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Multidisciplinary study of illnesses in professional pianists and guitarists and their association with anxiety levels in a Mexican university

Estudio multidisciplinario de las enfermedades profesionales de pianistas y guitarristas y su asociación con los niveles de ansiedad en una universidad mexicana

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ABSTRACT

The physical condition of the motor function of a musical performer is determined by the habits that musicians acquire right at the beginning of their professional training. A large percentage of instrumental musicians' health problems are caused by their occupational activities. This research work aims then to identify musculoskeletal disorders in pianists and guitarists and determine their association to anxiety levels. The study was conducted on 36 pianists and guitarists of both sexes, using the Nordic Musculoskeletal Questionnaire for wrists and hands to make a medical diagnosis, and the Adult Manifest Anxiety Scale[™] (AMAS[™]) to carry on psychological assessment. The mean age of participants was 24.5 (SD \pm 7.6) years. Twenty six musicians had at least one symptom: tendinitis, carpal tunnel syndrome, muscle cramps, and rheumatoid arthritis among others. Anxiety levels were as follows: low (14%), expected (39%), slightly elevated (30%), and clinically significant anxiety (17%). Nonetheless, the presence of any of those musculoskeletal disorders was not associated with anxiety levels. In conclusion, anxiety, sensitivity, or social concerns do not seem to cause the appearance and development of typical diseases of musicians. According to the orthopedic evaluation, the presence of musculoskeletal abnormalities is related to instrumental performance.

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RESUMEN

La condición física del aparato motor del intérprete está determinada por los hábitos correctos que un músico obtiene al inicio de su formación profesional. Un gran porcentaje de músicos instrumentistas tienen problemas de salud originados por su actividad profesional. El objetivo de este trabajo es identificar trastornos musculoesqueléticos en pianistas y guitarristas, de ambos sexos. El diagnóstico médico se hizo mediante el cuestionario Nórdico para muñeca y mano, la valoración psicológica mediante la Escala de Ansiedad Manifiesta en Adultos. Los participantes tenían una media de edad de 24.5 (\pm DE 24.5 \pm 7.6) años, 26 músicos tuvieron al menos un signo de patología: tendinitis, síndrome de túnel del carpo, contractura muscular, artritis reumatoide. Los niveles de ansiedad fueron: baja 14%, esperada 39%, elevación leve 30% y clínicamente significativa 17%. La presencia de algún trastorno musculoesquelético no se asoció con los niveles de ansiedad. Se concluyó que la ansiedad, hipersensibilidad y preocupaciones sociales podrían no estar relacionadas con la aparición y el desarrollo de enfermedades típicas de los estudiados. De acuerdo a la evaluación ortopédica, la presencia de anomalías musculoesqueléticas se encuentra relacionada con la ejecución instrumental.

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INTRODUCTION

Professional injuries in musicians go beyond the skin, especially in the areas where the instrument makes contact with the body, lips, chin, and inner thigh, up to muscular and osteoarticular injuries due, in this case, to pianists' and guitarists' essential interest in their work.

Musculoskeletal discomforts represent a significant health problem in musicians, as they are painful, chronic, and disabling conditions. Extensive studies on the prevalence, etiology, and management of musculoskeletal alterations related to musical performance have been developed recently.

The incidence of chronic pain has been documented in orchestra musicians; researches had found that 24.4% of musicians studied suffered from pain with a high degree of impairment (Gasenzer, Klumpp, Pieper & Neugebauer, 2017).

When the musician's hands present problems associated with pain, such as a partial loss of function, of agility or disability of the motor function, these are collectively called *overuse syndrome* and refer to a group of illnesses that include different kinds of tendonitis, tenosynovitis, dystonia, and other related conditions (Liu & Hayden 2002). Various researchers have detected problems within the musculoskeletal system derived from occupational activity in professional musicians (Brandfonbrener, 1989; Khalsa, Butzer, Shorter, Reinhardt & Cope, 2013; Rosset-Llobet, Fábregas, Rosinés, Narberhaus & Montero, 2005; Siemon & Borisch, 2002; Smet, Ghyselen & Lysens, 1998).

