



Study on the Prevalence and Prevention Measures of Musculoskeletal Diseases in Chinese Piano Students

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ABSTRACT

Objective: The purpose of this study is to establish the measures of musculoskeletal diseases among classical Chinese piano students and identify risk variables that are particular to the piano. **Methods:** In China, students who were studying classical piano at Chinese musical institutes were given a questionnaire that had been prepared just for them. The design that was employed was a cross-sectional one. Calculations were done to determine the prevalence of musculoskeletal diseases (MSDs) and cases were contrasted with non-cases.

Results: MSD and gender, practise, eating, and athletics were studied. China's music conservatory questioned 182 piano students. 35.8% (n=69) students had MSD, according to the study. Shoulders, arms, fingers, and wrists were impacted. MSD causes pain, tiredness, and stiffness. MSD frequency was connected to practise time (p=0.0334), practise breaks (p=0.056), physical cool-down activities (p=0.039), and diet (p=0.008). Small hands link with pianists' muscle strength disorders. Those impacted were unrelated to piano kind. Logistic regression analyses correlated age, inactivity, and the "No pain, no gain" **Implication:** Logistic regression analysis supported the independent relationship between MSDs and a particular diet, physical cool-down activities, and practice interruptions. Since MSDs are recorded at various severity levels, this study should increase MSD awareness among classical piano students and encourage artists to avoid injuries in the future to ensure long-lasting musical careers.

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1. Introduction

According to the definition of musculoskeletal disorders (MSDs), these are "regional impairments characterized as inflammatory and degenerative illnesses and disorders of the muscles, tendons, nerves, joints, and fascia." Work-related musculoskeletal disorders (WRMSDs) are those that develop over time as a result of factors including the surrounding work environment, task events, and the actual performance of the work. Depending on the damaged body structure, WRMSD causes a variety of symptoms, including pain (both acute and chronic), aches, disability, and discomfort in various body locations. This has a negative impact on quality of life overall through reducing productivity, limiting work hours, changing jobs, and absenteeism due to illness. Musculoskeletal diseases (MSDs) are one of the most prevalent and costly occupational health concerns in both developed and developing nations. They affect the skeletal muscles and connective tissues of the body. MSDs not only result in a loss of productivity at work as a result of sick leave, absenteeism, and early retirement, but they are also expensive to treat and cause individuals to suffer needlessly as illustrated by [Althomali et al. \(2021\)](#). In addition, MSD are a significant cause of health-related absences from work as well as visits to doctors and other medical professionals. In many different professions, MSD involve a broad variety of inflammatory and degenerative illnesses that affect the muscles, ligaments, tendons, nerves, bones, and joints. Workers in a variety of vocations suffer pain, impairment, and job losses as a result of work-related musculoskeletal diseases (WMSDs) are indicated by [Garg \(2021\)](#) and [Ojukwu et al. \(2018\)](#). They are common reasons for absence from work and often take months or even years to develop. As a result, there is a serious need to develop an ergonomic approach to work that adapts man to work. Although playing an instrument professionally is an activity compared to an athletic performance, it is not often thought of as a risky vocation for musicians. This results in a high physical load and increases the risk of musculoskeletal problems. "Playing-related musculoskeletal disease" (PRMSD), whose operational description has been provided by a prior qualitative study, is a suitable music-specific derivation of WMSD are presented by [Ahmed and Ali \(2020\)](#) and [Ng, Voo, and Maakip \(2019\)](#). Numerous statistics indicate that the incidence of MSDs is equivalent to that of WMSDs reported for other occupational groups, at least among adult classical musicians. MSDs include peripheral nerve entrapment disorders and overuse conditions like tendinitis. MSDs often develop into 2 to 5 year-long, on average, chronic, painful and incapacitating health conditions. Nevertheless, musicians who play the piano, strings, and guitar are among those who are more likely to acquire MSDs ([Joseph, Windham-Bannister, & Mangold, 2021](#)). Piano players have been reported to have high MSD prevalence rates, although little is known about the risk factors connected with each instrument. Additionally, there is no information in the literature on the instrumental features of the piano performed. [Figure 1](#) indicates the Do's and Don'ts for Injury Prevention. Continuously rotating the hands in a quasi-circular motion causes both the production of pre-attack gestures and the execution of post-attack movements. Following several guidelines for playing the piano, such as guiding the finger with the wrist, supporting the arm's weight with the fingers, using the muscle that has already been used, and repositioning motions. Some characteristics are missing in order to prevent the harm. Twist the wrist just as necessary, bringing the arch down, separating the fingers, and maintain your tension in muscles for a long period.

