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Research article *MPIIQM*

Playing Related Musculoskeletal Disorders Among Instrumental Musicians- A Prevalence Study Using Musculoskeletal Pain Intensity And Interference Questionnaire For Musicians (MPIIQM)

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ABSTRACT

Background: Musicians are not often thought of as having a risky career, the high physiological and psychological demands of their work put them at risk for a number of health issues. Musicians must utilise rapid and continual improvements with incredible quality, accuracy, and desired movements. These motions damage the muscles and ligaments. This study aims to assess the prevalence of playing-related musculoskeletal problems (PMRDs) in both professional and amateur musicians, identify relevant risk factors, and assess the relationship between musculoskeletal pain and particular instruments.
Method: An online and offline cross-sectional survey investigation was carried out. A total of 98 artists over the age of 16 from different institutions and musical bands were included in the sample. According to inclusion-exclusion standards, the participants were chosen. PRMD in musicians was evaluated using the MPIIQM questionnaire. Between amateur and professional musicians, the prevalence of PRMDs was compared, and PRMDs were then associated across gender, playing time, age, and years of experience. Each particular instrument's patterns of musculoskeletal pain areas were assessed.
Results: This study found 68.4% of musicians to be at risk for PRMDs. The prevalence of PRMD was 68.52% in professionals and 68.09% in amateur musicians. Career level has no discernible effects. The study established that age, gender, and the number of years spent playing in an orchestra are risk factors for PRMD among musicians. The lower back is the anatomical place most commonly impacted by PRMD.
Conclusion: This investigation led us to the conclusion that PRMD is more common in musicians. Additionally, it displays the linked risk factors that result in PRMD. This study demonstrates that both professional and amateur musicians frequently experience musculoskeletal issues.

Keywords: Playing related musculoskeletal disorders, Instrumental musicians, pain, MPIIQM.

INTRODUCTION

Music has the power to induce feelings of enjoyment and well-being. Whether it be vocal or instrumental, both accord immense pleasure to life. However, it is difficult for a common man to imagine that even musicians just like in other professions are susceptible to occupational hazards as they play and perform. [1]Playing an instrument is an intensified, multisensory and motor activity that often starts at a young age and necessitates the development and maintenance of a certain level of sensory and motor skills over the course of a musician's lifetime.[2] A musician must duly ensure brisk and laborious developments with exceptional levels of quality, precision and desired movement. Instrumentalists perform an average of 1300 hours a year in non-ergonomic posture due to maestro pressure, performance anxiety and a competitive

work atmosphere.[3,4] Furthermore, musicians must regularly train and perform in chamber ensembles in addition to practising alone.[5] By virtue of the high physical and psychological demands of their profession, instrumental players come across a peril of various health problems.[6]

Musculoskeletal or muscle-tendon pain syndrome (usually termed as overuse injuries), nerve entrapment and focal dystonia are the three basic diagnostic classes of performance-induced medical conditions seen among musicians.[7]Playing-related musculoskeletal disorders (PRMDs) are the most often used term for injuries allied with instrumentalists.[8] Any "pain, weakness, lack of control, numbness, tingling, or other symptoms that impair your ability to play your instrument at the level you are accustomed to" are considered signs of PRMD.[9] Recent studies have shown high prevalence rates of PRMD ranging from 44.7% to 93%, especially in string players. Symptoms start to appear when the musician increases the intensity and duration of their musical practice. Pain is typically the artist's first symptom.[10]

As every field of work embodies an amateur and professional duo, remarkably same is seen among instrumental musicians where amateur musicians are considered as individuals who played their instrument regularly but their main profession or education was out of the field of music and professional musicians as individuals who played regularly, full time, had their profession or education in the music field and had early musical training and performed more years.[11,12] Reports from a recent study have shown the point prevalence of musculoskeletal complaints among professional musicians as 9-68% [13]and among amateur musicians as 63% [14].

The occurrence of PRMD appears to be predicted by a model containing a complex combination of physical, biomechanical, and psychosocial risk factors[15]. The use of nonergonomic instrument techniques, excessive force, poor posture, and a lack of adequate rest have all been associated with the aetiology of PRMD.[16] The development of PRMD may also be influenced by additional elements like biomechanics, rehearsal time, instrument size and form, and work environment. [17] Other factors that affect injury causes include poor posture, changes in the musical load, overall physical fitness, and psychological stress. [18]

Generally, all musicians face pain in some common areas of the body once in their careers. Apparently, they experience back and arm discomfort as a result of spending so much time in one position while performing and overuse of them.[19] In addition to the general region of discomfort, certain instruments might cause pain in certain parts of the body.