Studies on similar subjects were realized in different countries. The works by Alford & Szanto (1996) in the USA (NY); Joubrel, Robineau, Petrilli & Gallien (2001) in France; Farias (2004) in Spain; Bruno, Lorusso, Caputo, Pranzo & L'abbate (2006) in Italy; Marinovic (2006) in Chile; Ranelli, Straker & Smith (2011) in Australia, can be mentioned, among others.

For the World Health Organization (WHO, 2004), repetitive movements at work implicate moving one and another parts of the body, without rest for even a short time or variation in the movements, and they are determined by reference to the duration and frequency of the work cycles, and the intensity and the strain of the activity. Osteomuscular injuries result from repetitive movements that are a consequence of prolonged periods of study or execution of studied repertoire, added to other factors, such as bad posture, excessive tendon tension, and fatigue (Liu & Hayden, 2002).

Musical training involves the confrontation with challenging situations, such as exams, where a positive or negative evaluation depends on the apprentices themselves, so they may feel threatened and begin to suffer from anxiety (Conde, 2004). Other results indicate that the best musical experiences are characterized by a sense of control, enjoyment of the stage and concentration, while negative experiences are characterized by emotions such as shame and embarrassment. Concerning gender and anxiety level in front of a musical performance, women tend to feel greater anxiety (Cantú, 2009), in physiological and cognitive terms (Osborne & Kenny, 2008).

Anxiety can be defined as the anticipation of harm or future disgrace accompanied by dysphoric (unpleasant) feelings and/or somatic symptoms of tension. It is an alert signal that warns against an imminent danger and allows the person to adopt the measures necessary to tackle the threat (*Agencia Lain Entralgo*, 2008). Some physical symptoms of anxiety are: sweating, dryn mouth, dizziness, instability, and muscular tension. There are also psychological symptoms such as: apprehension, the feeling of being overwhelmed, the fear of losing control, a sense of imminent death, difficulty concentrating, complaints of memory loss, irritability, and worrying (*Agencia Lain Entralgo*, 2008; *Enciclopedia de la psicología*, 1998; Pichot, 1995). There are many common complaints of discomfort among musicians and include pain or discomfort in the neck, shoulders, back, elbow, forearm, wrist or hand, and tiredness. In addition, the wrong technique can create problems, and sometimes these discomforts can have emotional or mental origin. In cases such as focal dystonia, the contributing factor may have a neurological basis; our body addresses the problem physically, mentally and emotionally, manifesting it physiologically as tension (Riley, 2011). In musicians, weak associations have been found between psychosocial work stress and performance anxiety; however, the risks differ remarkably depending on the type of instrument (Leaver, Harris & Palmer, 2011).

With respect to Mexico, no report was found which indicates the prevalence of this kind of alterations in musicians, nor therapies to treat them. This may be due to the lack of subjects such as ergonomics (as in Spain), or methodology for piano teachers and piano technique (as in Russia) in study programs.

The objective of this study is to determine the presence of musculoskeletal conditions and their relation between the levels of anxiety that a group of Mexican piano and guitar students and professors manifest at university.

METHODS

Selection and Description of Participants

36 volunteers (19 pianists and 17 guitarists), of both sexes, from the student community and faculty, belonging to the Department of Music at the University of Guanajuato, participated in this study. The average time using each instrument was: students, 10 years for students and 40 for teachers. The age range of the participants was: between 18 and 24 years for students and between 32 and 55 for teachers. Each participant was informed of the study's objectives and procedures, as well as its possible risks and benefits; signed informed consent was obtained from the participants, and the principles of the Declaration of Helsinki were followed. Approval for the study was granted by the Office of Research and Postgraduate Studies of the University of Guanajuato (grant number# 000031/08).