In order to ascertain the incidence of MSDs in this particular group and to look into piano-specific risk factors, this research was designed to concentrate on a specific instrumental group, represented by conservatory Chinese piano students are introduced by Ming et al. (2020b). Despite numerous research on musicians' injuries globally and the high frequency of MSDs among Chinese Pianists, there have been limited investigations on MSD among Chinese musicians. MSDs are unknown among music students. Since piano is a popular instrument in China, pianists were studied. Therefore, MSD induced by a particular equipment type remains unclear.



Figure 1: Do's and Don'ts for Injury Prevention

Musculoskeletal diseases at piano player cause significant economic losses for both the individual and the community. Piano students stress is a detrimental emotional and physical reaction that arises from a mismatch between an individual's ability, resources, and willingness to perform their assigned tasks. Teachers can have an impact on their students' self-defined understanding of music through encouraging interactions that foster a state of "flow" and "enjoyment" in learning. Having confidence in one's abilities and being driven to improve by internal factors can help students achieve a state of flow when learning and playing an instrument. Teachers share their students' love of music and their experience of flow can be powerful influences on their pupils' well-being and drive to succeed. Various students have different learning styles, thus instructors should tailor their lessons to the individual needs of their students. In this study, we focused on the prevalence and prevention measures of musculoskeletal diseases in Chinese piano students. By focusing on pianists, MSDs and their risk factors might be better understood.

2. Contributions of this research

- In this cross-sectional study, data were gathered from 182 classical piano major students at the China Conservatory of Music.
- A systematic series of questions used in questionnaire designs is a strategy for acquiring statistical data about a sample as a subset and viewpoints.
- Data analysis was used to analyze the data using logistic regression and Pearson chi-square.

- Cross-sectional design was the one that was used. Musculoskeletal Disorders (MSDs) prevalence calculations were performed, and cases and non-cases were compared.
- This study should enhance MSD awareness among classical piano students and encourage damage avoidance in musicians going ahead to ensure long-lasting musical careers.

The remaining part of this paper contains section 2- Literature review, section 3- Methods, section 4- Result and discussion, and finally section 5- Conclusion of this research.

3. Literature Review

This research aims to develop the measurements of musculoskeletal disorders among classical Chinese piano students as well as identify risk factors that are specific to the piano as its instrument of study. According to [Ming, Kiong, and Maakip \(2020a\)](#), found that the novel music-based Attention deficit hyperactivity disorder (ADHD) treatments. Previous clinical and special education experiences gave data on the usefulness of various musical therapies. The scope of Kim et al. was to teaching style of pre-school education professional piano course revealed challenges in the teaching of pre-school education professional piano courses ([Kim, 2022](#)). The goal of Zhang Kim et al. interviewed five worldwide and nationally known piano teachers for Autism Spectrum Disorder (ASD) to learn how they teach music counting ([Zhang, 2018](#)). Multiple odontogenic keratocysts are frequent in many of these disorders, according to [Mody and Bhoosreddy \(1995\)](#). Thio-Pera et al. presented the Piano players often acquire forearm musculoskeletal issues ([Thio-Pera et al., 2022](#)). These injuries are commonly caused to overuse, revealing a common forearm location where muscles are aroused in piano playing across subjects. Here, employ a grid of electrodes to test this theory, measuring where electromyograms (EMGs) with the most amplitude are most likely to be recorded when skilled pianists execute distinct excerpts. Wenfeng et al. discussed diagnosing piano reliability and formation, as well as the piano level of art faculty students from pedagogical universities ([Wenfeng](#)). Piano dependability is the integrity of repertoire preparation, assessment, and correction, as well as performance-based competency of structural components. Control cuts establish structural component creation requirements and indications. Masiulytė et al. introduced Playing wind and string musical instruments for an extended period of time may lead to specific occlusion difficulties ([Masiulytė, Žarovienė, & Švalkauskienė, 2021](#)). Toma et al. examined the both musical and medical areas are the effects of various sonata styles (from the baroque, classical, and romantic piano repertoire) on pianists' upper limbs ([Toma et al., 2022](#)). For all three piano styles, our findings revealed bilateral symmetry in the elbow extensor's isometric muscle force. In order to minimize musculoskeletal issues, future professional pianists should consider routine testing of their arm muscles in addition to their finger muscles. Toma and Popean evaluated high school pianists to concert pianists (experts) to examine the relationship between piano repertoire and symptoms of "playing-related musculoskeletal condition" (PRMD) ([Toma & Popean, 2021](#)). Zhang analysed occupational diseases in first-third year piano students. Health-related referrals for piano students rose from 14% to 38% (p 0.02). The rise in illness during the transition from the second to the third year of study is due to the higher educational load student's face when they practise music intensely after theoretical courses. Measures must be implemented to

