

## Original Article

# Generalized joint hypermobility, musculoskeletal injuries, and psychological factors among dancers in Lagos state

### ABSTRACT

**Introduction:** Dancers are athletes who are vulnerable to musculoskeletal injuries and hypermobility, and their emotional level is very important for optimal performance.

**Objective:** To evaluate the prevalence of generalized joint hypermobility (GJH) and its association with musculoskeletal injuries and psychological factors among dancers in Lagos state.

**Materials and Methods:** This was a cross-sectional analytical survey involving 114 dancers (54 males and 60 females), selected from two dance groups in Lagos state. The participants completed a 31-item musculoskeletal pain questionnaire, 9-item validated Beighton index, and 21-item depression, anxiety, and stress scale. Data were analyzed using inferential statistics of Chi-square and summarized using mean, standard deviation, frequency, and percentages at alpha level of 5%.

**Results:** The results showed that the 12-month prevalence of musculoskeletal disorders among dancers was 77 (67%), and the knee, 25 (21.9%), was the most commonly affected body site. The prevalence of GJH was 81 (71.1%), with the majority having distinct hypermobility. The level of anxiety among dancers was extremely severe, 35 (30.7%). There was no significant association ( $P = 0.487$ ) between GJH and the 12-month prevalence of musculoskeletal injuries and psychological factors ( $P > 0.05$ ) among dancers.

**Conclusions:** There was a high prevalence of musculoskeletal injuries and joint hypermobility among dancers. The knee was the most frequently injured joint. The majority of the dancers' joints are distinctly hypermobile, and most of the dancers have extremely severe anxiety. Musculoskeletal injuries and psychological factors did not influence GJH.

**Keywords:** Anxiety, dancers, depression, joint hypermobility, musculoskeletal injury, stress

### INTRODUCTION

Dancers are unique blend of artist and athlete, particularly susceptible to musculoskeletal injuries and pain.<sup>[1]</sup> Sport plays a significant role in education and socialization, patriotism and community spirit, recreation and health enhancement, and well-being and entertainment.<sup>[2]</sup>

Joint hypermobility (JH) is a condition in which a joint stretches beyond the normal range of motion, and this is classified into single-joint or generalized subtypes.<sup>[3]</sup> Joint hypermobility syndrome (JHS) occurs in an individual who presents with hypermobile joints in the absence of demonstrable rheumatologic disease.<sup>[4]</sup>

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**الملخص**

**مقدمة:** الراقصون هم رياضيون معرضون لإصابات العضلات الهيكلية وفرط الحركة، ومستواهم العاطفي مهم جداً لتحقيق الأداء الأمثل.

**الهدف:** تقييم مدى انتشار فرط حركة المفصل المعمم وارتباطه بإصابات العضلات الهيكلية والعوامل النفسية بين الراقصين في ولاية لاغوس.

**المواد والمنهجية:** كان هذا مسحاً تحليلياً مقطوعياً شمل 114 راقصاً (54 ذكوراً و60 إناثاً)، وقد اختيروا اختياراً عشوائياً من مجموعتي رقص في ولاية لاغوس. أكمل المشاركون استبياناً بشأن الألم العضلي الهيكلية مكون من 31 بنداً، و9 بنود صالحة وفقاً لمؤشر Beighton، ومقياس الاكتئاب والقلق والتوتر 21 بنداً. ومن ثم قمنا بتحليل البيانات باستخدام الإحصائيات الاستدلالية لمربع كاي ثم تلخيصها باستخدام المتوسط والانحراف المعياري والتكرار والنسب المئوية عند مستوى ألفا بنسبة 5%.

**النتائج:** أظهرت النتائج أن معدل انتشار الاضطرابات العضلية الهيكلية لمدة 12 شهراً بين الراقصين كان 77 (67%)، والركبة 25 (21,9%) كانت الأكثر إصابة في الجسم. كان انتشار فرط حركة المفصل المعمم 81 (71,1%)، مع وجود الغالبية العظمى من فرط الحركة المتميز. وكانت نسبة القلق بين الراقصين شديدة للغاية 35 (30,7%). لم يكن هناك ارتباط معنوي ( $P=0.487$ ) بين فرط حركة المفصل المعمم وانتشار إصابات العضلات الهيكلية لمدة 12 شهراً والعوامل النفسية ( $P < 0.05$ ) بين الراقصين.