Medical evaluation

General information and information on musculoskeletal discomforts in the wrists and hands were obtained through the application of the Nordic questionnaire (Kuorinka *et al.*, 1987). This questionnaire has been translated and validated for Latin American population (Agila-Palacios, Colunga-Rodríguez, González-Muñoz & Delgado-García, 2014; Vernaza-Pinzón & Sierra-Torres, 2005) and has been designed to identify areas of the body that cause musculoskeletal discomfort, including the neck, shoulders, upper back, elbows, lower back, wrist/hands, hips/thighs, knees and ankles/feet (Kuorinka *et al.*, 1987). An orthopedic physician realized the comprehensive medical evaluations and applied the Nordic questionnaire as part of an interview. The musculoskeletal pathology of the hand and wrist were evaluated by physical examination.

Psycho-pedagogic Evaluation

The psycho-pedagogic evaluation was applied in a group setting the Adult Manifest Anxiety Scale (AMAS). It is an instrument that consists of three different scales: the AMAS-A (adult version), the AMAS-C (for university students), and the AMAS-E (for older adults). The scales of AMAS are very useful to distinguish between individuals with normal levels of stress and those that have clinically significant levels. The test is standardized for the Mexican population (Reynolds, Richmond & Lowe, 2007). The Honey-Alonso questionnaire of learning styles (CHAEA, for its acronym in Spanish), adapted by Catalina Alonso, was also applied (Alonso, Gallego & Honey, 1994).

Data analysis

Percentiles from the AMAS survey were used and the Mann-Whitney U test was applied to analyze differences. The Spearman test was employed for the analysis of correlations, and for the analysis of the association of anxiety to musculoskeletal disorders, a logistic regression was applied. The StatSoft statistical software package (Tulsa, Oklahoma, USA) was used. The significant value of p was set at $p < 0.05$.

RESULTS AND DISCUSSION

Medical Evaluation

The median age of the 36 participants analyzed (31 students and 5 teachers), 27 of whom were male and 9 females, was 24.5 ± 7.6 years. Among the 36 musicians in the sample, 29 (80.6%) felt pain in their wrists, hands or in both areas; however, the presence of pain did not mean that they had a pathology. Among the 29 subjects who felt pain, a total of 26 (72%) were diagnosed with a pathology during the evaluation, and 3 individuals (8.3%) feeling pain were not diagnosed with any pathology, leaving 7 (19.5%) subjects without any alteration. The most affected regions were located in the right upper limb, and the hand was the most affected one. In the left upper limb, wrist was affected the most. The orthopedic study found evidence that 26 musicians (72.2%) had at least a symptom of any pathology. 38% of participants were diagnosed with symptoms of tendinitis, 25% with carpal tunnel syndrome, 16% with muscle cramps, 8% with rheumatoid arthritis, and 8% with neuropathy of the ulnar nerve. One patient presented a synovial cyst in the wrist, and another one had previously been diagnosed with focal dystonia (table 1).

Table 1.
Percentage of people with some musculoskeletal disorder.

Disorder	%
Tendinitis	38
Carpal tunnel syndrome	25
Muscular contraction	16
Rheumatoid arthritis	8
Neuropathy of the ulnar nerve	8
Synovial cyst	2
Focal dystonia	2

Source: Author's own elaboration.

Psychological Evaluation

Piano players show greater anxiety or hypersensitivity in comparison to guitar players ($p = 0.015$). Comparing participants in gender, no significant differences were found between total anxiety levels ($p = 0.67$) nor in exams ($p = 0.63$) (table 2).

Regarding anxiety in pianists, the levels of physical anxiety were positively correlated to worry or hypersensitivity ($r_s = 0.68$, $p = 0.02$) and the levels of social worrying or stress with anxiety before exams ($r_s = 0.67$, $p = 0.04$), while in guitarists a correlation was observed between the levels of total anxiety and levels of social concern or stress ($r_s = 0.77$, $p = 0.01$).

Logistic regression analysis found no association between the presence of musculoskeletal disorders and the following regressors: total anxiety ($p = 0.79$), age ($p = 0.67$) and instrument ($p = 0.89$) (table 3).

When the connection between the presence of musculoskeletal disorders and the kind of instrument was analyzed, taking into account the weekly practice time (in hours), a significant borderline ($p = 0.058$) was found in the general model. However, when a possible relationship between the presence of musculoskeletal disorders and the experience playing each instrument was analyzed, no association was found ($p = 0.9$).