Elena R. Gasenzer et.al proposed the location of pain as back pain (70%) is found to be the most typical and often reported localisation, followed by shoulder pain (67.8%), neck pain (64.1%), and hand and wrist pain (39.8%). Pain and degree of impairments have been reported in 27.4% of musicians.[20] In comparison to a similar study Cinzia Cruder et. al, the results ensued five patterns of pain location: wrist pain (22.6%), right shoulder pain (18.5%), both shoulder pain (23.2%) left more concentrated, widespread pain (16.9%), neck and back pain (18.8%) respectively.[21] The specific location of pain was concluded by the group of instruments they played.

There are four categories of instrument including string, wind, percussion and keyboard instruments. Brass and woodwind instruments are both considered wind instruments. These instruments are sustained by numerous demands made on the upper body, particularly on the right hand and thumb. If the instrument is not balanced properly or is held for an extended amount of time, its weight and uneven posture may cause PRMD. [22]The left and right sides are both vulnerable. Wrist and thumb pain, tenosynovitis of the first dorsal compartment (deQuervians tenosynovitis), flexor tendon pain, and bilateral thoracic outlet syndrome are among the prevalent diseases reported. Additionally, there is ulnar nerve compression, medial nerve compression (carpal tunnel syndrome), and nerve irritation. [23,24,25]

High-string and low-string instruments are subcategories of string instruments. When playing a high-string instrument, the left hand and shoulder support the instrument while the collarbone is rested. It involves the position of the chin, cervical spine, role of the jaw, shoulder support, weight of the head, relaxed neck, and last hand for fluid playing. The right hand is also used to play these instruments' bows. [26]

Poor sitting mechanics, poor trunk control, and unequal playing demands all contribute to pain and injury when playing low-string instruments. [27] The most frequent issues include weariness, forearm pain, neck and shoulder pain, as well as weak and overused lumbrical muscles in the hands.[28] Low-string symptoms include paraesthesia at the tip of the finger, and thumb, radial wrist pain, foreman pain, and digital nerve irritation. [29]

The high upper limb demands of percussion instruments cause the fingers and wrist to decelerate quickly during playing.[30] It also includes soreness in the lower extremities after prolonged sitting. Tenosynovitis, arthritis in the hands and wrists on both sides, muscle tension, inflammatory disorders, neuropathies, back and spinal difficulties, problems with the muscles and tendons, the possibility of leg pain in tabla players, and other issues are frequently mentioned.[31,32]

The dominant and non-dominant upper limbs must be continuously stressed when playing the piano. The pianist's arms are flexed at the elbow joints while the forearm and wrists are in neutral alignment. There is a little ulnar deviation that increases with pace. Hand size is noted as a PRMD risk factor. Muscle tension, contractures, trigger fingers, and other illnesses caused by overusing soft tissues are among the often-identified issues. Weakness in the shoulders and scapular instability is observed. [33]

Coming across these literature reviews, marks a positive response about the presence of musculoskeletal problems among musicians in accordance with playing instruments. Each of the studies has accustomed different outcome measures for obtaining results including the SF-36 health survey, Quick DASH, Nordic questionnaire, VAS, BPI, MPQM, MPIIQM and more respectively. Individually, all measures had their own pros and cons but basing the community of musicians where a questionnaire was needed only meant for musicians, MPIIQM met all the requirements. The MPIIQM is a valid and reliable self-report instrument for assessing musculoskeletal pain, specific regions of pain and intensity of pain as well as the amount of disability it causes in a population of musicians. It includes the face and content validity, good construct validity has a two-factor structure namely the pain intensity and interference, present with test-retest reliability also confirms its properties as a potential evaluative instrument capable of measuring change over time.[34]

As the MPIIQM instrument has been validated, the study's goal is to investigate the prevalence of PRMDs among instrumental musicians also specifying about the amateur and professional musicians using the questionnaire. Also, to learn more about the relationship between risk factors and PRMDs, as well as to analyse the common locations of pain as well as specific areas in certain instruments, also to determine their pain intensity and psychosocial interference.

METHODOLOGY

1. Study design: a cross-sectional study
2.Study setting: The study was conducted in various musical bands.
3. Sample method: purposive sampling
4.Sample size :98
5.Sample duration: 3 months

Inclusion criteria

- age above 16 years
- Those who are playing musical instruments for at least 5hrs/week
- Willing to participate

Exclusion criteria

- Those who have other neurological/ musculoskeletal problems due to any other reason.
- Those who are taking medicines.
- Any recent surgery/injury

The material used: MPIIQM and Pen
Mode of the survey: both online form and printed questionnaire
Outcome measure: MPIIQM
It is a 22-item instrument in which the first half consists of 12-item questions of demographic data and history of playing-related pain. The second half consists of the remaining 10 items in which the 13th question marks about the body chart and the rest 9 questions about pain intensity 4 items and pain interference with 5 items respectively of scores ranging from 0-10.

