

16 to 20 (59.4%) and 21 to 25 (52.2%) were not hypermobile. No significant association ($p>0.05$) was found between age and gender and the joint hypermobility status (Table 4). Bivariate multiple regression analysis shows how participants' socio-demographic and clinical features can predict the future occurrence of ligamentous laxity. The correlation coefficient of 0.359 signifies a substantial and robust association between participants' socio-demographic and clinical features and the occurrence of ligamentous laxity. The R-square value of 0.129 obtained suggests that the participants' socio-demographic and clinical features employed in this study account for roughly 12.9% of the observed variation in the joint hypermobility status i.e., the occurrence of ligamentous laxity. Thus, this reveals that 12.8% of the differences in the occurrence of ligamentous laxity can be attributed to the factors included in the model. Moreover, the F-value of 8.893 and a $p<0.001$ demonstrated the achievement of statistical significance which can be taken that the participants' socio-demographic and clinical features have a combined and substantial impact on the occurrence of ligamentous laxity. Furthermore, gender, age and body mass index had no significant correlation with the joint hypermobility status of the participants hence occurrence of ligamentous laxity cannot be predicted by gender, age and body mass index ($p>0.05$). However, a positive and significant relationship existed between joint pain, family history physical fitness and the occurrence of ligamentous laxity ($p<0.05$). Hence, joint pain, family history and physical fitness could predict the future occurrence of ligamentous laxity (Table 5). The Chi-square test showing the gender point prevalence of hypermobility syndromes among the participants. The study indicated that more than half of the male participants whose joints were hypermobile had hypermobility syndrome (55.7%). Also, the majority of the female participants with a hypermobile joint were found to have hypermobility syndrome (51.1%). More so, there was a significant association between hypermobility status and hypermobility syndrome ($p<0.05$) in the different gender categories of the participants (Table 6).

Table 6: Chi-square test showing the gender point prevalence of hypermobility syndromes among the participants

		HM syndrome (f (%))			
Gender	JHM status	Non-hypermobile	Hypermobile	Chi-square	p-value
Male	Non-hypermobile	101 (100.0)	0 (0.0)	74.453	<0.001
	Hypermobile	35 (44.3)	44 (55.7)		
Female	Non-hypermobile	98 (100.0)	0 (0.0)	66.315	<0.001
	Hypermobile	44 (48.9)	46 (51.1)		

DISCUSSION

This study ascertains the differential gender point prevalence of generalized joint hypermobility among students of the College of Health Sciences, Okofia and the future occurrence of ligamentous laxity.

The number of female participants captured in the study was significantly higher than the number of male participants. Several factors explain why this is so; A woman's body has a structure that's more prone to laxity, soft tissues in women are more likely to be looser and hormones can play a huge role as well. This finding did not correspond with the results of a similar study conducted by Al-Jarallah *et al.*[14] on undergraduate university students of the Health Sciences Centre, Kuwait University as the majority of participants captured in their study were male. Furthermore, it was revealed that the majority of the students recruited for the present study had a normal body mass index with a mean score of 23.79±3.879, which is consistent with the findings of the study carried out by Deshmukh and Humane[15]. Also, the majority indicated that they had experienced no joint pain, no family history of hypermobility syndrome and a high level of physical fitness, which can be attributed to the fact that a higher number of participants recruited for the present study were not hypermobile.

Apart from the joint in the left little finger, the rest of the other joints (thumb, elbow, knee and hip joints) were found to be non-hypermobile. The mean Beighton score of the study of 3.86±2.293 can be classified within the normal range of mobility. The study by Al-Jarallah *et al.*[14] indicated a high level of localized hypermobility in the fifth finger, which is also consistent with the findings of the current study. However, the findings of the study done by Qamar *et al.*[16] did not concur with that of the present study as a higher prevalence of joint hypermobility among the participants was found in both the right and left elbow joint.

More so, the study showed that the majority of the male and female participants and those aged 16 to 20 and 21 to 25 were not hypermobile but most of those aged 26 and above were found to be hypermobile. This finding revealed a decrease in generalized joint hypermobility with the increase in age. This could be attributed to increased intrafibrillar cross-links in collagen with advancing age. In addition, in the elderly, there seems to be a stiffening of the flexor tendons and volar plates, the progression could be due to biochemical changes in collagen structures that result in the stiffening of connective tissue components of joints. However, the risk of increased hypermobility among affected persons could increase as the individual ages. Similar to the results of the present study, a study by Tekin *et al.*[17] to ascertain the level of hypermobility in Turkish school children revealed a higher number of participants without generalized hypermobility. Also Dhankher *et al.*[18] in their study on the prevalence of joint hypermobility in adolescent females indicated that the prevalence of generalized hypermobility decreases with age.