DISCUSSION

It has been reported that musculoskeletal complaints are more common among musicians compared with non-musicians, and this seems to be associated with the part of the body used to play the instrument (Kok, Vliet Vlieland, Fiocco & Nelissen, 2013). The WHO (2004) considers repetitive movements at work as consecutive movements of body parts for a prolonged period of time, and it has been reported through the clinical analysis of focal dystonia in musicians that these refined, intense and repetitive movements may have as a consequence the appearance of dystonia (Rosset-Llobet *et al.*, 2005). Among piano students, musculoskeletal disorders are a very common problem (Bruno *et al.*, 2006). The pathologies founded and registered in this study may be the result of repetitive movements that are a consequence of prolonged practice periods, execution, or the difficulty of the repertoire studied. In a pilot study, it was demonstrated that the number of hours of practice per week did not significantly contribute to complaints in the arm, neck or shoulder in a group of amateur musicians (Kok, Huisstede, Douglas & Nelissen, 2017). A significant borderline was found between the presence of musculoskeletal disorders and the kind of instrument studied and the hours of

weekly practice. This result could be limited by the number of musicians studied, future studies should increase the number of participants. In a systematic review article about pain prevalence in instrumental musicians, the researchers found that the pain prevalence is high among musicians, and this is independent of the pain definition and time period used (Silva, Lã & Afreixo, 2015).

The findings give a picture of anxiety levels, such as the sub-scale in a population of students from the Department of Music at the University of Guanajuato, measured against a scale that was standardized for the Mexican population; there is no any background on any similar research on this sector of the population.

Studies on performance anxiety have found that 78% admit to experiencing it. By age, instrumentalists over 35 years tend to recognize persistent performance anxiety, different to the sporadic performance anxiety presented in younger players, but the intensities were not evaluated (Marinovic, 2006). It was reported that in a group of university students, social anxiety is due to high perfectionism (Al-Naggar, Bobryshev & Alabsi, 2013), in the case of our results, anxiety levels could be influenced by the perfectionism of musical interpretation.

Table 2.
Psychological characteristics for piano and guitar players.

	Piano	Guitar	Z	p
	Mean±SD	Mean±SD		
Total anxiety	2.7±0.9	2.6±0.9	0.42	0.67
Hypersensitivity	3.1±0.8	2.0±0.7	2.43	0.015
Physiological anxiety	2.3±1.2	2.8±1.3	-0.80	0.42
Anxiety regarding exams	2.4±0.9	2.6±0.9	-0.48	0.63
Stress	2.6±1.2	2.4±1.0	0.23	0.82

Source: Author's own elaboration.

Table 3.
TBARS concentration in CNS and spleen.

Factor	OR	CI 95%	P
Total anxiety	0.82	0.15 – 4.42	0.79
Age (years)	1.03	0.87 – 1.23	0.67
Instrument type	0.84	0.05 – 11.9	0.89

Source: Author's own elaboration.

In this study, it was found that 80.5% of the participants presented pain in their hands, wrists or in both parts; in other studies, it has been reported that among 121 Italian pianists, 39.6% had a musculoskeletal disorder (Bruno *et al.*, 2006). In another study, subjects from New York belonging to a professional musical association, at least 50% had physical problems related to their practice as pianists (Alford & Szanto, 1996). In addition, in the 1989 survey conducted among 3000 members of the Music Teachers National Association (MTNA), 29% of those who were not pianists had problems related to their work as concert musicians (Brandfonbrener, 1989). The percentage of musculoskeletal disorders is high in the population studied; this enhances the need to incorporate some subjects in syllabus such as methodology for instrument playing or ergonomics.