Statistical analysis

The data were clustered in the Excel sheet for analysis. The percentage of the prevalence was extracted. The significance among amateur and professional musicians was assessed using an independent t-test. Association of risk factors were tabulated and evaluated using one-way analysis of variance (ANOVA) for age, chi-squared test for association with gender and independent t-test respectively. All tests were performed using a 5% level of significance(α=0.05)

Procedure

The study was conducted during the month of September 2022. The respondents were carefully selected according to inclusion & exclusion criteria. The survey was conducted through offline and online method. We introduced ourselves & briefly explained the purpose of the study to the respondents who met the inclusion criteria for the study. Consent was taken from the respondents for participation in the study.
The MPIIQM questionnaire was given. It is a valid & reliable self-report instrument for the measurement & evaluation of MSK pain &pain interference in a population of professional orchestra musicians. (Patrice Berque et.al. Man Ther.2014 dec). It is a 22-item instrument in which the first half consists of 12-item questions in which the respondents were asked to fill out the demographic data on age, gender, & practice habits. Then they proceeded to the next section consisting of 4 questions to know the prevalence of musculoskeletal pain & problem. Those who responded "yes" to 11 & 12 questions were asked to continue towards the remaining sections, otherwise, they can stop the questionnaire.
The next section was a body chart to locate the areas where the pain or other problems. Further, they proceeded to 4 questions related to pain intensity, frequency & duration.
To know whether pain interferes with their daily life activities. They were given pain affective interference questions & pain activity interference questions respectively as 5 questions.

Scoring of MPIIQM

1. Pain Intensity Subscale
- The pain Intensity score can be defined as the sum of the four pain intensity items i.e., a scoring range from 0-40.
- Since the MPIIQM uses the four-pain intensity items from the BPI, it is also suggested that a mean pain intensity score can be used instead as a composite measure of these four items (0-10 mean score).

2. Pain interference Subscale
- The questionnaire measures the interference using the five items including “mood”, “enjoyment of life”, “using your usual technique”, “playing because of your symptoms” and “playing as well as you like”. The pain interference score can be defined as the sum of the five pain interference items i.e., ranging from 0 -50.
- A mean pain interference score can be used instead as a composite measure of the five items (0 to 10 mean scale).

RESULT

Data were tabulated in Microsoft EXCEL computer software and analysed according to the study's objectives.

Table 1: Descriptive statistics for demographic characteristics of participants

Characteristics	Participants (n=98)
Age, mean ± SD, range	23.5± 3.73, 16-40 years
Gender	
Male, n (%)	75 (76.5%)
Female, n (%)	23 (23.5%)

Musicians group	
Amateur, n (%)	47(47.9%)
Professional n (%)	51 (52.04%)

Table 1 provides an overview of the participant's demographics, including their age, gender, and musical genres.