**الخلاصة:** كان هناك انتشار كبير لإصابات العضلات الهيكلية وفرط حركة المفاصل بين الراقصين. كانت الركبة أكثر المفاصل إصابة. فغالبيتها مفاصل الراقصين شديدة الحركة بشكل واضح، ومعظم الراقصين يعانون من قلق شديد للغاية. لم تؤثر الإصابات العضلية الهيكلية والعوامل النفسية على فرط حركة المفصل المعمم.

**الكلمات الرئيسية:** القلق، الراقصون، الاكتئاب، فرط حركة المفاصل، إصابة العضلات الهيكلية، الإجهاد.

The reported prevalence and incidence of JHS vary in the literature. The prevalence of JHS in adult population has been reported to range from 10% to 30%.<sup>[5]</sup> While the prevalence of JH was reported to be 64.9% in a cohort jazz dancers,<sup>[6]</sup> another study reported the prevalence to be as high as 44% among student dancers.<sup>[7]</sup> Joint laxity is usually greatest at birth, decreases during childhood, and reduces during adolescence and adult life.<sup>[8]</sup> A study by Anbarasi *et al.*<sup>[9]</sup> reported reduced muscle flexibility, especially in the hamstrings among dancers which result into musculoskeletal disorders.

Some dancers are hypermobile and do not have a history of pain and injury, and they can utilize their level of flexibility and avoidance of injury to succeed in their choice of career. However, some hypermobile individuals will experience both pain and injury.<sup>[10]</sup> Excellent joint proprioception and balance are required by all dancers to achieve proper control, while dancers who are hypermobile will require more effort to improve joint proprioception.<sup>[10]</sup>

Musculoskeletal injury is a regularly reported health issue among classical and modern dancers.<sup>[11]</sup> The majority (60%–80%) of dancers in a Nigerian study by Aweto *et al.*<sup>[11]</sup> reported at least one injury that has affected their dancing or kept them from dancing. Biomechanical factors, environmental and training problems, and technical capability cause dance-related injuries.<sup>[11]</sup> Injury occurs mostly in the late afternoon which is a reflection of muscular and psychological fatigue.<sup>[11]</sup>

Dance psychology is a burgeoning area of research within the broader field of dance medicine and science. Studies

have been done in the area of dance psychology, including performance anxiety<sup>[12]</sup> and injury psychology,<sup>[13]</sup> while studies addressing the role of psychological factors within talent or career development are very few.<sup>[14]</sup>

Therefore, this study was designed to investigate the prevalence of generalized joint hypermobility (GJH) in association with musculoskeletal injuries and psychological status among dancers in Lagos state.

**MATERIALS AND METHODS****Participants**

A descriptive cross-sectional analytical survey was carried out between January and August 2021. It involved 114 dancers with the sample size derived from the formula by Cochran<sup>[15]</sup>  $\frac{Z^2 \times P(1-p)}{d^2}$  that is where Z = standard normal variate (at 5%), Type 1 error ( $P < 0.050$ ) is 1.96, and P is the prevalence of musculoskeletal disorders among dancers with a value of 86.1%. The participants were volunteers from two dance groups in Lagos state selected using the purposive sampling technique.

The study included professional and nonprofessional dancers who are registered members of a dancing school in Lagos state and who do not have any injury at the time of the study. At the same time, professional dancers who have retired were not allowed to participate in the study.

Before commencing the study, consent to participate in the study was obtained from all participants. Approval to conduct

the study was granted by the Health Research and Ethics Committee of College of Medicine University of Lagos with approval ID: CMUL/HREC/12/19/706. The aim and objectives of this study were clearly explained to the participants, and they were assured of the confidentiality of their data.