Various countries have become concerned about professional illnesses in musicians: Bruno *et al.* (2006) in Italy reported that among 195 pianists, 75 had some form of musculoskeletal affliction, finding significant differences between different age groups and number of practice hours. Siemon & Borisch (2002) evaluated 130 amateur musicians, 74% of which had problems with their musculoskeletal system: keyboardists suffered in the hands, principally the fingers, and the hands of 39% of individuals in the study group were affected. The prevalence of discomfort in amateur musicians was essentially identical to that reported in professional musicians. Joubrel *et al.* (2001) evaluated 141 French musicians and found that 76.6% suffered some kind of overuse syndrome. The main problems being in the vertebral column (60.9%), hands and wrists (52.5%). Smet *et al.* (1998) evaluated the incidence of overuse syndrome in the elbows, hands and wrists of 66 pianists and 28 of them (42%) presented issues. Small hands tend to develop overuse syndrome more frequently, both in males and females. Farias (2004) reported that in 50 soloist professionals of flamenco guitar, 12% of those interviewed presented muscular overload, 4% carpal tunnel syndrome, 20% tendinitis, 12% focal dystonia, 4% epicondylitis (tennis elbow), 4% lower back pain and 4% had been diagnosed with De Quervain disease.

The orthopedic exploration within this study provides evidence that 75% had at least one sign of pathology: 38% had signs of tendonitis, 25% carpal tunnel syndrome, 16% muscle contraction, 8% rheumatoid arthritis, and 8% neuropathy of the ulnar nerve, 2% synovial cyst of the wrist and 2% focal dystonia, so data appear very similar to those found by other researchers.

During this investigation, it was found that the use of electronic or acoustic instruments has a significant difference in relation to musculoskeletal problems; on the other hand, it was observed that this abnormalities and the type of instrument and the hours of study is not relevant.

Other factors that contribute to these pathologies are bad posture, excessive tension of the tendons, fatigue, wrong size of the instrument and/or adverse conditions of the biomechanics of the hand (Liu & Hayden, 2002). Furthermore, it was observed that musicians with a longer time in the profession are at greater risk of suffering from some kind of disorder. This agrees with the data obtained from the Italian group of musicians in which it was observed that older musicians that practiced many hours every day had a greater chance of suffering from some kind of disorder (Bruno *et al.*, 2006).

The data obtained in this study is limited by the small number of participants, due to the fact that there is a small group of members of the Music Department at the University of Guanajuato. That is why, for future research it is suggested the broadening of this kind of studies among the musical population in Mexico; moreover, the combination of medical therapy with alternative ones, such as yoga, is recommended, as it has been proven to diminish levels of performance anxiety in adolescent musicians (Khalsa *et al.*, 2013). Based on this study, it is considered that it is necessary to develop programmes of prevention of this disorders in Mexico as well as this is done in other countries.

It has been reported that musculoskeletal problems may be detected from a young age in adolescent and child musicians in Australia, where 67% of those interviewed reported some kind of discomfort (Ranelli *et al.*, 2011).

If no significant difference exists between the levels of anxiety and the existence of some kind of pathology, and it is considered that the presence of some kind of musculoskeletal disorder is associated with the kind of instrument (piano or guitar), it may be suggested that these anomalies of the motor function are due to the poor techniques or inappropriate procedures in the use of the instrument.

CONCLUSIONS

Among the musicians evaluated, 72.2% have at least one sign of pathology; the most frequent was tendinitis, followed by carpal tunnel syndrome. Anxiety, hyper-sensitivity, and social worries do not seem to be

related to the appearance and development of any kind of typical disorders found in pianists and guitarists. The presence of pain is found to be related to the use of the instrument. This way, it is possible to consider that the posture of the musician and the correct technique allow for the prevention of musculoskeletal discomfort; this corroborates the hypothesis of this research. Thus, the programming of preventative methods within musical tuition is recommended, based on the multidisciplinary collaboration between musicians and doctors, in order to understand the motor function, some possible conditions related to professional practice and to prevent some kind of musculoskeletal disorder.

Further ergonomic and neurophysiological research is needed to precisely determine the risk factors implied in the musculoskeletal alterations, related to playing music. It is important to elaborate preventative psychological programs that support music students to enable them to better manage anxiety in general, both for performing on stage or presenting exams, because the fact of showing quality does not imply not enjoying the task at hand.

One limitation of this study was the number of participants, but this research focused only on making a transversal diagnosis of the situation of the members of the Department of Music of a Mexican university. We consider that future studies should be done with a larger population of musicians to be able to stratify the age groups and obtain more detailed results.

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