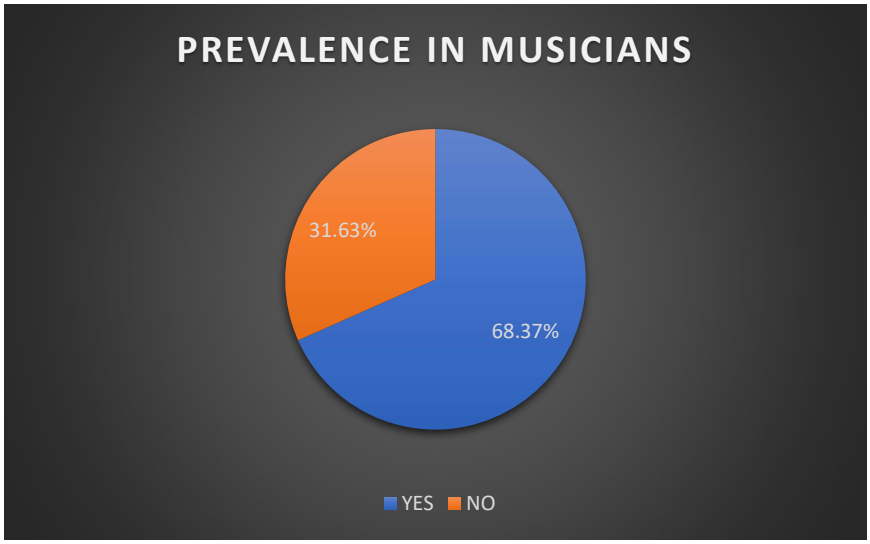
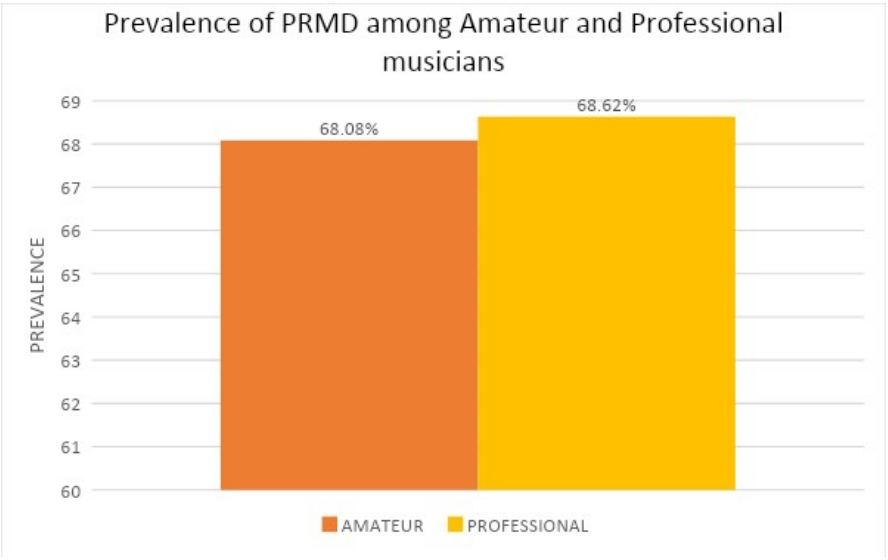


Chart 1: Prevalence of PRMD in instrumental musicians

Chart 1 demonstrates that 68.37% of instrumental musicians had playing related musculoskeletal issues.



Graph 1: Prevalence of PRMD among Amateur and Professional Instrumental Musicians

According to graph 1, 68.08% of amateur musicians and 68.62% of professional musicians had reported PRMD among all musicians.

Table 2: Comparison of PRMD prevalence between Amateur and Professional Musicians

Musicians	PRMD Prevalence	T	P value
Amateur (n=36)	68.09%	1.02	0.31
Professional (n=63)	68.62%		

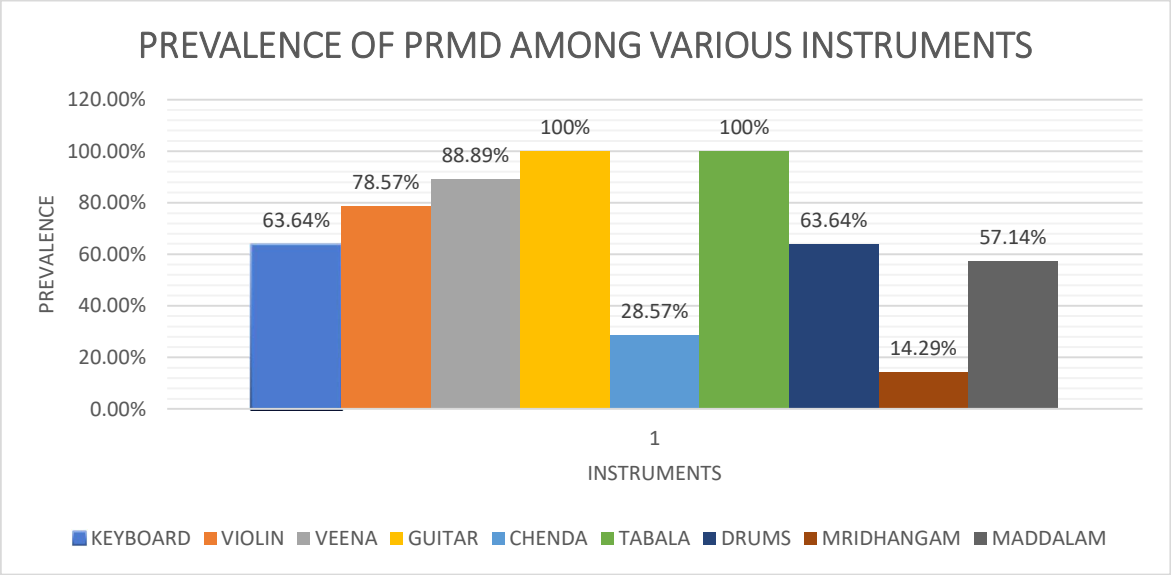
Table 2 compares the PRMD of amateur and professional musicians using an independent t-test. There were no significant effects discovered.