reduce occupational ailments, improve physical education, and extend piano lesson breaks (Stephan, 2021; Zhang, 2022).

4. Methods

A. Participants and Study Design

A questionnaire was employed in this cross-sectional research to gather information from Chinese musical institutions. A total of 182 Chinese classical piano majors who were enrolled in foundation, diploma, and degree-level music classes took part in the survey. For students interested in pursuing a music degree, preparation programmes called the foundation and diploma music programmes are available. Participants who experienced bodily harm as a result of anything other than playing the piano were not included in the research.

Questionnaire Design

B. The survey was divided into four categories.

Table 1

The severity of pain symptoms and signs among pianists

Level	Signs and Symptoms	No. of Respondents (n=182)	Percentage
0	Piano playing is painless both during and after	75	39.12%
1	While playing the piano, I felt exhausted. However, there was no discomfort or other indications.	13	6.81%
2	Pain may be felt while playing the piano or for a short time (up to two days) following. The player is capable of playing normally.	35	18.81%
3	While playing the piano, there is pain that lasts longer (>2 days) than usual. The ability to play the piano is still unrestricted.	18	9.91%
4	The pain increases. The player must modify their playing style and cut down on their playing time. After the change, the pain goes away.	28	15.12%
5	As soon as the person begins to play the piano, pain sets in. Pain is not alleviated by altering technique or cutting down on playing time. A few routine tasks are impacted.	14	6.83%
6	Even when the person is not playing the piano, pain is still there. Numerous routine tasks are impacted. Up until recovery, the person must entirely quit playing the piano.	8	3.64%
7	Pain continues. Lack of recuperation The person's piano playing skills have worn off.	0	0%

First category: Data on the respondents' past experiences with physical injuries brought on by listening to music or other variables was gathered before the first category. The data were not included in the analysis if the responder was hurt for a non-musical cause. Questions on respondents' demographic details, including gender, study programme, weight, height, and hand size, made up the first part of the survey.

Second category: The second segment looked at the practice routines of the respondents, including their practice schedules, breaks, and warm-up and cool-down routines.

Third category: In the six months proceeding to the third section's questions concerning respondents' experiences with MSD, only those respondents who had noticed any symptoms or indicators were included. A scale from 0 to 7 was used to further characterize the severity of MSD (Table 1).

Only individuals who had evaluated severity at level 3 or higher were determined to have MSD since level 0 to 2 were regarded as really minor pain.

Fourth category: The last segment looked at the respondents' dietary practices, participation in sports, and specialized piano-playing routines. According to the operational definition of MSD, our questionnaire's definition of the presence of MSD was "any pain, weakness, and lack of control, numbness, tingling, or other symptoms that interfere with musicians' ability to play piano at the level they are accustomed to, without taking into account very mild symptoms." Mild, transitory, and fleeting symptoms that did not prevent listening to music were disregarded since they may not really be MSD.

C. Data Analysis

SPSS statistical software was used for all data analysis. The information was examined using descriptive statistics and Pearson chi-squared tests. The Pearson chi-squared test was used to determine the significance of the link between the independent factors and the incidence of MSD. To confirm the factors' independent connection, logistic regression analysis was next carried out. At a significance threshold of $p < 0.04$, the analyses of Pearson chi-squared and logistic regression were also performed.