The findings of the study revealed that a higher proportion of generalized joint hypermobility was found among the female participants than the male participants. This result was consistent with the findings of the study conducted by Castori and Hakim[19], in which generalized joint hypermobility was shown to be more prevalent in women than men. Similarly, Zhong *et al.*[20] also stated in their study that generalized joint hypermobility was higher in women than men. However, a greater proportion of generalized joint hypermobility among the male participants than the females. Al-Jarallah *et al.*[14] revealed that the generalized joint hypermobility was more predominant in the male participants than the females. This could be because the number of male participants in their study was higher than that of the females.

The results of the study indicated that joint pain, family history and physical fitness could predict the future occurrence of ligamentous laxity as a positive and significant relationship was found to exist between the aforementioned factors and the joint hypermobility status of the participants. However, gender, age and body mass index had no significant correlation with the joint hypermobility status and thus were not deemed to be suitable predictors of ligamentous laxity. The ligamentous laxity is the primary cause of hypermobility in people, thus an increase in the joint hypermobility status of an individual can attributed to an increase in laxity of the ligaments[21]. A study conducted has attributed a generalized joint laxity to a genetically inherited trait that alters the composition and alignment of the collagen matrix within connective tissues[22]. This, thus, agrees with the fact that family history could be a strong predictor of ligamentous laxity. Also Saremi *et al.*[23] showed that athletes with ligamentous laxity suffered a significant level of pain and had chronic injuries and instability, compared to non-affected individuals. Al-Jarallah *et al.*[14] stated that pain in multiple joints was a clinical manifestation of joint hypermobility in some individuals. A study by Anieto *et al.*[24] identified reduced physical fitness as one of the musculoskeletal symptoms of generalized joint hypermobility. Although most recent studies inferred that there was a higher prevalence of physiological hypermobility of joints in women than men, the hypermobility of the joints affects both genders and may be present at birth, but its diagnosis can be delayed until childhood, adolescence and even adulthood.

According to Al-Jarallah *et al.*[14] children and the majority of persons with joint hypermobility can be asymptomatic, but it is usually associated with symptoms like arthralgia, myalgia, fatigue, anxiety and fibromyalgia, thus resulting in hypermobility syndrome. The present study indicated that a significant proportion of the participants whose joints were hypermobile had hypermobility syndrome. The findings of the current study were consistent with that of Chan *et al.*[25] in which a high prevalence of hypermobility syndrome was found in both genders among the elite Australian dancers captured in their study.

CONCLUSION

The study revealed that the average Beighton score of the undergraduate students of the College of Health Sciences Okofia was 3.86±2.293. There was a higher prevalence of generalized joint hypermobility among the female participants than that of the male participants. Age and gender were not associated with the joint hypermobility status of the undergraduate students of the College of Health Sciences Okofia. Joint pain, family history and physical fitness were found to be the best predictors of the future occurrence of ligamentous laxity among the participants. The majority of the male participants and half of the female participants whose joints were hypermobile had hypermobility syndrome. Health authorities should promote advocacy programs at local, national and international levels to raise awareness about ligamentous laxity, its risk factors, diagnosis and management. Early clinical screenings and education, especially for older students with higher joint hypermobility, are essential. Further research on the gender prevalence of generalized joint hypermobility in athletes is needed. Personalized clinical interventions like gentle mobilizations, electrotherapy and muscle-strengthening exercises can help alleviate pain for those with hypermobility syndrome. Educating individuals about their condition and management strategies is crucial for better joint health.

SIGNIFICANCE STATEMENT

This study highlights the prevalence of generalized joint hypermobility among undergraduate students at the College of Health Sciences Okofia, with a higher occurrence in females. Key predictors of future ligamentous laxity include joint pain, family history and physical fitness. The findings emphasize the need for awareness, early screenings and personalized interventions to manage hypermobility syndrome and improve joint health. Further research is recommended to explore gender differences in athletes.

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