### Procedure

Measurement of height and weight was done and the body mass index was calculated with the formula; weight/height.<sup>[2]</sup>

### Measurement of hypermobility

After completing the questionnaire, the participants were assessed for hypermobility using the validated Beighton index hypermobility questionnaire<sup>[16]</sup> via a goniometer. Nine items were scored based on the ordinary score of 0–9, with a higher score representing greater joint mobility. Each individual item was scored using a nominal scale in which “1” represents a positive sign and “0” represents a negative sign. For the first score, the subjects sat next to the table or plinth with the shoulder in 80° of abduction, elbow was flexed to 90°, and the forearm was pronated. Then, a passive extension was performed at the fifth metacarpal, and if a 90° extension is achieved with the aid of the goniometer, it is a positive test; this was repeated on the other limb. The second score was done while the subjects were seated on the chair facing the table. The shoulder was flexed to 90° with the forearm supinated, and the elbow extended, and then elbow hyperextension was passively checked. Ten or more degrees of elbow hyperextension with the aid of the goniometer indicates a positive test, and this was repeated on the other limb. For the third score, the subjects were in supine lying position, and then, knee hyperextension was checked for 10° or more degrees of hyperextension with the aid of the goniometer indicating a positive test, which was repeated on the other limb. For the fourth score, the subjects flexed the shoulder to 90°, extended the elbow, and pronated the forearm; then, the subjects tried to bend the thumb to the flexor side of the forearm, if the subjects were able to do so, this indicated a positive score, and this was repeated on the other limb. For the last score, the subjects were told to bend over and try to touch the floor with flat hands while keeping their legs fully extended; the ability of the subjects to do so indicates a positive test.<sup>[17]</sup>

Two types of questionnaire, including the musculoskeletal pain and injury questionnaire<sup>[1]</sup> and the Depression Anxiety, Stress Scales (DASS) questionnaire<sup>[18]</sup> were used to assess the participants’ musculoskeletal pain and psychological status. These self-administered questionnaires were distributed to the participants and were collected after completion by the researcher.

### The musculoskeletal pain and injury questionnaire

It was adopted from the study by Aweto *et al.*<sup>[1]</sup> on “Prevalence of musculoskeletal pain and injury amongst professional dancers.” It has 31 questions with 6 sections; Section A collected demographic data of participants which includes age, sex, height, weight, body mass index, and years of experience of dancing. Section B collected information on history of the participants. Section C collected information on prevalence of musculoskeletal injuries of the participants. Section D consists of questions on the predisposing factors to musculoskeletal pain and injury. Section E sought information on the participants’ limitation due to pain and injury. Section F collected data on the participants’ treatment history.

### Depression, Anxiety, and Stress Scale questionnaire

DASS is a clinical assessment scale that measures the three related states of depression, anxiety, and stress. It has 21 questions and takes about 3 min to complete, each reflecting a negative emotional symptom. The DASS-21 is a short form version of the DASS (the long form has 42 items); the final score of each item group was multiplied by two. These scores range from 0, meaning that the client believed the item “did not apply to them at all,” to 3, meaning that the client considered the item to “apply to them very much, or most of the time,” with 14 questions for depression, anxiety, and stress, respectively. It is also stressed in the instructions that there are no right or wrong answers.<sup>[18]</sup> The reliability scores of the scales in terms of Cronbach’s alpha scores rate

**Table 1: Demographic characteristics of the participants (n=114)**

Variable	Frequency, n (%)
Age (years)	
18-20	55 (48.20)
21-23	36 (31.60)
24-26	18 (15.8)
>26	5 (4.4)
Mean age	21.35±3.09
Height (m)	
1.5-1.6	27 (23.7)
1.61-1.7	42 (36.8)
1.71-1.8	45 (39.5)
Mean height	1.67±0.11
Weight (kg)	
41-62	68 (59.6)
63-82	45 (39.5)
83-102	1 (9)
Mean weight	61.28±10.48
BMI (kg/m <sup>2</sup> )	
<18.5	12 (10.5)
18.5-24.9	81 (71.1)
25.0-29.9	19 (16.7)
≥30	2 (1.8)

BMI=Body mass index

the depression scale at 0.91, the anxiety scale at 0.84, and the stress scale at 0.90 in the normative sample.<sup>[19]</sup>

### Data analysis

The data were analyzed using Statistical Package for the Social Sciences IBM SPSS version 25, New York city, New York, USA for Windows and summarized using descriptive statistics of mean, standard deviation, frequency, and percentage. Inferential statistics of Pearson's Chi-square test was used to find an association between variables at an alpha level of 5%.