5. Results and Discussion

A total of 182 students from eight different universities out of 311 students responded to the survey, yielding a response rate of 61.7%. Among the research group, women ($n=154$, 83.9%) outnumbered men ($n=28$, 14.1%), reflecting the gender imbalance in Chinese students enrolled in music programmes as a whole. The pupils' average age was 20.5 years. The degree of damage or MSD among the responders is shown in Table 1. Some survey participants had numerous symptoms across various body sites (Table 2).

Table 2

Injury Symptoms at Different Body Sites in Respondents with MSD

No. of Respondents (%) [*]	Finger	Wrist	Arm	Neck	Shoulder	Back	Leg	Foot
Pain	17 (27.9%)	19 (36.8%)	29 (50.0%)	14 (32.4%)	25 (52.9%)	24 (48.5%)	1 (1.5%)	0 (0.0%)
Fatigue	12	13	24	18	22	26	0	0
Stiffness	26	22	22	11	19	10	1	0
Numbness	7	8	2	3	4	2	0	0
Swelling	1	0	2	0	1	0	0	0
Spasm	1	3	3	3	8	5	0	0
Pins and needles sensation	5	0	1	0	2	5	0	0

The data gathered demonstrated that respondents had rated a range of pain intensities at various body areas affected by MSDs. The greatest injury level assessed by each responder was the only one that was recorded in the present research. A MSD was discovered in a total of 69 responders (35.4%). The arm (50.0%), back (48.5%), and shoulder (52.9%) were the three most often injured body parts. The three symptoms that were most often mentioned were pain, weariness, and stiffness. The degrees of damage or MSD among the responders are illustrated in Figure 2.

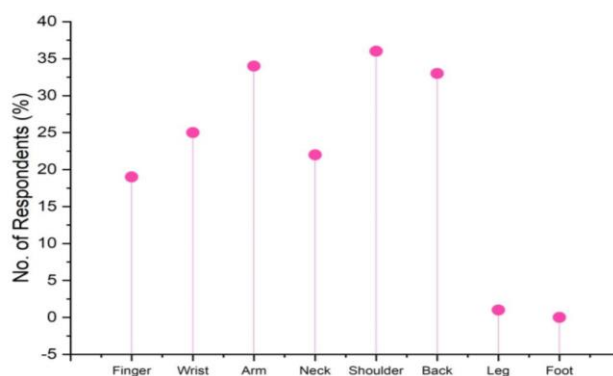


Figure 2: The degree of damage or MSD among the responders

Relationship between MSD and Risk Factors

To evaluate the correlation between the incidence of MSD and independent factors, Pearson chi-squared analysis was used. As demonstrated in Table 3, none of the respondents' demographic traits were significantly correlated when assessed using Pearson chi-squared analysis.

Table 3

Pearson Chi-Squared Analysis's association of MSD with other features and demographic data

% of Respondents(n)*	Row Percentage of Respondents(n)*			Sig- χ^2 †	†
	PR	MD	NO PRMD		
Gender				0.533	0.476
Male	15.10 (28)	41.5 (14)	58.61 (18)		
Female	84.0 (183)	34.4 (58)	65.62 (108)		
Program					
Foundation	2.7 (5)	—	—	—	
Diploma	46.4 (85)	—	—		
Degree	51.0 (97)	—	—		
BMI				0.00	0.991
<24.9 (underweight, normal)	91.2 (171)	35.4 (65)	64.6 (117)		
>25 (25 (overweight, obesity)	8.8 (19)	35.3 (8)	64.7 (12)		
Hand size (left)				2.79	0.095
>20 cm	45.8 (89)	54.5 (49)	45.5 (40)		
≤20 cm	54.2 (10)	66.3 (7)	33.7 (35)		
Hand size (right)				0.889	0.348
>20 cm	38.5 (74)	56.8 (44)	43.2 (33)		
≤20 cm	61.5 (118)	63.6 (76)	36.4 (46)		

The daily amount of piano practise varied from 30 minutes to 7 hours. According to Pearson chi-squared tests, practise time, habit of taking breaks while practicing the piano and the usage of physical cool-down exercises were all shown to be significantly associated with the incidence of MSD, as shown in Table 4.