Table 3: Association of risk factors with playing instruments

Variables	Prevalence	Mean± SD	X^2	T	F score	P value
Age					0.32	0.95
16-20 years(n=21)	71.43%(15)					
21-25 years(n=49)	83.67%(41)					
26-30 years(n=24)	91.67%(22)					
31-35 years(n=3)	100% (3)					
36- 40 years(n=1)	100%(1)					
Gender	62.7%(47)		2.47			0.116
Male (n=75)	86.9%(20)					
Female (n=23)						
Total years of playing the instrument		7.66 ± 4.4		9.53		<0.001*
Weekly hours of playing in the orchestra		27.79±9.95		2.57		0.0114*
Weekly hours of playing outside the orchestra		17.53±10.37		0.01		0.992

*p<0.05, *=significant*

The associated risk factors for performing instruments are shown in Table 3. One-way ANOVA was used to analyse the relationship between age and PRMD prevalence and was found to be insignificant. When employing the chi-square test for analysis, no gender-related significant relationship was discovered. Regardless of instrument group, gender, age, or kind of musician, significant relationships were established between the total years of playing the instrument and the weekly hours spent playing in the orchestra. The relationship was discovered using independent T-tests.



Graph 2: Prevalence of PRMD among various instruments

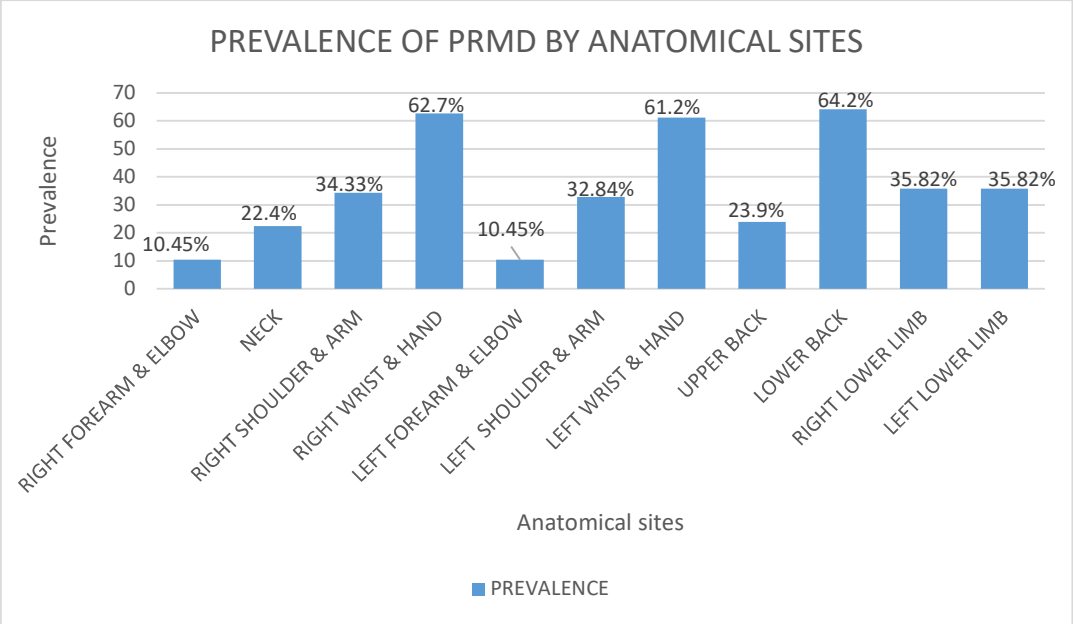
Graph 2 displays the frequency of PRMD reported across different instrument groupings. A 100% predominance was seen for guitar and tabla players.

Table 4: Prevalence of PRMDs by instrument group

Instrument group N=98	Yes	No	PRMD prevalence
Keyboard (n=22)	14	8	63.6%
Guitar (n= 15)	15	0	100%
Violin (n=14)	11	3	78.6%
Veena (n=9)	8	1	88.9%

Chenda (n=7)	2	5	28.6%
Drums (n=11)	7	4	63.5%
Tabla (n= 6)	6	0	100%
Mridangam (n=7)	1	6	14.3%
Maddalam (n=7)	4	3	57.1%

Table 4 lists the distribution of instrument groups and the prevalence of PRMD among them.