## RESULTS

A total of 160 copies of the questionnaire were distributed, and 114 copies were returned. This gave a response rate of 71.2%. Therefore, 114 copies of the questionnaire were valid for analysis. The study population has a mean age of  $21.35 \pm 3.09$  years. The majority, 81 (71.1%), of the participants have normal weight; only two (1.8%) are obese while 19 (16.7%) are overweight [Table 1]. The majority of the participants, 90 (78.9%), have the right leg as their dominant leg, while 17 (14.9%) use left as their dominant leg and 7 (6.1%) of the participants make use of both legs.

### DANCING HISTORY OF THE PARTICIPANTS

Eight-seven (76.3%) participants are professional dancers while 27 (23.7%) of the participants are nonprofessional dancers. Among the professional dancers, 62 (54.4%) have been dancing professionally for 1–3 years, 16 (14.0%) have been dancing professionally for 4–6 years, 3 (2.6%) have been dancing professionally for 7–9 years, and 6 (5.3%) have been dancing professionally for 10–12 years.

Furthermore, most of the participants partake in more than one type of dance, and from the result, 88 (77.2%) of the participants dance Hip-hop, 40 (35.1%) partake in Contemporary dance, 44 (38.6%) partake in African contemporary dance, 24 (21.1%) partake in Salsa, 63 (55.3%) partake in African dance, 14 (12.3%) partake in Jazz, 18 (15.8%) partake in Ballet, 9 (7.9%) partake in Tango dance, 13 (11.4%) partake in Ball room dance, 21 (18.4%) partake in Aerobic dance, 11 (9.6%) partake in Waltz, and 23 (20.3%) partake in other forms of dance.

Twenty-two (19.3%) of these dancers train daily, 18 (15.8%) train once in a week, 35 (30.7%) train twice in a week, and 23 (20.2%) train thrice in a week. In addition, 30 (26.3%) of the participants train for an average of 1 h in a day, 31 (27.2%) train for an average of 2 h in a day, 29 (25.4%) train on an average of 3 h in a day, 11 (9.6%) train on an average of 4 h in a day, and 13 (11.4%) train for more than 5 h in a day.

**Table 2: Point and 12-month prevalence of musculoskeletal disorders of the participants (n=114)**

Variables	Frequency, n (%)
Felt pain in the last 12 months	
Yes	77 (67.50)
No	37 (32.50)
Total	100.00
Had injury and pain during dancing	
Yes	67 (58.80)
No	47 (41.20)
Total	100.00
How often do you get injured	
Daily	6 (5.30)
Weekly	5 (4.40)
Monthly	14 (12.30)
Never	39 (34.20)
Others	50 (43.90)
Total	100.00
Isolate injury to dancing	
Yes	44 (38.60)
No	37 (32.50)
Not applicable	33 (28.90)
Total	100.00

**Table 3: Prevalence of joint hypermobility of the participants**

	Frequency, n (%)
Not hypermobile	17 (14.9)
Moderately hypermobile	16 (14.0)
Distinctly hypermobile	81 (71.1)
Total	114 (100.0)

Not hypermobile: A score of 0-2, Moderately hypermobile: A score of 3-4, Distinctly hypermobile: A score of 5-9

The majority of the participants, 61 (53.5%), reported that they were not feeling pain presently, while 53 (46.5%) were feeling pain presently. Among the 53 participants who were having pains as at the time of the study, 3 (5.7%) reported a pain score of 1, 6 (11.3%) reported a pain score of 2, 6 (11.3%) reported a pain score of 3, 10 (18.9%) reported a pain score of 4, 9 (17.0%) reported a pain score of 5, 7 (13.2%) reported a pain score of 6, 5 (9.4%) reported a pain score of 7, 3 (5.7%) reported a pain score of 8, 2 (3.8%) reported a pain score of 9, and 1 (1.9%) reported a pain score of 10.

Most of the injury that affected the participants resulted from strain 23 (43.4%), 10 (18.9%) had fracture, 6 (11.3%) had sprain, 5 (9.4%) had scrape (cut), 3 (5.7%) had bruises, 2 (3.8%) had tendonitis, 8 (15.1%) had swelling, 2 (3.8%) had dislocation, and 7 (13.2%) had other forms of injury.