Table 4

MSD and Practice habits are associated using Pearson Chi-Squared Analysis

Row Percentage of Respondents (n)*					
	% of Respondents(n)*	MSD	No MSD	χ^2	Sig- χ^2 †
Practice time					
>3hrs	53.1(102)	28.4 (29)	71.6 (73)	4.642	0.031†
≥3 hrs	46.9 (90)	43.3 (39)	56.7 (51)		
Taking break					
Yes	91.7 (176)	37.5 (66)	62.5 (110)	4.008	0.045†
No	8.3 (16)	12.5 (2)	87.5 (14)		
Physical warm-up					
Yes	46.9 (90)	42.2 (38)	57.8 (52)	3.43	0.064
No	53.1 (102)	29.4 (30)	70.6 (72)		
Physical cool-down					
Yes	22.4 (43)	48.8 (21)	51.2 (22)	4.363	0.037†
No	77.6 (149)	31.5 (47)	68.5 (102)		
Musical warm-up					
Yes	74.0 (142)	37.3 (53)	62.7 (89)	0.867	0.352
No	26.0 (50)	30.0 (15)	70.0 (35)		
Musical cool-down					
Yes	8.9 (17)	47.1 (8)	52.9 (9)	1.105	0.293
No	91.1 (175)	34.3 (60)	65.7 (115)		

Table 5 lists the respondents' usage of nutritional supplements, involvement in sports, and use of certain exercises performed to improve piano playing.

Table 5

Pearson Chi-Squared Analysis of MSD, Diet, Sports, and Exercises

Row Percentage of Respondents (n)*					
	% of Respondents (n)*	MSD	No MSD	χ^2	Sig- χ^2 †
Taking dietary supplement				7.287	0.007†
Yes	16.7 (32)	57.3 (18)	43.7 (14)		
No	84.3 (160)	32.2 (50)	67.8 (110)		
Engagement in sports				0.495	0.485
Yes	43.2 (81)	38.31 (31)	61.7 (50)		
No	52.8 (111)	33.32 (37)	66.7 (74)		
Specific exercise				0.857	0.356
Yes	17.20 (33)	42.5 (14)	57.7 (19)		
No	82.81 (159)	34.1 (54)	66.01 (105)		

It was discovered that using certain dietary supplements significantly correlated with the development of MSD. Sports participation or certain types of exercise had no discernible impact on MSDs. Taking dietary supplement, Engagement in sports and specific exercise of respondents are illustrated in Figures 3, 4 and 5.