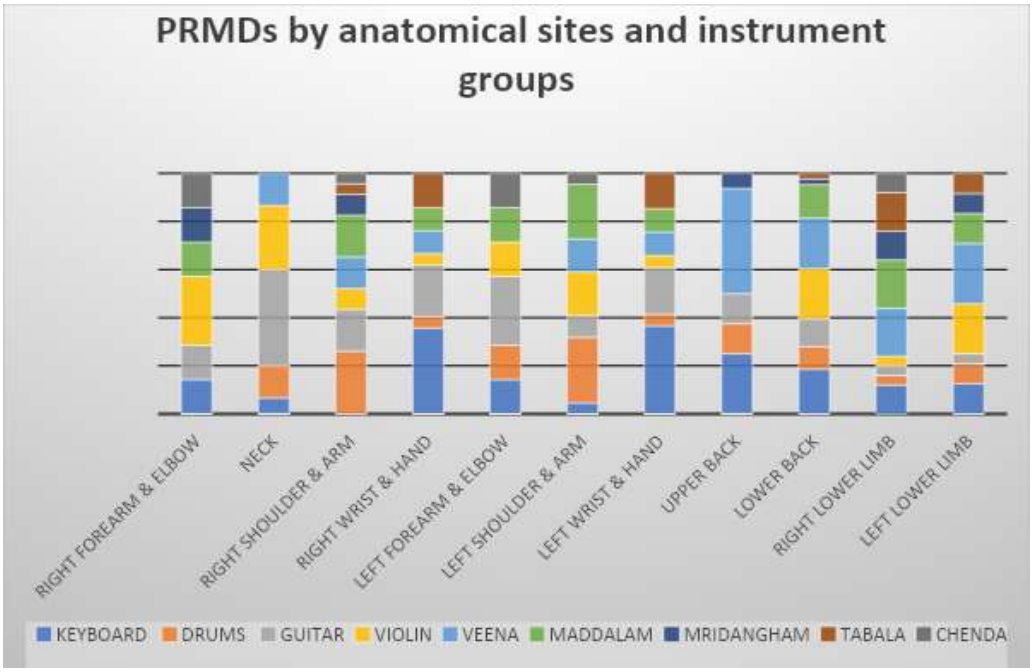
Graph 3: Prevalence of PRMD according to anatomical sites

Graph 3 displays the prevalence of PRMD based on anatomical sites regardless of the musical instrument. The lower back (43.88%), right wrist and hand (42.86%), left wrist & hand (41.84%), and both legs (24.45%) were the most frequently reported pain locations across all instrument groups.

Table 5: Anatomical sites and sole instruments

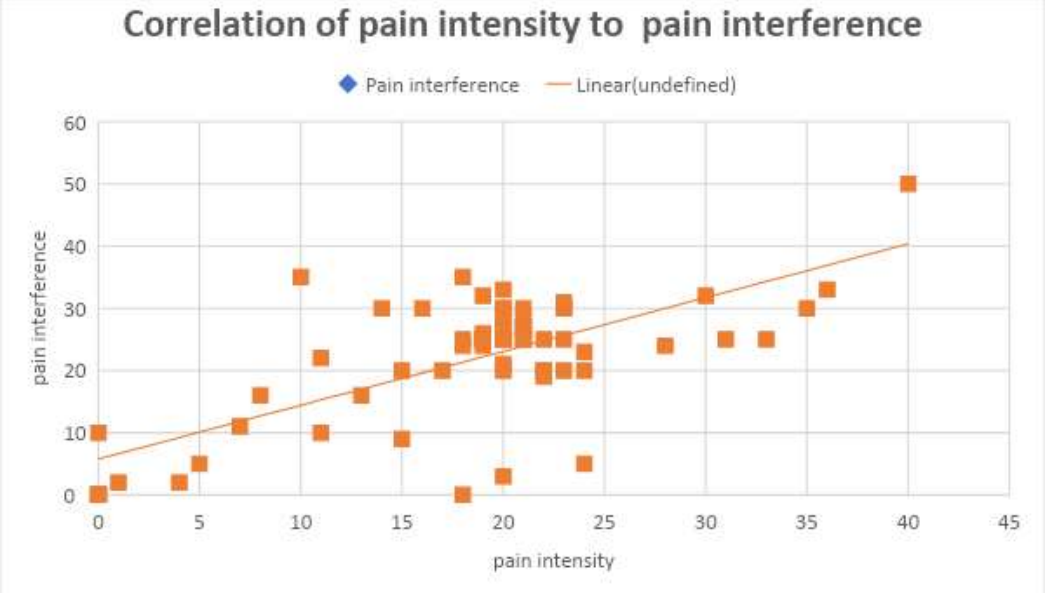
	UPPER BACK	RIGHT WRIST & HAND	RIGHT SHOULDER &	RIGHT LOWER LIMB	RIGHT FOREARM & ELBOW	NECK	LOWER BACK	LEFT WRIST & HAND	LEFT SHOULDER & ARM	LEFT LOWER LIMB	LEFT FOREARM & ELBOW
CHENDA	0	0	1	2	1	0	0	0	1	0	1
TABALA	0	6	1	4	0	0	1	6	0	2	0
MRIDANGAM	1	0	2	3	1	0	1	0	0	2	0
MADDALAM	0	5	4	5	1	0	6	4	5	3	1
VEENA	7	5	3	5	0	2	9	4	3	6	0
VIOLIN	0	3	2	1	2	4	9	2	4	5	1
GUITAR	2	9	4	1	1	6	5	8	2	1	2
DRUMS	2	2	6	1	0	2	4	2	6	2	1
KEYBOARD	4	15	0	3	1	1	8	15	1	3	1