### Point and 12-month prevalence of musculoskeletal disorders of the participants and the body part affected

Table 2 shows that 77 (67.5%) of the participants had felt pain

**Table 4: Depression, anxiety, and stress profile of the participants**

	Frequency, n (%)
Depression	
Normal	64 (56.1)
Mild	19 (16.7)
Moderate	20 (17.5)
Severe	7 (6.1)
Extremely severe	4 (3.5)
Total	114 (100.0)
Anxiety	
Normal	25 (21.9)
Mild	8 (7.0)
Moderate	23 (20.2)
Severe	23 (20.2)
Extremely severe	35 (30.7)
Total	114 (100.0)
Stress	
Normal	66 (57.9)
Mild	23 (20.2)
Moderate	12 (10.5)
Severe	12 (10.5)
Extremely severe	1 (0.9)
Total	114 (100.0)

Depression: Normal: 0-9, mild: 10-13, moderate: 14-20, severe: 21-27, extremely severe: 28+, Anxiety: Normal: 0-7, mild: 8-9, moderate: 10-14, severe: 15-19, extremely severe: 20+, Stress: Normal: 0-14, mild: 15-18, moderate: 19-25, severe: 26-33, extremely severe: 34+

in the past 1 year. Sixty-seven (58.8%) of the participants had injury and pain during dancing. Six (5.3%) of the participants get injured daily, and 14 (12.3%) of the participants get injured monthly. Knee, 25 (21.9%), was the body part mostly affected by musculoskeletal disorders followed by the lower back; 17 (14.9%), ankles and feet; 17 (14.9%), thighs (back); 14 (12.3%), neck; 11 (9.6%), wrist and hand; 10 (8.8%), toes; 10 (8.8%), hips; 7 (6.1%), elbow; 5 (4.4%), thighs (front); 5 (4.4%), mid-back; 3 (2.6%) and calves; while 2 (1.8%) occurred in the shin. However, some of the participants gave multiple responses.

**Prevalence of joint hypermobility and psychological status of the participants**

In Table 3, the prevalence of JH was reported to be 97 (85.1%), but most of the participants, 81 (71.1%), were distinctly hypermobile. Table 4 shows that 20 (17.5%) participants were moderately depressed and 7 (6.1%) were severely depressed. Twelve (10.50%) participants were moderately stressed, and 12 (10.50%) were severely stressed. Twenty-three (20.20%) participants had severe anxiety and 35 (30.70%) had extremely severe anxiety.

**Association between age, sex, years of experience, frequency of training, prevalence of musculoskeletal disorders, psychological status, and generalized joint hypermobility**

In Table 5, there was no association between age ( $P = 0.086$ ),

sex ( $P = 0.544$ ), frequency of training ( $P = 0.237$ ), and GJH, while there was an association between years of experience ( $P = 0.026$ ) and GJH. It was also observed that there was no association between 12-month prevalence of musculoskeletal injury and GJH ( $P = 0.487$ ) [Table 6]. Table 7 shows that there was no association between depression ( $P = 0.544$ ), anxiety ( $P = 0.357$ ), stress ( $P = 0.350$ ), and GJH.

**Association between age, sex, years of experience, frequency of training, psychological status (depression, anxiety, and stress), and 12-month prevalence of musculoskeletal pain**

Table 8 shows that there was no association between age ( $P = 0.088$ ), sex ( $P = 0.849$ ), years of experience ( $P = 0.078$ ), and 12-month prevalence of musculoskeletal pain, but an association exists between frequency of training ( $P = 0.044$ ) and 12-month prevalence of musculoskeletal pain. It was observed in Table 9 that there was no association between depression ( $P = 0.277$ ), anxiety ( $P = 0.232$ ), stress ( $P = 0.082$ ), and 12-month prevalence of musculoskeletal pain.

**DISCUSSION**

This study was embarked on to explore the prevalence of GJH in association with musculoskeletal injuries and psychological status among dancers in Lagos.

The study outcome revealed that 67.5% of dancers reported musculoskeletal pain and injury in the last 12 months. This implies a high prevalence of musculoskeletal pain and injury among them. This level of prevalence may be as a result of anatomic alignment, poor training, technical errors, unfamiliar choreography or style, and extrinsic factors, including flooring surfaces and theatre temperature, which have been implicated as contributing factors to the high prevalence of dance injuries.<sup>[11]</sup>