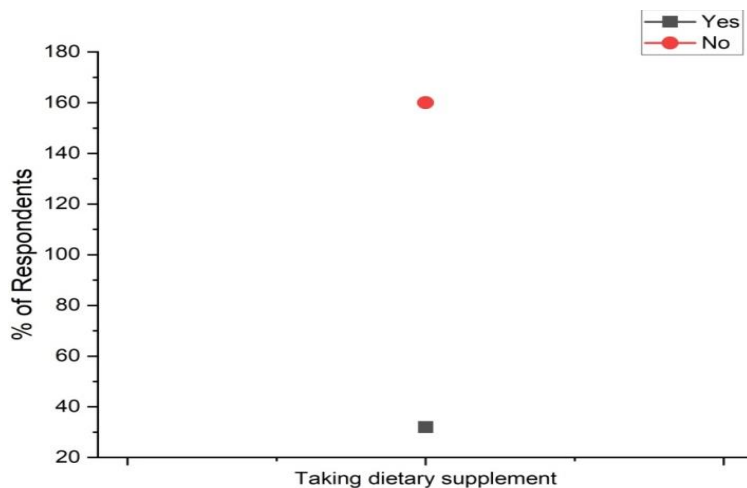


Figure 3: Taking dietary supplement of respondents

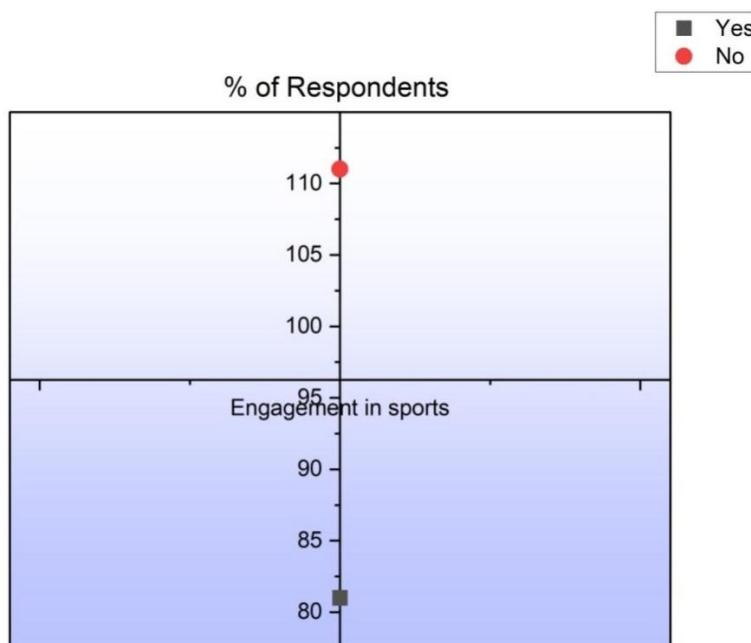


Figure 4: Engagement in sports for respondents

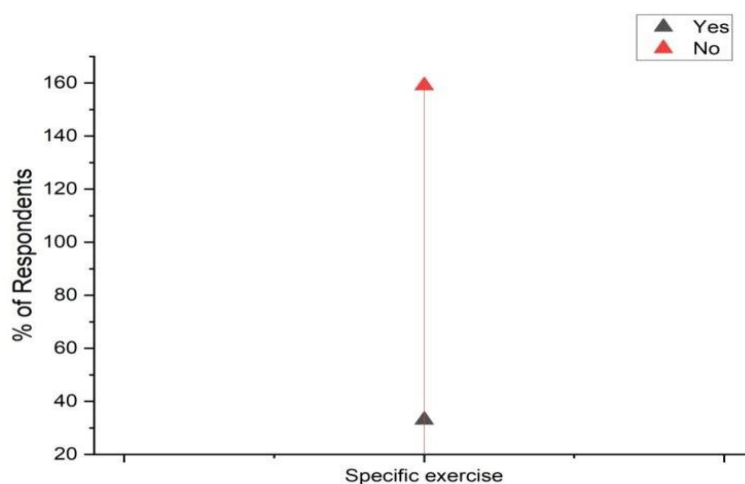


Figure 5: Specific Exercise for respondents

To validate the independent relationships discovered by Pearson chi-squared analysis, a logistic regression analysis was conducted. It revealed that the incidence of MSD was linked to the absence of taking a break in the midst of practise, the absence of physical cool-down activities, and the absence of particular nutritional intake (Table 6).

Table 6

Logistic regression of PRMD risk factors

Variables	Odds Ratio	95% CI	p-Value
>3 hrs of practice	0.500	0.267 - 0.939	0.031
Lack of taking a break during practice	4.488	0.953 - 21.273	0.05
Lack of physical cool-down exercises	2.053	0.99 - 4.225	0.06
Lack of special dietary intake	2.569	1.141 - 5.739	0.07

Even though there was a strong correlation between MSD and practise time as shown by Pearson chi-squared analysis, the outcomes of logistic regression did not support this theory.

6. Discussion

In contrast to findings, the body part most often affected by MSD in the analysis was the shoulder. The arm and back were the next two most damaged body parts. Piano players often develop MSD in the hand area, particularly the wrist, as a result of prolonged playing postures that are uncomfortable for the body. If the wrist is not kept in a neutral posture with respect to the piano keys during playing, it will ache. Although the survey technique used in the present research did not include piano playing, it is plausible that poor playing posture, such as a raised shoulder, might lead to shoulder pain. The most prevalent symptoms among those who reported MSD were stiffness, weariness, and discomfort. This research was a questionnaire-based self-reported survey and Relaxation exercises with ergonomic intervention pre and after score analysis of teachers' pain and discomfort

perceptions. Teachers suffer from work-related neck, shoulder, and back pain. School instructors spend much of their workdays performing jobs that stress their bodies. Healthy habits and lifestyle can prevent muscle injuries in pianists. Performers who are aware of their body motions maintain equilibrium and prevent muscle tension, making their performance look natural. The report found that a complex mix of pianistic skills is preferable to a single technique in piano performance and education.