Table 5 represents the sites affected in accordance with sole instruments. The following data is shown as graph above.



Graph 4: PRMDs by anatomical sites and instrument groups

The PRMDs for each instrument group are shown in Graph 4 by anatomical sites. To determine the musculoskeletal problem location particular to a given instrument, each instrument and its associated pain sites were noted from the distinct sample. The most affected areas were found as keyboard-both wrist & hand, drums-both shoulder & arm, guitar-both wrist & hand, violin-lower back, veena-lower back, maddalam-lower back, mridangam-right lower limb, tabala-both wrist & hand and chenda-right lower limb respectively.



Graph 5: Relationship of pain intensity to pain interference

Pain interference and pain intensity are correlated, as seen in graph 5. There was a positive correlation, according to Pearson correlation. According to the p-value of $< 0.0001 (r=0.7)$, it is statistically significant.

Table 6: Pain intensity and interference summary statistics for the PRMD group

N=67	Mean±SD	
Total PRMD group pain intensity	18.33±8.52	
Worst pain	5.72±2.97	
Least pain	3.04±2.39	
Average pain	4.48±2.31	
Pain right now	4.56±2.67	r=0.70
Total PRMD group pain interference	21.61±10.46	p<.00001
Mood	4.24±2.63	
Enjoyment of life	4.13±2.81	
Using your usual technique	3.72±2.54	
Playing because of symptoms	4.35±2.75	
playing as well as you would like	4.54±2.9	

The statistics for the PRMD group with regard to the relationship between pain intensity and interference are summarised in Table 6.

DISCUSSION

Instrumental musicians older than 16 years old were the subject of the investigation. In the age range of 16 to 40 years, we collected 98 subjects altogether. The goal of the study was to learn more about PRMPs in instrumental musicians. It also focused on the prevalence of PRMPs in both professional and amateur instrumental musicians, the risk factors that contribute to their occurrence, the anatomical location of the pain, the intensity of the pain, and the impact of the pain on the participants' quality of life.

In this study, 68.4% (n=67) of the 98 participants had PRMD. The findings are almost identical to those of Scottish research on orchestra musicians, which found a prevalence rate of 72.2% out of 183 participants.

Citing the study's objective to determine the prevalence among amateur and professional musicians, the results revealed a nearly identical prevalence of 68.09% (n=47) and 68.62% (n=51), respectively. A recent study by Laura M. Kok et al., performed in the Netherlands in 2018, found that out of 357 individuals, 67.8% of them were amateur musicians. Additionally, 76% of 79 participants in research on professional musicians in South Africa reported having the condition.

This highlights how both types of artists suffer as a result of their respective situations, such as the amateurs' lack of industry expertise and the time it takes for them to adjust and the professionals' lengthy, exhausting hours of practice. Both of them consider the part that posture plays. It was demonstrated that there was a strong correlation between the class of musicians and the severity of their pain.

The findings of a 2017 study on string instruments in South Africa, which included 114 people and had a prevalence rate of 77%, were almost identical. A prevalence rate of 40% was found in 50 participants of a different study done in 2022 among Indian percussionists. A prevalence of 35.8% out of 68 individuals was found in the 2018 study by Fung Chiat Loo et al. among classical piano students at Malaysian tertiary institutions.

Pain, numbness, tingling, or other symptoms that make it difficult for them to play their instruments are known as playing-related musculoskeletal disorders. Every issue has a reason, as was previously said, and PRMDs also have a wide range of causes for the appearance of pain. A group of risk factors later become the cause of the disorder.