The knee (21.9%) was the most commonly injured body part among the dancers particularly for the different types of dance followed by the low back (14.9%) and ankle (14.9%) which concurs with the research carried out by Aweto *et al.*<sup>[11]</sup> The finding that the frequently injured area was knee, especially for most of the dance types, followed by the low back and ankle corroborates previous report by Rickman *et al.*,<sup>[20]</sup> who observed that most musculoskeletal disorders occurred at the lower back and lower extremities. This may be as a result of the anatomic structures of these areas and the demands made on them when performing the different dance styles. The joints of the lower extremities bear much of the weight of the body. This may also be another contributing factor. Wainwright *et al.*<sup>[21]</sup> stated that the occurrence of injuries is

**Table 5: Association between age, sex, year of experience, frequency of training, and generalized joint hypermobility of the participants**

	Hypermobility			Total, n (%)	$\chi^2$	P
	Not hypermobile, n (%)	Moderately hypermobile, n (%)	Distinctly hypermobile, n (%)			
<b>Age (years)</b>						
16-20	14 (25.5)	8 (14.5)	33 (60.0)	55 (100.0)	11.080	0.086
21-25	2 (4.3)	6 (12.8)	39 (83.0)	47 (100.0)		
26-30	1 (11.1)	1 (11.1)	7 (77.8)	9 (100.0)		
31-35	0	1 (33.3)	2 (66.7)	3 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Sex</b>						
Male	10 (18.5)	8 (14.8)	36 (66.7)	54 (100.0)	1.217	0.544
Female	7 (11.7)	8 (13.3)	45 (75.0)	60 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Years of experience</b>						
None	9 (33.3)	3 (11.1)	15 (55.6)	27 (100.0)	17.433	0.026*
1-3	6 (9.7)	10 (16.1)	46 (74.2)	62 (100.0)		
4-6	1 (6.3)	0	15 (93.8)	16 (100.0)		
7-9	1 (33.3)	1 (33.3)	1 (33.3)	3 (100.0)		
10-12	0	2 (33.3)	4 (66.7)	6 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Frequency of training</b>						
Daily	0	3 (13.6)	19 (86.4)	22 (100.0)	12.766	0.237
Once a week	2 (11.1)	3 (16.7)	13 (72.2)	18 (100.0)		
Twice a week	6 (17.1)	6 (17.1)	23 (65.7)	35 (100.0)		
Three times a week	4 (17.4)	3 (13.0)	16 (69.6)	23 (100.0)		
Four times a week	3 (50.0)	1 (16.7)	2 (33.3)	6 (100.0)		
Others	2 (20.0)	0 (0.0)	8 (80.0)	10 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		

\*Significant at  $P < 0.05$

**Table 6: Association between point, 12-month prevalence of musculoskeletal injury, and generalized joint hypermobility**

	Not hypermobile, n (%)	Moderately hypermobile, n (%)	Distinctly hypermobile, n (%)	Total, n (%)	$\chi^2$	P
<b>Felt pain in the past 1 year</b>						
Yes	13 (16.9)	12 (15.6)	52 (67.5)	77 (100.0)	1.437	0.487
No	4 (10.8)	4 (10.8)	29 (78.4)	37 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Had injury and pain during dancing</b>						
Yes	9 (13.4)	11 (16.4)	47 (70.1)	67 (100.0)	0.915	0.633
No	8 (17.0)	5 (10.6)	34 (72.3)	47 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		

related to the type of dance being performed, the dancer's technique, experience, physiology, and psychological factors. Shah *et al.*<sup>[22]</sup> observed that the most common injury sites were the foot and ankle, lower back, and knee among dancers in the United States of America.

Most of the dancers who were having pains at the time of this study had strain (43.4%) as the type of injury that affected them the most, followed by fracture (18.9%) and then swelling (15.1%). This may be the aftermath effect of the strong influence of dancing on the body coupled with the different maneuvers the musculoskeletal system is exposed to while dancing. This assertion was corroborated

by the studies of Cho *et al.*<sup>[23]</sup> and Aweto *et al.*<sup>[11]</sup> The fracture could be attributed to the female athlete triad amenorrhea, disordered eating, and low bone density, which has been implicated in an increased risk of stress fractures in dancers by Negus *et al.*<sup>[24]</sup> The average severity of pain was reported for most of the dancers who were injured. This may be due to the subjectivity of pain severity rating, and it is not a true indicator of how individuals perceive pain severity. This is in line with the report of the studies by Lai *et al.*<sup>[25]</sup> and Aweto *et al.*<sup>[11]</sup>