According to Senthil kumar et al, pianists most often mentioned pain as a symptom (Senthilkumar, Parthiban, & Parghavi, 2019). According to the findings of Toma and Popean research on the wrist postures of musicians (Toma & Popean, 2021), pianists' wrists are frequently seen to be in a position that is 15 degrees ulnarly deviated and slightly extended. Lima et al. (2020) presented Increased pressure in the carpal tunnel may be the result of ulnar deviation that is more than 20 degrees and 15 degrees of wrist extension are indicated by Yang (Yang, Fufa, & Wolff, 2021). According to Mathew, who studied the position of the elbow, pianists sit in front of the instrument with their elbows flexed to an angle of around ninety degrees and their wrists in a position that is near to neutral (Mathew et al., 2022). In the present research, the majority of participants who did not have MSD but who assessed their discomfort as level 1 or 2 also mentioned modest levels of pain, weariness, and stiffness. This finding suggests that stiffness, weariness, and discomfort may be the first signs of MSD. Playing may be affected when the pain worsens, and if the MSD becomes worse, additional symptoms may start to appear (Bastepe-Gray et al., 2021). Piano players should be aware of any level of pain, fatigue, stiffness, and any awkward condition in the hands that affects playing because these symptoms may be the first indications of a developing MSD. On the other hand, there are times when no pain or other symptoms exist but playing is still affected, as in the case of. If proper rest and a reassessment of one's piano practise habits are done to alleviate the symptoms, it could still be possible to stop a MSD from progressing to a more severe state. In the view of above issues, this paper attempts to investigate the incidence of musculoskeletal disorders among Chinese piano students as well as the preventative methods currently available. It is possible that MSDs and the risk factors associated with them might be better understood by concentrating on pianists.

7. Conclusion, Recommendations and Implications

In this paper, we focused to the study on the prevalence and prevention measures of musculoskeletal diseases in Chinese piano students. 182 the cross-sectional study used a questionnaire given to students major in classical piano at the China Conservatory of Music. Questionnaires are designed to gather data from a certain set of individuals by asking them a series of questions that are meant to capture their answers and opinions. Logistic regression and Pearson's chi-square were used for data analysis. Statistics from the study suggest that in order to reduce the risk of developing MSD, classical piano players should pay attention to their practise schedules, make it a habit to take pauses during practise, incorporate physical cool-down activities after practise, and eat certain foods. Students in this study may potentially be at a higher risk for MSDs due to their participation in other, more common activities, such as internet use. There is no exception for music students when it comes to the requirement of regular use of a computer for schoolwork, research, and maybe even social networking. Injuries or a worsening of MSD

symptoms from excessive piano practise are possible outcomes of these practices. Neither computer-related injuries nor those stemming from participation in other activities or employment were adequately explored in the present study. Since only classical pianists were investigated, our findings shed light on a facet of MSD that is unique to this subset of musicians. Although age may play a role in the start and progression of MSD in younger and older classical pianists, it was not a consideration in our study because the respondents were all teenagers. Even if the proportion of respondents in this study who reported a serious MSD was not very high, the issue of MSDs should not be disregarded. The amount of MSDs that have been recorded, which should be viewed as an alarming incidence of injury, is expected to make musicians more aware of MSDs as a result of this research. Future studies on MSDs may benefit from a larger sample size and a closer examination of the amount of practise time classical piano players devote to their instrument. To improve the welfare of classical piano students, tertiary institutions must offer MSD education. The duration of the kids' musical careers in the future would also benefit from being able to enjoy creating music without running the risk of getting injured.

Conflict of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

The data used to support the findings of this study are available from the corresponding author upon request.

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There is no funding in this research.

Reference

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