A set of risk factors contribute to the disorder's cause. The PRMDs are linked to other elements that raise the possibility of prevalence. Age, gender, years of experience playing the instrument, and weekly hours spent playing in and outside the orchestra are the variables listed as having a high likelihood of prevalence.

Age was classified into a range of 16 to 40 years, with a mean of 23.5 ± 3.73, and the group of 26 to 30 years exhibited a high-risk prevalence. The one-way ANOVA test was used to sort the data, and it revealed no significance of age to pain.

Thus, the years spent playing the instruments follow, which make up a large range of total years. Using an independent t-test, it was determined that the following mean of 7.66±4.4 years was significant, indicating that an increase in playing years would probably be accompanied by an increase in playing-related discomfort. The number of hours played per week both as part of orchestra duties and outside of them was the next consideration. This variable differed from person to person and was therefore shown to be significant for the weekly hours played in the orchestra and statistically not significant for the weekly hours played outside the orchestra.

According to a prior study carried out in Scotland, weekly hours of playing the instrument are not statistically significant, but age and years of playing the instrument are substantially connected with the PRMP group (r=0.865, p0.001). The articles emphasise that women are more in danger than men are, however, the study found that men were more likely to be affected since the sample's gender distribution was not homogeneous. The chi-square test was run, and it produced an insignificant result.

Interestingly, when the different instrument groups were taken into account, guitarists (100%) and Tablaists (100%) had the highest prevalence of PRMDs. Mridangam players reported the lowest prevalence of PRMDs (14.29%).

Identifying the sites of pain differs from person to person. According to the research done by Patrice Berque et al., 43% of the PRMP group reported feeling discomfort in three or more places, with the right upper limb, neck, left forearm, and elbow being the most common. The study found that the lower back (43.88%), right wrist and hand (42.86%), left wrist and hand (41.84%), and both legs (24.45%) were the most frequently affected anatomical regions. During the course of the investigation, a few more locations with regard to the upper back, forearm, and elbow as well as the shoulder and arm also were identified.

When we looked more closely at the individual instruments, we discovered that each of them had multiple pain sites that were caused by a variety of things, including how the instrument was held, how it was played, how long it was played for, the anatomical region that was under the most stress while playing each instrument, and more. Each instrument cited different sites of pain. The most affected areas were found as keyboard-both wrist & hand, drums-both shoulder & arm, guitar-both wrist & hand, violin-lower back, veena-lower back, maddalam-lower back, mridangam-right lower limb, tabala-both wrist & hand and chenda-right lower limb respectively.

According to a popular saying, pain generally interferes with a person's daily life, just as it does for musicians whose pain levels vary in relation to their ability to perform their daily tasks. The MPIIQM, a validated instrument employed in the study, secures information about the degree of pain interference. It gets comprehensive data regarding the severity of the pain and the interference from the discomfort. This information, in a nutshell, tells us how the amount of discomfort affects musicians' ability to perform. Previous research found no connection between pain interference and pain intensity. The study found an association between interference and pain severity, which turned out to be statistically significant. It was discovered that the mean scores for pain intensity and interference were, respectively, 18.33±8.52 and 21.61±10.46.

In order to further understand how musicians' health-related behaviours and health education may affect the prevalence and consequences of PRMD, future studies may examine these topics. These findings could be used to design or refine targeted preventive strategies that will increase physical stamina and musical performance while preventing overuse injuries and minimising muscle fatigue.

CONCLUSION

Instrumental musicians have a high prevalence of PRMDs (68.4%). This study has verified that there are no appreciable differences in the prevalence of PRMD between amateur and professional instrumental musicians, and relevant factors have been discovered. Although the cross-sectional and self-reported character of the data should be taken into consideration when interpreting the study's findings, they generally represent the conclusions of a relatively comprehensive investigation. The results of this study may provide significant additional data to those from the existing literature that will help develop primary prevention strategies for PRMDs and the burden they place on all sorts of musicians. They might be helpful in spreading awareness within musical communities.

Limitation & Scope

The sample size was rather small, which may be seen as enhancing the facilitating information about the occurrence and development of PRMDs while also limiting the robustness of the study's conclusions. The current cross-sectional research study did not completely cover all the possible causes of PRMDs in musicians. The gender distribution is not uniform. The group of wind instruments and other solo instruments are absent from the study sample. The samples of amateur and professional musicians were not obtained uniformly. The samples for each instrument group weren't all chosen equally.

In order to effectively rule out any significant disorders that impact the musculoskeletal system, a future study could be implemented with self-reported data along with any physical examination. More research can be done to develop a precise standard for separating amateur and professional musicians. To learn more about the unique relationships between factors for amateur and professional musicians, more research must be done.

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