This study points out that the prevalence of JH was 85.1% while most dancers are distinctly hypermobile (71.1%) and

**Table 7: Association between depression, anxiety, stress and generalized hypermobility of the participants**

	Not hypermobile, n (%)	Moderately hypermobile, n (%)	Distinctly hypermobile, n (%)	Total, n (%)	$\chi^2$	P
<b>Depression</b>						
Normal	7 (10.9)	9 (14.1)	48 (75.0)	64 (100.0)	6.931	0.544
Mild	3 (15.8)	4 (21.1)	12 (63.2)	19 (100.0)		
Moderate	6 (30.0)	1 (5.0)	13 (65.0)	20 (100.0)		
Severe	1 (14.3)	1 (14.3)	5 (71.4)	7 (100.0)		
Extremely severe	0	1 (25.0)	3 (75.0)	4 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Anxiety</b>						
Normal	3 (12.0)	4 (16.0)	18 (72.0)	25 (100.0)	8.826	0.357
Mild	0	1 (12.5)	7 (87.5)	8 (100.0)		
Moderate	2 (8.7)	2 (8.7)	19 (82.6)	23 (100.0)		
Severe	5 (21.7)	6 (26.1)	12 (52.2)	23 (100.0)		
Extremely severe	7 (20.0)	3 (8.6)	25 (71.4)	35 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		
<b>Stress</b>						
Normal	6 (9.1)	10 (15.2)	50 (75.8)	66 (100.0)	8.911	0.350
Mild	5 (21.7)	2 (8.7)	16 (69.6)	23 (100.0)		
Moderate	4 (33.3)	3 (25.0)	5 (41.7)	12 (100.0)		
Severe	2 (16.7)	1 (8.3)	9 (75.0)	12 (100.0)		
Extremely severe	0	0	1 (100.0)	1 (100.0)		
Total	17 (14.9)	16 (14.0)	81 (71.1)	114 (100.0)		

**Table 8: Association between age, sex, years of experience, frequency of training, and 12-month prevalence of musculoskeletal pain**

	Felt pain in the past 1 year			$\chi^2$	P
	Yes, n (%)	No, n (%)	Total, n (%)		
<b>Age (years)</b>					
16-20	39 (70.9)	16 (29.1)	55 (100.0)	6.537	0.088
21-25	32 (68.1)	15 (31.9)	47 (100.0)		
26-30	6 (66.7)	3 (33.3)	9 (100.0)		
31-35	0	3 (100.0)	3 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		
<b>Sex</b>					
Male	36 (66.7)	18 (33.3)	54 (100.0)	0.036	0.849
Female	41 (68.3)	19 (31.7)	60 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		
<b>Years of experience</b>					
None	16 (59.3)	11 (40.7)	27 (100.0)	8.398	0.078
1-3	42 (67.7)	20 (32.3)	62 (100.0)		
4-6	14 (87.5)	2 (12.5)	16 (100.0)		
7-9	3 (100.0)	0 (0.0)	3 (100.0)		
10-12	2 (33.3)	4 (66.7)	6 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		
<b>Frequency of training</b>					
Daily	11 (50.0)	11 (50.0)	22 (100.0)	11.382	0.044*
Once a week	14 (77.8)	4 (22.2)	18 (100.0)		
Twice a week	24 (68.6)	11 (31.4)	35 (100.0)		
Three times a week	20 (87.0)	3 (13.0)	23 (100.0)		
Four times a week	4 (66.7)	2 (33.3)	6 (100.0)		
Others	4 (40.0)	6 (60.0)	10 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		

\*Significant at  $P < 0.05$

female dancers are more distinctly hypermobile than their male counterparts. This may be due to the requirement of the

task they have to perform to produce a desired performance. This finding was corroborated by a research carried out by

**Table 9: Association between depression, anxiety, stress and 12-month prevalence of musculoskeletal pain**

	Felt pain in the past 1 year			$\chi^2$	P
	Yes, n (%)	No, n (%)	Total, n (%)		
<b>Depression</b>					
Normal	45 (70.3)	19 (29.7)	64 (100.0)	5.106	0.277
Mild	13 (68.4)	6 (31.6)	19 (100.0)		
Moderate	12 (60.0)	8 (40.0)	20 (100.0)		
Severe	6 (85.7)	1 (14.3)	7 (100.0)		
Extremely severe	1 (25.0)	3 (75.0)	4 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		
<b>Anxiety</b>					
Normal	15 (60.0)	10 (40.0)	25 (100.0)	5.590	0.232
Mild	3 (37.5)	5 (62.5)	8 (100.0)		
Moderate	17 (73.9)	6 (26.1)	23 (100.0)		
Severe	18 (78.3)	5 (21.7)	23 (100.0)		
Extremely severe	24 (68.6)	11 (31.4)	35 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		
<b>Stress</b>					
Normal	39 (59.1)	27 (40.9)	66 (100.0)	8.282	0.082
Mild	19 (82.6)	4 (17.4)	23 (100.0)		
Moderate	9 (75.0)	3 (25.0)	12 (100.0)		
Severe	10 (83.3)	2 (16.7)	12 (100.0)		
Extremely severe	0	1 (100.0)	1 (100.0)		
Total	77 (67.5)	37 (32.5)	114 (100.0)		

Scheper *et al.*<sup>[26]</sup> that most dancers are distinctly hypermobile. The result that female dancers are more hypermobile than their male counterparts was supported by Jansson *et al.*,<sup>[27]</sup> and they stated that the cause of this is idiopathic.

This study showed that the stress level and depression level in dancers are normal while the anxiety level in dancers are extremely severe, and this may be attributed to the expectations that they intend to achieve during their auditions, dance classes, and the learning of some particular dance moves before each performance. This high percentage in their anxiety level was supported by Scheper *et al.*<sup>[26]</sup> Sahin *et al.*<sup>[28]</sup>

This study showed no association between the age, sex, frequency of training of dancers, and GJH, while there was an association between the years of experience of dancers and GJH.

This study showed that there was no association between depression, anxiety, stress, and GJH. Although it was stated that there was a significant association between depression, anxiety, stress, and GJH by Bulbena *et al.*<sup>[29]</sup> and Sahin *et al.*,<sup>[28]</sup> this may be because this study was carried out on adult dancers while previous studies were carried out on young children.

This study showed no association between the 12-month prevalence of musculoskeletal pain and injuries and GJH.

This is not in line with what was revealed in the study by Sahin *et al.*<sup>[28]</sup>

It was shown in this study that there was no association between age, sex, years of experience, and 12-month prevalence of musculoskeletal injuries, while there was a significant association between frequency of training and 12-month prevalence of musculoskeletal injuries among dancers in Lagos state. This means that the age of dancers has no influence on musculoskeletal pain and injury and this is in line with the study by Aweto *et al.*<sup>[11]</sup> while Stretanski and Weber<sup>[30]</sup> observed that there was a significant relationship between the age and prevalence of musculoskeletal pain and injury among professional dancers. This may be because all the dancers are subjected to the same rehearsal techniques and the pains experienced after each dance classes were not related to the age of the dancers. In this study, there was no association between the prevalence of musculoskeletal pain and injury among professional dancers and the training hours among professional dancers per day. This finding is in line with the report of Aweto *et al.*<sup>[11]</sup>

This study revealed that there was no association between depression, anxiety, and stress and 12-month prevalence of musculoskeletal injuries among dancers in Lagos state. However, this is not in line with the study by Scheper *et al.*<sup>[26]</sup> They were able to show that a significant relationship exist among psychological status, GJH, and musculoskeletal pain among dancers. This could be due to the number of participants that took part in this present study.

This study was limited due to the inadequate response of most of the dancing schools in Lagos state due to the ongoing COVID-19 pandemic and unwillingness to fully answer the questions in the questionnaire, due to the number of questions and their busy schedule.

**CONCLUSION**

There was a high prevalence of musculoskeletal pain and GJH among dancers in Lagos state, the knee followed by the lower back was the most commonly affected body part among the participants, most of the injuries of the dancers occurred during their training sessions, and the years of experience influenced the GJH in dancers. Frequency of training influenced 12-month prevalence of musculoskeletal injuries among dancers in Lagos state. Likewise, years of experience influenced musculoskeletal pain and injury felt by dancers during dancing. In addition, point and 12-month prevalence of musculoskeletal injuries were not influenced by the psychological status of the dancers and GJH.



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### Conflicts of interest

There are no conflicts of interest.

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